

ASSAM POWER DISTRIBUTION COMPANY LTD.

BID DOCUMENT

FOR

1. Construction of 3.65 Km new 11 KV dedicated Feeder in north side of NH-31 along with terminal equipment and Construction of 3.55 Km new 11 KV feeder for DIC under Nalbari ESD-1, Construction of 3.5 Km 11 KV new Feeder for bifurcation of 11KV chamata Feeder under Chamata ESD within the jurisdiction of Rangia EC.
2. Construction of 7 Km new 11 KV dedicated Feeder along with terminal equipment & one RCC Control Room under Mangaldai ESD, extension of 11 KV Betybari Feeder by 0.6 Km(river crossing) for dedicated power supply to Bahipukhuri TE and Construction of 3.6 Km dedicated 11 KV Feeder for Orang TE under Mazbat ESD within the jurisdiction of Mangaldai EC.

ON

“TURNKEY” MODE



SCHEME: UDAY 2017-18

NIT No. CGM(PP&D)/APDCL/UDAY 17-18/FDR-Separation/GEC-II/PKG 4/ Dtd:
18.11.2020

**ASSAM POWER DISTRIBUTION COMPANY LIMITED
(APDCL)**

**O/o Chief General Manager (PP&D), Bijulee Bhawan, Paltanbazar,
Guwahati- 781001**

NOTICE INVITING TENDER

NIT No. CGM(PP&D)/APDCL/UDAY 17-18/FDR-Separation/REC&MEC/PKG 4/ Dtd: 18.11.2020

E-tenders, with validity up to 180 (One Hundred Eighty) days from the last date of bid submission, are hereby invited by the undersigned for:

1. Construction of **3.65 Km** new 11 KV dedicated Feeder in north side of NH-31 along with terminal equipment and Construction of **3.55 Km** new 11 KV feeder for DIC under Nalbari ESD-1, Construction of **3.5 Km** 11 KV new Feeder for bifurcation of 11KV chamata Feeder under Chamata ESD within the jurisdiction of Rangia EC.
2. Construction of **7 Km** new 11 KV dedicated Feeder along with terminal equipment & one RCC Control Room under Mangaldai ESD, extension of 11 KV Betybari Feeder by **0.6 Km(river crossing)** for dedicated power supply to Bahipukhuri TE and Construction of **3.6 Km** dedicated 11 KV Feeder for Orang TE under Mazbat ESD within the jurisdiction of Mangaldai EC.

The complete tender documents can be downloaded from our official website www.apdcl.org and also from <https://assamtenders.gov.in>. Interested bidders can download the Bidding Documents and commence preparation of bids to gain time. Download of bidding document is free of cost. However, bidders must deposit online non-refundable tender processing fee of **Rs. 10,000.00 (Rupees Ten Thousand) only** while online submission of tenders in <https://assamtenders.gov.in>.

All interested parties are requested to understand this BID DOCUMENT in detail in order to comply with APDCL's requirements including but not limited to the fees and deadlines, eligibility criteria, selection methodology, scope of work, and minimum technical standards.

The earnest money for the work is **Rs. 10,00,000.00 (Rupees Ten Lakhs) only**. EMD shall be deposited online at the time of submission of tender in <https://assamtenders.gov.in>. Any tender without EMD will be rejected outright.

Key Dates:

a)	Tender publishing and download start date & time:	18.11.2020	14:00 Hours
b)	Last date for submitting Pre-bid queries	23.11.2020	10:00 Hours
C)	Pre-Bid meeting date & time:	23.11.2020	11:30 Hours
c)	Bid submission start date and time:	24.11.2020	10:00 Hours
d)	Last date of Bid Submission:	01.12.2020	12:00 Hours
e)	Bid opening date & time:	01.12.2020	15:00 Hours

The Company reserves the right to accept or reject any tender in part or in full or cancel/withdraw the Notice Inviting Tender without assigning any reason thereof whatsoever and in such case, no bidders/intending bidders shall have any claim arising out of such action.

For details please visit www.apdcl.org and <https://assamtenders.gov.in>

Chief General Manager (PP&D), APDCL

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SECTION – I

INVITATION FOR BIDS (IFB)

**ASSAM POWER DISTRIBUTION CO. LTD.
PROJECT PLANNING & DESIGN**

NIT No. CGM(PP&D)/APDCL/UDAY 17-18/FDR-Separation/REC&MEC/PKG 4 / Dtd: 18.11.2020

E-tenders, with validity up to 180 (One Hundred Eighty) days from the last date of bid submission, are hereby invited by the undersigned for:

1. Construction of **3.65 Km** new 11 KV dedicated Feeder along north side of NH-31 along with terminal equipments and Construction of **3.55 Km** new 11 KV feeder for DIC under Nalbari ESD-1, Construction of **3.5 Km** 11 KV new Feeder for bifurcation of 11KV chamata Feeder under Chamata ESD within the jurisdiction of Rangia EC.
2. Construction of **7 Km** new 11 KV dedicated Feeder along with terminal equipment & one RCC Control Room under Mangaldai ESD, extension of 11 KV Betybari Feeder by **0.6 Km (river crossing)** for dedicated power supply to Bahipukhuri TE and Construction of **3.6 Km** dedicated 11 KV Feeder for Orang TE under Mazbat ESD within the jurisdiction of Mangaldai EC.

IMPORTANT INFORMATION

SL No.	Event	Information to the Bidders	
1	Tender publishing and download start date & time	18.11.2020	14:00 Hrs.
2	Last date & time for queries/ seeking clarification	23.11.2020	10:00 Hrs.
3	Pre-Bid Meeting Date & time	23.11.2020	11:30 Hrs.
4	Bid submission start date & time	24.11.2020	10:00 Hrs.
5	Last date & time of submission of Tender	01.12.2020	12:00 Hrs.
6	Date & time of opening of Technical bid	01.12.2020	15:00 Hrs.
7	Date & time of opening of Financial bid	To be intimated later	
8	Pre-Bid Meeting Address	Venue: O/o the Chief General Manager (PP&D), APDCL 6 th floor, Bijulee Bhawan, Paltanbazar, Guwahati-781001	
9	Tender Document	The complete Tender Documents can be downloaded free of cost from the APDCL's website www.apdcl.org as well as E-tendering portal of GoA www.assamtenders.gov.in	
10	Estimated Cost of the Project	Rs. 4,88,06,426.00 (Rupees Four Crore Eighty Five Lakhs Fourty Nine Thousand Six Hundred Fifteen only)	
11	Tender Processing Fees	Rs. 10,000/- (Rupees Ten Thousand only). The Bidder must deposit non-refundable tender processing fees for the aforesaid amount through online mode at the time of submission of the E-tender. For further details regarding online payment of the tender processing fees, the online published tender documents may be referred.	
12	Bid Security/EMD	Rs. 10,00,000/- (Rupees Ten Lakhs only) The EMD must be submitted through online mode at the time of submission of the E-tender. Any tender without EMD will be rejected outright. For further details regarding online payment of the EMD, the online published tender documents may be referred.	
13	Address & contact details for future correspondences in this regard	O/o the Chief General Manager (PP&D), APDCL 6 th floor, Bijulee Bhawan, Paltanbazar, Guwahati-781001. Email ID: cgmppdapdcl@yahoo.com	

1. Source of Fund: "UDAY 2017-18" Scheme.

Section I: Invitation for Bid (IFB)

2. **Tender Processing fees & EMD:** As delineated above. The tender processing fees and EMD shall be deposited through online mode as per the provision explained above.
3. **Bid Validity:** The bid shall remain valid for a period of 180 days from the last date of bid submission. However, in exceptional circumstance, APDCL may solicit the Bidder's consent to an extension of the bid validity period. The request and responses thereto shall be made in writing or by Email.
4. The completion period for the Contract shall be the period as specified in Section V: GCC Sub-Clause 3.1.
5. The bidding will be conducted through the open competitive bidding procedures as per the provisions specified in the Bid. A Single Stage Two Envelope E-tendering Procedure to be adopted to carry out the tendering formalities against this tender in pursuant to Clause No. 4.1 under Section: ITB.
6. Bids must be submitted electronically through E-tender portal www.assamtenders.gov.in in two parts as Techno Commercial bid and Price bid. A copy of the Technical bid shall be submitted in a sealed envelope super scribing (a) Tender No. (b) Name of the bidder with full address. The submitted hardcopies shall be used for preservation purpose only. **Submission of Techno-commercial Bid in hard/paper form shall not be considered for evaluation purpose. Further, any document not found in the online uploaded copy, but furnished as a part of offline/hardcopy submission shall not be considered for evaluation purpose. Hence, the intending Bidders are advised to upload their techno-commercial bids carefully and completely.**
7. The detailed Qualifying Requirements (QR) are specified in the **Section IV: "Qualifying Criteria & Document Checklist"** of the Bidding Document.
8. Only those bidders found responsive in Part-I of Bid viz. Techno Commercial bid with adequate bid capacity shall be considered for opening of Price Bid. The date and time of opening of Part-II Bid (Price) shall be communicated to those bidders whose bids are qualified for opening.
9. The issue of this BID DOCUMENT does not imply that APDCL is bound to select a Bidder for the Project. APDCL reserves the right to cancel/withdraw this invitation for bids without assigning any reason and shall bear no liability whatsoever consequent upon such a decision.

----- End of Section-I (IFB) -----

SECTION – II INSTRUCTION TO BIDDERS (ITB)

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1. INTRODUCTION

1.1 Preamble

This section of the bidding document provides the information necessary for bidders to prepare responsive bids, in accordance with the requirements of APDCL. It also provides information on bid submission, opening and, on contract award.

Further in all matters arising out of the provisions of this Bid or of the Bidding Documents, the laws of the Union of India shall be the governing laws and Hon'ble Gauhati High Court at Guwahati shall have exclusive jurisdiction.

1.2 General Instructions

1.2.1 All Bidders shall comply with the dates and amounts indicated in **"Section I: Invitation for Bid (IFB)"** of the BIDDOCUMENT.

1.2.2 All Bidders must be required to meet the Eligibility Criteria stipulated in Clause 1.4 under this Section of the BIDDOCUMENT.

1.2.3 The Bidders shall comply with and agree to all the provisions of this existing Section II of the BID DOCUMENT for various bidding considerations including but not limited to eligibility, costs, payments, information regarding APDCL systems, bid formats, bid submission and other considerations.

1.2.4 The Bidders shall be evaluated based on the norms and procedures laid out in Section III of this BIDDOCUMENT.

1.2.5 The Bidders shall be required to undertake and bid for the scope of work for the Project indicated in Section IV of this BIDDOCUMENT.

1.2.6 The Bidders shall comply with various terms and conditions provided in this BID DOCUMENT including but not limited to those provided in Section V of this BID DOCUMENT.

1.2.7 The Bidders are expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the Bid.

1.3 General Terms for Bidding

1.3.1 The Bidders who wish to participate in online tenders will have to procure/shall have legally valid digital certificate as per Information Technology Act'2000 using which they can sign their electronic bids. Bidders who already have a Digital Certificate need not procure a new Digital Certificate.

1.3.2 All bids must be digitally signed. In view of participation through Joint Venture mode, the E-bids must be digitally signed by the lead partner.

1.3.3 Bids prepared by the Bidders and all correspondence and documents relating to the Bid exchanged by the Bidder and APDCL and its associates 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.

- 1.3.4 If for any reason the Bid of any selected bidder is rejected or Letter of Intent issued to such selected bidder is rescinded, APDCL is empowered to take decisions for any of the following:
- i) Consider the next Lowest Evaluated Bid from qualifying Bidders; or
 - ii) Annul the entire bid process; or
 - iii) Take any such measure as may be deemed fit in the sole discretion of APDCL, as applicable.
- Decision of APDCL will be final and binding on all.
- 1.3.5 Technical bid submitted by the Bidders before the Bid Submission Deadline, shall become the property of the APDCL and shall not be returned to the Bidders.
- 1.3.6 APDCL may, at its sole discretion, ask for additional information/document and/ or seek clarifications from a Bidder after the Bid Submission Deadline, inter alia, for the purposes of removal of inconsistencies or infirmities in its Bid. However, no change in the substance of the Financial Bid shall be sought or permitted by APDCL.
- 1.3.7 APDCL may verify Bidder's technical and financial data by checking with Bidder's clients/ lenders/ bankers/ financing institutions/ any other person, as necessary.
- 1.3.8 The Bidders shall satisfy themselves, on receipt of the Bid Document, that the Bid Document is complete in all respects. Intimation of any discrepancy shall be given to the Tender Inviting Authority (TIA) for this Bid Document immediately. If no intimation is received from any Bidders on or before the date and time of the pre-bid meeting as notified in the Section I, then it shall be considered that the issued document, complete in all respects, has been received by the Bidder.
- 1.3.9 The Bid Document includes statements, which reflect the various assumptions arrived at by APDCL in order to give a reflection of the current status in the Bid Document. These assumptions may not be entirely relied upon by the Bidders in making their own assessments. The Bid Document does not purport to contain all the information each Bidder may require and may not be appropriate for all persons. Each Bidder should conduct its own investigations and analysis and should check the accuracy, reliability and completeness of the information in the Bid Document and obtain independent advice from appropriate sources.
- 1.3.10 All bank related documents must be submitted only from a Scheduled Bank as notified by the Reserve Bank of India (RBI).

1.4 Eligibility of Bidder

- 1.4.1 This Invitation for Bids, issued by APDCL is open to all firms (fulfilling the qualifying criterion mentioned herein) which can be a legal entity in the form of sole Indian proprietorship, a partnership firm set up under Indian Partnership Act, 1932, HUF, company registered under the Indian Companies Act, 1956 or a Limited Liability Partnership (LLP) registered under the Indian LLP Act, 2008, barring those bidders with whom business is banned by the APDCL.
- 1.4.2 The Bidder must not be debarred by any Procuring Entity under the State Government, the Central Government, Autonomous body, Authority by whatever name called under them.
- 1.4.3 Bids may be submitted by qualified individual firm or Joint Venture as given below:

- a) A single firm that on its own meets all the qualifying criteria as mentioned in the sub-Section: **“Technical Requirements”** and **“Financial Requirements”** under **Section III: Qualifying Criteria and Document Checklist** of this Bidding Document.
- b) A Joint Venture (JV) can be defined as legal association of two or more firms provided that one of the members of the joint venture shall be nominated as being partner in-charge (i.e. the “Lead partner”) and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the members. Hence, the Joint Venture shall be represented to APDCL by the Lead partner.
- c) The Lead Partner shall be authorized to incur liabilities and receive instructions for and on behalf of any/all partners of the Joint Venture, and the entire execution of the contract, including payment, shall be done exclusively with the lead partner, provided otherwise requested by the Joint Venture in writing and agreed between APDCL and the Lead Partner.
- d) The Bidders, directly or indirectly shall not be a dependent agency of APDCL.
- e) The Bidder shall be wholly responsible for execution of the contract.
- f) In case of non-performance (slippage in milestones, scope & quality of work, discipline, etc. as assessed by APDCL) and/or bankruptcy of any of the partners, the lead bidder shall take necessary remedial action through addition/change of partner for the concerned role. The addition/change of partner for concerned role shall be with necessary prior approval of APDCL and shall be at no additional cost to the already agreed after of bidding for the project, failing which the next progressive payment, if applicable, will be held up. The addition/change of partner for concerned role shall be required to meet the Qualifying Criteria as detailed in the Qualifying Criteria and Document Checklist section.
- g) Sole bidder or any partners including lead partner (in case of Joint Venture) is not allowed to bid as partner of other bidders for the same bid. This will result in the disqualification of all Bids in which it is involved.
- h) Bidders willing to take part in the process of E-tendering are required to obtain Digital Signature Certificate (DSC) in the name of person who will sign the tender, from any authorized Certifying Authority (CA) under O/o the Controller of Certifying Authorities(CCA), Govt of India. DSC is given as a USB-Token.
- i) Any bidder willing to take part in the bidding process will have to be enrolled & registered with the Assam Government eProcurement System (Tenders Assam portal, <https://www.assamtenders.gov.in>).

1.5 Cost of Bidding

The Bidders shall bear all costs associated with the preparation and submission of its bid including post-bid discussions, technical and other presentations etc., and the APDCL will in

no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

1.6 Payment of Fees by Bidders

- 1.6.1 Tender processing fees and EMD shall be paid online during submission of bid via <https://www.assamtenders.gov.in>. A schematic guideline for the same has been provided along with the tender documents for reference of the bidders.
- 1.6.2 Any Bid **not** accompanied by a substantially responsive EMD shall be rejected by APDCL as non-responsive.
- 1.6.3 The cost of all stamp duties payable for executing the Bid Documents or Project shall be borne by the relevant Lead Partner.
- 1.6.4 No interest shall be paid to the Bidder on any amount submitted to APDCL, whether to be returned or not.
- 1.6.5 Deposition of Fees by the bidders as tender processing fees or EMD may be subject to any procedural changes in the bidding portal. In case of any such developments, the same will be communicated by APDCL in the bidding portal as well as APDCL website.

1.7 Bidders to inform itself fully

- 1.7.1 The Bidder shall make independent enquiry and satisfy itself with respect to all the required information, inputs, conditions (including site conditions) and circumstances and factors that may have any effect on its Bid. Once the Bidder has submitted the Bid, the Bidder shall be deemed to have examined the laws and regulations in force in India, the grid conditions, and fixed its price taking into account all such relevant conditions and also the risks, contingencies and other circumstances which may influence or affect the supply of power. Accordingly, the Bidder acknowledges that, on being selected as Successful Bidder, it shall not be relieved from any of its obligations under the Bid Document nor shall be entitled to any extension of time for commencement of supply or financial compensation for any reason whatsoever.
- 1.7.2 The Bidders shall particularly acquaint themselves with the technical requirements of APDCL's systems, operations, assets, equipment, statutory codes and standards.
- 1.7.3 The Bidder shall familiarize itself with the procedures and time frames required to obtain all Consents, Clearances and Permits required for implementation of the Project. APDCL shall have no liability to obtain any of the Consents, Clearances and Permits required for setting up the Project other than those covered under APDCL's conventional business.

1.8 Study of APDCL's existing system

- 1.8.1 APDCL shall, if required, share certain information for the benefit of the prospective Bidders. The intention of sharing the data by APDCL is to share information about its

existing resources to provide a tentative idea of the existing systems at APDCL only to provide a perspective of the Scope of Work.

- 1.8.2 The intending bidders are requested to physically survey/inspect the location or route and get themselves understood the scope of work by having discussion with the concerned field officials in order to reduce post Contract award contingencies. The requirement of any additional work/quantity for fulfilling the scope of work under the project but inadvertently left out in the BOQ may be intimated in the pre-bid meeting only. The cost of visiting the site shall be at the bidder's own expense.
- 1.8.3 The Bidder and any of its personnel or agents will be granted permission by APDCL to enter upon its premises and lands for the purpose of such inspection, but only upon the express condition that the bidder, its personnel and agents will release and indemnify APDCL and its personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of/or damage to property and any other loss, damage, costs and expenses incurred as a result of the inspection.
- 1.8.4 Bidders shall never publish /quote information gathered in this process, either in full or part. APDCL is entitled to claim compensation from any defaulting bidders.

2. BIDDING DOCUMENTS

2.1 Contents of Bidding Document

- 2.1.1 The Bidding Document includes the following Sections, which shall be read in conjunction with any amendment issued in accordance with sub-clause 2.4 of this section.

- Section I : Invitation for Bid(IFB)
- Section II: Instruction to Bidders(ITB)
- Section III : Qualifying Criteria and Document Checklist
- Section IV : Scope of Work & BOQ of materials
- Section V : General Conditions of Contract(GCC)
- Section VI : Technical Specifications
- Section VII : Forms of Bid

2.2 Clarifications on Bid Document

- 2.2.1 The Bidders may seek clarifications on this bid in writing as per the prescribed format (Annexure-1 of Section: VII) through email to reach APDCL on or before **10:00 Hrs. of 23.11.2020**. The Email shall be sent to **cgmpdpdcl@yahoo.com**
- 2.2.2 The Utility shall not be obliged to respond to any request for clarification received later than the above period.
- 2.2.3 APDCL may issue clarification only, at its sole discretion, which is considered reasonable by it.

- 2.2.4 Any such clarifications issued shall be made available in the official website of APDCL www.apdcl.org
- 2.2.5 Verbal clarification and information given by Employer or his employee(s) or his representative(s) shall not in any way be binding on Employer.
- 2.2.6 APDCL is not under any obligation to entertain/respond to suggestions made or to incorporate modifications sought for.

2.3 Pre-Bid Meeting

- 2.3.1 In order to provide response to any doubt regarding Bidding Documents or to clarify any issue arising out of it, a pre-bid meeting will take place at the venue and time specified in the Section I of this Bidding Document.
- 2.3.2 The bidder's designated representative(s) is/are invited to attend a pre-bid meeting. The purpose of the meeting shall be to clarify any issue regarding the Bidding Documents in general and the Technical Specifications in particular. The Bidder is requested, as far as possible to submit any question in writing, to reach the Employer not later than the period notified in the sub-clause 2.2 under this section.
- 2.3.3 Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

2.4 Amendments to BIDDOCUMENT

- 2.4.1 At any time prior to the deadline for submission of bids, APDCL may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Document by issuance of amendment(s).
- 2.4.2 The amendment(s) shall be made available in E-tendering portal as well as in the official website of APDCL. Bidders are required to regularly check / visit the E-procurement web-portal and immediately acknowledge receipt of any such amendments, and it will be assumed that the information contained therein will have been taken into account by the Bidder in its bid.
- 2.4.3 APDCL shall not be responsible for any delay in receipt of the addendum/ modification/ errata and/ or revised document and receipt of the same by the Bidders. Late receipt of any addendum/ modification/ errata and/ or revised document will not relieve the Bidder from being bound by that modification or the Bid Submission Deadline.
- 2.4.4 In order to provide reasonable time to the Bidders to incorporate the modification into account while preparing their Bid, or for any other reasons, APDCL may, at its discretion, extend the deadline/ timeline for Bid submission.

3. PREPARATION OF BIDS

3.1 Language of Bid

- 3.1.1 The bid prepared by the Bidder and all correspondences and documents relating to the bid, exchanged by the Bidder and APDCL shall be written in the English language, provided that any printed literature furnished by the Bidder may be written in another language so long as accompanied by an English translation of its pertinent passages. Failure to comply with this may disqualify a bid. For purposes of interpretation of the bid, the English translation shall govern.

3.2 Documents comprising the Bid

- 3.2.1 The E-bid submitted by the bidder shall be in two envelope and shall comprise the following: -

Envelope I: - Relevant technical and commercial documents required to fulfil the eligibility criteria as specified under Section III: Qualifying Criteria and Document Checklist shall be submitted by the bidder on the E-tendering portal by the schedule date and time of submission of bids.

Envelope II: - Financial bid shall also be submitted electronically as per the prescribed format provided along with the tender documents.

- 3.2.2 Alternative (alternate technology/method/design/functionality or proposals with multiple options) Bids shall be rejected.

3.3 Bid Forms

- 3.3.1 The information and documents shall be prepared and submitted by the Bidders as per the enclosed formats in the Section VI of this bidding document. The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

3.4 Bid Prices

- 3.4.1 The contract shall be for the whole works as described in **Section IV – Scope of Works & BOQ of materials** based on the priced Bill of Quantities submitted by the Bidder.
- 3.4.2 Items against which no price is entered by the Bidder will not be paid for by APDCL when executed and shall be deemed to be covered by the prices for other items.
- 3.4.3 All duties, taxes, and other levies payable by the Contractor under the Contract, shall be included in the rates and prices and the total bid price submitted by the Bidder.

3.5 Bid Currencies

- 3.5.1 Prices shall be quoted in Indian Rupees only.

3.6 Bid Security/Earnest Money Deposit (EMD)

- 3.6.1 The Bidder shall furnish as part of its bid, a bid security, for the amount as specified in this bid Document through online mode.
- 3.6.2 Any bid not accompanied by a bid security or an acceptable bid security shall be rejected by APDCL as being nonresponsive. The bid security of a joint venture must be in the name of all the partners/lead partner of the joint venture submitting the bid.
- 3.6.3 The bid security of a joint venture must be in the name of all the partners/lead partner in the joint venture submitting the bid.
- 3.6.4 The bid security of a bidder lying with APDCL ,if any ,in respect of other bids awaiting decision shall not be adjusted towards bid security required under this Bidding Documents.
- 3.6.5 The Bid Securities of the unsuccessful bidders at the techno-commercial evaluation stage shall be returned after opening of the price-bids against the said tender. However, for the responsive bidders found to be unsuccessful at the financial evaluation stage, the Bid Security shall be returned after signing of Contract Agreement and deposition of performance security by the successful bidder to the satisfaction of APDCL.
- 3.6.6 The successful Bidder shall be required to keep its bid security valid for a sufficient period till the performance security(ies) pursuant to ITB Clause 6.3 are furnished to the satisfaction of APDCL. The Bid Security of successful Bidder shall be released upon the signing of Contract Agreement as well as submission and acceptance of the Performance Security to the satisfaction of APDCL.
- 3.6.7 No interest shall be payable by the Employer on the above Bid Security.
- 3.6.8 The Bid Security may be forfeited–
 - 3.6.8.1 If the Bidder withdraws its bid during the period of bid validity specified by the Bidder in the Bid Form; or
 - 3.6.8.2 In case of a successful bidder; if the bidder fails within the specified time limit-
 - i) to sign the Contract Agreement, in accordance with ITB Clause 6.4or,
 - ii) to furnish the required performance security(ies), in accordance with ITB Clause 6.3 and/or to keep the bid security valid as per the requirement of ITB Sub-Clause 3.6.6.

3.7 Validity of the Bid

- 3.7.1 Bids shall remain valid for the period of **180 (one hundred eighty) days** from the last date of bid submission. A bid valid for a shorter period shall be rejected by the APDCL as being non-responsive.
- 3.7.2 In exceptional circumstance, APDCL may solicit the Bidder's consent to an extension of the bid validity period. The request and responses thereto shall be made in writing or by email.

4. SUBMISSION OF BIDS

4.1 Method of submission of Bid

The procedure for bid submission to participate in this E-tender has been delineated as follows: -

- 4.1.1 The technical and financial bids must be submitted through online mode only at <https://assamtenders.gov.in> on or before the Bid Submission Deadline. The Documents to be uploaded shall be properly scanned and duly signed wherever required. All required documents as per Document Checklist must be attached as a soft copy during technical bid submission. The price bid should distinctly indicate the following components - Quoted price with clear differentiation of Taxes and Duties. The bidders are to quote FIRM rates showing break up of all taxes and duties in the 'Schedule of Price'.
- 4.1.2 Bidders must make online deposit of tender processing fee of Rs. 10,000.00 (Rupees Ten Thousand) only while online submission of tenders in <https://assamtenders.gov.in>.
- 4.1.3 Bidders must make online deposit of EMD (Earnest Money Deposit) of Rs. 10,00,000.00 (Rupees Ten Lakhs thousand) only while online submission of tenders in <https://assamtenders.gov.in>.

4.2 Deadline for Submission of Bids

Bids must be submitted in the E-tendering portal within the stipulated date and time specified in the Section I: IFB of the Bidding Document. As the mode of submission is online, the prospective bidders are recommended to submit their bids sufficiently advance in time to avoid any last hour rush.

4.3 Late Bids

Since the bidder has to submit bids online on E-tendering portal, so bidder will not be able to upload tender after due time for bid submission on the last date of bid submission.

4.4 Modification and Withdrawal of Bids

- 4.4.1 The Bidder may modify or withdraw its bid after submission prior to the deadline prescribed for bid submission.
- 4.4.2 However, no bid shall be withdrawn, substituted, or modified after the expiry of bid submission period as specified in the tender.

5. BID OPENING AND EVALUATION

5.1 Opening of Techno-Commercial Bid

- 5.1.1 The Employer will open the Techno – Commercial Part online on the scheduled time and date as specified in the NIT. The bids shall be opened in the presence of the Bidders' authorized representatives who choose to be present, enabling them to watch the proceedings.
- 5.1.2 The Bids shall be deemed to be under consideration immediately after they are opened and confirmation or receipt of the Tender Processing Fee and Bid Security, and until an official intimation of award or rejection is made by APDCL to the Bidders.
- 5.1.3 APDCL shall prepare the summary of the bid opening in the form of Bid Opening Statement including the information of accepted bids and upload the same in the E-tendering portal to carry forward the tendering process to the Techno-Commercial Evaluation stage.
- 5.1.4 APDCL shall then separately evaluate the Bids with respect to the Eligible Criteria, sufficiency of the submission, as well as other parameters outlined in this BID DOCUMENT.

5.2 Confidentiality

- 5.2.1 Information relating to the examination, evaluation, comparison and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process.
- 5.2.2 Any attempt by a Bidder to influence APDCL in the examination, evaluation, comparison, and post qualification of the Bids or Contract award decisions may result in rejection of the Bid of that Bidder.
- 5.2.3 If any Bidder, from the time of opening the Technical Bids to the time of Contract award, wishes to contact APDCL on any matter related to the bidding process, it should do so in writing.

5.3 Clarification on Bids

- 5.3.1 To assist in the examination, evaluation, comparison and post-qualification of the Bids, APDCL may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by APDCL shall not be considered. APDCL's request for clarification and the response shall be in writing. No change in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by APDCL in the evaluation of the Financial Bids.

5.4 Responsiveness of Technical Bid

- 5.4.1 APDCL's determination of the responsiveness of a Technical Proposal is to be based on the contents of the Technical Proposal itself.
- 5.4.2 A responsive Technical Proposal is one that conforms to all the mandatory requirements, terms, conditions, and specifications of the Bidding Document

without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:

- a) does not meet all the Minimum Technical Specifications; or
- b) affects the scope, quality, or performance of the Solution; or
- c) limits or is inconsistent with the BID DOCUMENT, APDCL's rights or the Bidder's obligations; or
- d) if rectified would unfairly affect the competitive position of other Bidders presenting responsive Technical Proposals.

5.5 Non-Conformities, Errors, and Omissions

- 5.5.1 Provided that a Technical Bid is substantially responsive, APDCL may waive any non-conformity or omission in the Bid that does not constitute a material deviation.
- 5.5.2 Provided that a Technical Bid is substantially responsive, APDCL may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial, nonconformities or omissions in the Technical Bid related to documentation requirements. Such omission shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.
- 5.5.3 Provided that the Technical Bid is responsive, APDCL will correct arithmetical errors during evaluation of Price bids on the following basis:
 - a) if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of APDCL there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;
 - b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail, and the total shall be corrected;
 - c) if there is a discrepancy between words and figures, the amount in words shall prevail. However, where the amount expressed in words is related to an arithmetic error, the amount in figures shall prevail subject to (a) and (b) above.
 - d) Except as provided in (a) to (c) herein above, APDCL shall reject the Financial Bid if the same contains any other computational or arithmetic discrepancy or error.
- 5.5.4 If the Bidder that submitted the Lowest Evaluated Bid does not accept the correction of errors, its Bid shall be disqualified, and its Bid Security shall be forfeited.
- 5.5.5 If the price of any item is kept blank the highest rate quoted among the techno-commercial qualified bidders will be loaded for evaluation purpose. However, if the bidder happens to be L-1 then rate against the item which the bidder has kept blank will be awarded as zero i.e. he will have to execute the work without any financial involvement.

5.6 Evaluation of Techno-commercial part

- 5.6.1 APDCL shall evaluate the bidders based on the Qualifying criteria set forth in the Section III of the Bid Document.
- 5.6.2 The Bidders may participate in any or all the packages as stipulated under the NIT subject to a net positive difference of the Average Annual Turnover (AAT) of the bidder and estimated cost of the successive bids. In the event of a net negative result, their offered bids shall not be considered for further techno-commercial evaluation and may liable to be rejected.

5.7 Opening of Financial Bid

- 5.7.1 After completion of the technical evaluation, APDCL shall intimate the successful bidders for opening of Financial Bids of the responsive bidders. No objection/request from bidders in respect of evaluation of technical bids shall be entertained by APDCL after intimation in respect of opening of price bids is sent to the technically qualified bidders.
- 5.7.2 Representatives of Qualifying Bidders may be present during opening of the Financial Bids of the Qualifying Bidders at the specified date and time as intimated.
- 5.7.3 The prices and details as may be read out during the price bid opening and recorded in the Bid Opening Statement would not be construed to determine the relative ranking amongst the Bidders, or the successful Bidder, and would not confer any right or claim whatsoever on any Bidder.

5.8 Evaluation of Financial Bids

- 5.8.1 The Financial Bids will be examined to determine whether they are complete, whether any computational errors have been made and whether the bids are generally in order.
- 5.8.2 The Financial bids containing any arithmetic errors shall be evaluated in pursuant to Clause 5.5.3 under this section.
- 5.8.3 The quoted price of the responsive bidders shall be accepted/rejected in conformity to the clause 5.9 under this section.

5.9 Abnormally Low Bids (ALB)

- 5.9.1 An abnormally Low Bid is one in which the Bid price, in combination with other elements of the Bid, appears to be so low that it raises concerns as to the capability of the Bidder to perform the contract for the offered price.
- 5.9.2 For the purpose of identification and dealing with the ALBs, the MD, APDCL shall act as ex-officio Chairman of the Tender Evaluation Committee. The Committee shall undertake the following three-stage review process to check the possibility of an ALB by a potential successful bidder and take necessary action, as deemed fit. The decision of the Committee shall be conclusive and binding on all.
 - i. identify abnormally low costs and unit rates by comparing them with the APDCL estimate or other substantially responsive bidders, or recently awarded similar contracts;
 - ii. clarify and analyze the Bidder's resource inputs and pricing, including

- overheads, contingencies and profit margins; and
- iii. decide whether to accept or reject the Tender.

- 5.9.3 The ALBs shall be identified using any of the following 2(two) methodologies, as applicable:

When Estimated Cost is disclosed:

In this case, the ALB shall be identified based on the comparison with the Estimated Cost of the Project. The bids with quoted price below 10% (ten percent) of the Estimated Cost shall be treated as ALB by the Committee.

When Estimated Cost is not disclosed:

In this event, the Committee shall resort to a statistical approach in which first the Average Bid value shall be calculated among the substantially responsive bidders. Subsequently, the bids with quoted price found to be lower than 10% of the calculated average value shall be identified as ALBs.

- 5.9.4 Once a potential ALB has been identified, the Committee will seek a written explanation from the bidder of the reasons for the offered Tender price, including a detailed price analysis, proposed methodology, schedule, and allocation of risks and responsibilities. This may also include information regarding the economy of the manufacturing process; the services to be provided, or the construction method to be used; the technical solutions to be adopted; and any exceptionally favorable conditions available to the bidder for the works, equipment or services proposed.
- 5.9.5 Failure to furnish the required information against point 5.9.4 above within the stipulated time period will lead to the rejection of the bidder. In that case, the Committee will resort to the next lowest ranked bidder and reiterate the process, in case that bidder also happens to come under ALB.
- 5.9.6 On receiving the Bidder's justification, the Committee will meticulously examine the information provided by the bidder while taking into account all the relevant evidences produced in response to the request for clarification.
- 5.9.7 After examining the explanation given and the detailed price analyses presented by the bidder, the Committee may at its sole discretion:
- i) accept the Tender subject to requiring the bidder to submit an Additional Performance Security in pursuant to the Clause 6.3.2 under this section to protect the Employer from any financial loss in the event of default of the successful bidder under the contract; or
 - ii) reject the Tender, if the evidence provided does not satisfactorily account for the low Tender price and make a similar determination for the next lowest ranked bid, if required.

5.10 Overall Techno-commercial Evaluation

The techno-commercially responsive Bidder with the acceptable lowest total quoted prices (inclusive of all taxes) i.e. the L1 bidder shall be the Successful Bidder.

5.11 Purchase/Domestic preference

No preference shall be given to any bidder.

5.12 Employer's Right to Accept Any Bid, and to Reject Any or All Bids

APDCL reserves the right to accept or reject any bid, and to cancel / annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to the Bidders for which the Employer shall keep record of clear and logical reasons properly for any such action / recall of bidding process. In case of cancellation / annulment, bid securities, shall be promptly returned to the Bidders.

6. AWARD OF CONTRACT**6.1 Award Criteria**

- 6.1.1 APDCL will award the contract to the successful Bidder (also referred to as the L-1 Bidder) whose bid has been determined to be substantially responsive and to be the lowest evaluated bid, further acceptable as per the clause 5.9 under this section.
- 6.1.2 In the event if two or more bidders offering the same Bid Price, the Employer shall identify the bidder for award of contract on the basis of (a) highest available bid capacity, (b) Volume of similar nature of works executed during any one of the last 5 years by the bidder as prime contractor and (c) Average Annual Turnover of the Bidder during the last 3(three) consecutive FYs (2016-17, 2017-18, 2018-19).
- 6.1.3 The contract shall not be awarded to more than one bidder by splitting the work.

6.2 Notification on Award

- 6.2.1 Prior to the expiration of the period of Bid validity, APDCL shall notify the successful Bidder, in writing, that its Bid has been accepted and offer the Letter of Intent (LOI).
- 6.2.2 Within 10 (ten) days of the receipt of letter of intent (LOI) from APDCL, the successful Bidder shall furnish the Performance Security in pursuant to the clause no. 6.3 below, as per the proforma given in Annexure 5 under Section VII.
- 6.2.3 Failure of the successful Bidder to submit the above-mentioned Performance Security or convey the acceptance of the LOI shall constitute sufficient grounds for the annulment of the LOI and forfeiture of the Bid Security. In that event, APDCL may resort to the next successful Bidder whose offer is responsive and is determined by APDCL to be qualified to perform the project satisfactorily.
- 6.2.4 The bidder shall be offered the Letter of Award (LOA) after submission of the LOI Acceptance Letter and furnishing and acceptance of the Performance Security to the satisfaction of APDCL in pursuant to clause 6.3.
- 6.2.5 Until a formal Contract is prepared and executed, the Letter of Award (LOA) shall constitute a binding Contract.

6.3 Performance Security

- 6.3.1 The successful bidder shall have to deposit the Performance Security in the shape of Bank Guarantee of nationalized bank or scheduled bank of RBI having their regional office in Assam or at least a branch office at Guwahati (in case of those, whose regional office is not located in the state of Assam) with a certificate from the Bank

to the effect that the verification or any confirmation in regard to the BG issued by the bank can be taken up with the Branch office at Guwahati pledged in favour of "ASSAM POWER DISTRIBUTION COMPANY LIMITED." as per proforma for an amount equivalent to 10% (ten percent) of the contract value of the order. The Performance Security shall be furnished to the CGM (PP&D), APDCL along with the acceptance of Letter of Intent (LOI), valid for a period of 60(sixty) days beyond the stipulated date of completion of the Project as per LOI/LOA.

Further, a Performance Bank Guarantee (PBG) for an amount equivalent to 10% of the Contract value shall be furnished after successful completion and commissioning of the Project covering the period of 1(one) month beyond the warranty period of 60(sixty) months. The earlier BG i.e. the Performance Security shall be released on submission and acceptance of the 2nd BG i.e. Performance Bank Guarantee. If supplier fails or neglect to perform any of his obligations under the contract, the APDCL shall have the right to forfeit in full or in part at its absolute discretion the performance security deposit furnished by the contractor. No interest shall be payable on such deposits. Detail order will be issued on receipt of acceptance of LOI and Performance security deposit. The performance security of a joint venture shall be in the name of **Lead Partner** of the joint venture.

6.4 Additional Performance Security in the event of ALB

In the event that an Abnormally Low Bid has been accepted for award of contract, the successful bidder shall be required to submit an additional Performance Security along with the regular Contract Performance Guarantee for an amount calculated as under:

- i) If the Bid Price offered by the shortlisted Bidder is lower than 10% but up to 20% of the estimated Project cost, then the Additional Performance Security shall be calculated @ 5% of the Contract Price.
- ii) If the Bid Price offered by the shortlisted Bidder is below 20% of the estimated Project cost, then the Additional Performance Security shall be calculated @ 15% of the Contract Price.
- iii) The additional Performance Security shall be treated as part of the Performance Security and shall be valid for a period coextensive with the Contract Performance Guarantee.
- iv) Non-submission of the additional Performance Security shall constitute sufficient ground to reject the bid and similar assessment pursuant to clause 1 will be made for the next ranked bidder.

6.5 Signing the Contract Agreement

- 6.5.1 The successful bidders shall have to enter into an agreement with APDCL within 10 (ten) days from the date of issue of detailed work order (LOA) failing which the LOA shall be rescinded without any further communication from APDCL end.
- 6.5.2 The successful Bidder shall sign on the Contract Agreement with seal on each page, date as per the prescribed format provided in Annexure 7 under Section VII.

6.6 Fraudulent practices and Corruption

6.6.1 It is the APDCL's policy that requires the Bidders, suppliers, and contractors under the contract to observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, APDCL defines, for the purpose of this provision, the terms set forth below as follows:

- (i) "corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
- (ii) "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
- (iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
- (iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
- (v) "obstructive practice" is
 - (a) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Employers' investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or
 - (b) acts intended to materially impede the exercise of the APDCL's inspection and audit rights.

6.6.2 APDCL will reject a proposal for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question;

6.6.3 APDCL will sanction a firm or individual, including declaring 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, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for, or in executing, a contract; and

6.6.4 APDCL will have the right to require that the provision be included in Bidding Documents and in contracts, requiring Bidders, suppliers, and contractors and their sub-contractors, if any to permit the Employer to inspect their accounts and records and other documents relating to bid submission and contract performance and to have them audited by auditors appointed by the Employer.

-----**End of Section II (ITB)**-----

Section III: Qualification Criteria & Document Checklist

1. Qualifying Criteria and Document Checklist

The Eligibility Criteria described below shall determine the Bidder's Qualification:

- 1.1** Bids may be submitted by qualified individual firm or Joint Ventures of firms provided they can be classified as one of the following:
- 1.1.1 A single firm that on its own meets all the qualification requirements as mentioned in the Section- "Technical Requirements" and "Financial Requirements" below.
 - 1.1.2 A Joint Venture (JV) can be defined as association of two or more firms in which all such firms shall be jointly and severally bound to the Employer for the fulfilment of the provisions of the Contract and shall designate one of such firms to act as a leader with authority to bind the joint venture. The composition or the constitution of the joint venture shall not be altered without the prior written consent of the Employer.
 - 1.1.3 No bidder, either JV partners or single bidder, who is blacklisted or given a "Stop Deal" notice by any of the Government of ASSAM/ Government of India Departments, Agencies, or Public Sector Undertakings (PSU) including APDCL, can take part in the bid.
 - 1.1.4 APDCL may assess the capacity and capability of the bidder, to successfully execute the scope of work covered under the contract within stipulated completion period. This assessment shall inter-alia include (i) document verification; (ii) bidders work/manufacturing facilities visit; (iii) manufacturing capacity, details of works executed , works in hand, anticipated in future & the balance capacity available for present scope of works; (iv) details of plant and machinery, manufacturing and testing facilities, manpower and financial resources; (v) details of quality systems in place; (vi) past experience and performance; (vii)customer feedback; (viii) banker's feedback etc. Utility/Owner reserves the right to waive minor deviations if they do not materially affect the capability of the bidder to perform the contract.

1.2 Technical Requirements

Bid shall be submitted by an individual firm or Joint Venture of firms who shall meet the following Technical requirements:

- 1.2.1 The bidder shall be a single Indian legal entity in the form of sole proprietorship, or partnership firm set up under Indian Partnership Act, 1932, or HUF, or company registered under the Indian Companies Act, 1956 or a Limited Liability Partnership (LLP) registered under the LLP Act, 2008 and necessary supporting documents for the same must be submitted by the bidder along with the technical bid.

- 1.2.2 The bidder must be registered in the **Contract Management System (CMS)** portal of APDCL and shall furnish the Provisional/Final Registration Certificate at the time of bid submission.
- 1.2.3 The bidder must have valid Electrical Contractor's and Supervisor's License (HT minimum up to 33 KV) issued by any Licensing Authority of Govt. of Assam. In case, the bidder does not have the licenses from the Licensing Authority of Govt. of Assam but has valid licenses from other Licensing Authority under the Electricity Act 2003, the bidder will have to obtain the same from the Licensing Authority of Govt. of Assam in case of award of contract.
- 1.2.4 The bidder must have the experience of **successful execution of minimum (i) 12 Km 11 KV line with ACSR conductor and (ii) Supply, installation & commissioning of terminal equipments under a single contract or each of the above category wise qualifying criteria under one contract each during the last 5 years** as on the date of opening of techno- commercial bid. All the above must be in satisfactory operation for **at least 1 (one) year**.
- 1.2.5 The experience certificate furnished against point 1.2.4 above must be from an officer not below the rank of **CEO/DGM/Superintending Engineer** of electrical utilities within India.
- 1.2.6 The Guaranteed Technical Particulars (GTPs) of the major terminal equipments and line materials shall be submitted as per the specifications and drawings mentioned in the bid along with all the required type test reports. Failure to submit the same shall be treated as a major technical deviation and may lead to rejection of the bidder.
- 1.2.7 The bids submitted by the bidders shall be rejected, if-
 - i. If any milestones of an ongoing project of APDCL wherein the bidder is involved, has not been completed on time; or
 - ii. If any of the projects awarded to the bidder has not been completed within the scheduled project completion period and the reason for such delay is solely because of fault of contractor or reasons attributed to him/her.

1.3 Financial Requirements

Bid shall be submitted by an individual firm or consortium of firms who shall jointly meet the following financial requirements:

- 1.3.1 Minimum Average Annual Turnover (MAAT) for the last 3(three) consecutive financial years (2016-17, 2017-18, 2018-19) of the bidder shall be at least **12.00 Crores** and must be certified by a registered Chartered Accountant. This shall be supported by copy of audited balance sheet for the said years along with the subsequent income tax return statements.
- 1.3.2 In case of Joint Venture bids, the figures against Average Annual Turnovers for each Joint Venture partners shall be added together to determine the bidder's compliance with the minimum average turnover requirement against the tender. However, the lead partner must meet **minimum 40% of the MAAT** whereas each of the individual partners must meet at **least 25%**

of the MAAT.

- 1.3.3 Be it a single bidder or a Joint Venture, Net Worth of all the bidders for last three (3) audited financial years i.e. 2016-17, 2017-18 and 2018-19 (CA certified) shall be positive. Net worth means the sum of total of paid up capital and free reserves (excluding reserves created out of revaluation) reduced by aggregate value of accumulated losses (including debit balance in profit and loss account for current year) and intangible assets.

1.4 Bid Capacity

Bidders fulfilling the qualifying criteria specified against Technical & Financial requirements above will be evaluated against their available Bid Capacity. They will be treated responsive only if their available bid capacity at the time of bidding is more than the estimated cost of the project. The available capacity will be calculated as under:

$$\text{Assessed available bid capacity} = (A \times N \times 2 - B)$$

Where,

A = Maximum value of Electrical works executed in any one year during the last five consecutive years (updated to the price level of the year as indicated in Annexure 10(A), rate of inflation may be taken as 10% per year taking into account the completed as well as works in progress).

N = Number of years prescribed for completion of the works for which bids are invited. (Value of N=1/2 up to 6 Months & N=1 above 6 Months)

B = Value (updated to the price level) of existing commitments and ongoing works to be completed during period of completion of works for which bids are invited. This shall be supported by an affidavit as per the format indicated in the Annexure 10(B) along with all the relevant supporting documents mention therein.

Please note that, the prospective bidder shall furnish offered price(s) where the bidder has been awarded Letter of Intent (LOI) in the ongoing tendering process in APDCL and its successor companies. This value shall be taken into account for assessment of the 'B' value.

N.B The statement showing the value of existing commitments /ongoing works as well as remaining period of completion against each of the works shall be countersigned by the Engineer in charge, not below the rank of **CEO/DGM/Superintending Engineer** of electrical utilities.

- APDCL reserves the right to carry out the Bid Capacity assessment of the Bidders and the owner's decision shall be final and binding to the bidder.
- Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have:
 - Made misleading or false representations in the forms, statements and enclosures submitted as a proof of the qualification requirements; and/or
 - Record of poor performance such as abandoning the work, rescinding of contract for which the reasons are attributed to the non-performance of the contractor, consistent history of litigation awarded against the Applicant or financial failure due to bankruptcy. The rescinding of contract of a Joint Venture on account of reasons other than non-performance, such as most experience partner of Joint Venture pulling out, court directions leading to breaking up of a Joint Venture before the

start of work, which are not attributable to the poor performance of the contractor will, however, not affect the pre-qualification of the individual partners.

1.5 Document Checklist:

S/N	Attachment	Form of Submission	To be submitted by the Single Bidder / Lead partner of Joint Venture	To be submitted by all other partners in case of a JV
1.	Bid submission covering letter	On Official Letter Head of the Single bidder/Lead partner signed by all JV partners in case of a JV (as per ANNEXURE-2)	√	
2.	EMD	As mentioned in NIT	√	
3.	Tender Processing Fees	As mentioned in NIT	√	
4.	Notarised Joint Venture Agreement entered amongst all Members of the Bidding partners.	Non-judicial stamp paper of Rs. One Hundred only.	√	
5.	Notarised Power of Attorney in favor of the Lead partner of the JV signed by all the JV partners.	Non-judicial stamp paper of Rs. One Hundred only.		√
6.	Notarised Power of Attorney by Lead partner of JV authorizing an Individual designated representative for the joint venture.	Non-judicial stamp paper of Rs. One Hundred only.	√	
7.	List of all work orders and relevant Experience Certificates establishing the Bidder's eligibility in pursuant to point 1.2.4 & 1.2.5 under this section.	Work orders shall be accompanied by the corresponding Performance certificate clearly mentioning all the details as per point 1.2.4 & 1.2.5 on concerned utility's official letter head. (refer to Annex. 8)	√	√
8.	CA certified company balance sheet of last 3 (three) consecutive financial years (i.e. 2016-17, 2017-18, 2018-19, distinctly indicating the Net Worth, Revenue heads and Turnover corresponding to sole bidder/each individual partners of the JV	CA certified and as per Annex. 9	√	√
9.	Certificate of Incorporation/Firm Registration/ Trade License, whichever		√	√

	applicable			
10.	CMS Registration Certificate	System generated copy	√	√
11.	Documents establishing adequate Bid Capacity	As per Annex. 10(A) & 10(B)	√	√
12.	Self Attested copy of GSTN certificate of all the JV partners.		√	√
13.	Self Attested copy of PAN Card for all the JV members.		√	√
14.	Name and Contact Information of all JV partners (Complete address with email/phone no)	On Official Letter Head of each JV partner	√	√
15.	Self-certification of Non-Blacklisting/No litigation by/with any of the Government Departments, Agencies or Public Sector Undertaking (PSU) including APDCL/AEGCL/APGCL	On Official Letter Head of each JV partner	√	√
16.	Letter of consent regarding compliance of terms & conditioning of each element of the Bid	On Official Letter Head of each sole Bidder/all members including Lead partner	√	√
17.	Certificate showing the number of skilled manpower for relevant technical skill set, individually for each JV partner.	Self-certified by each partner (refer to Annex. 11)	√	√
18.	Project execution Plan	in PERT chart	√	
19.	Provident Fund (PF) Certificate indicating PF Code of the Bidder/ each Consortium Member.		√	√
20.	Employees' State Insurance Corporation (ESIC) Registration Certificate		√	√
21.	Up to date Labour License for the Electrical Installation works		√	√
22.	Up to date Electrical Contractor's License & Supervisors' competency License in pursuant to point no. 4.2.3		√	√
23.	Bank Solvency Certificate indicating various financial parameters like limit of liquid assets, line of credit etc.		√	√
24.	Proof of availability of the tools, tackles, spare parts, etc. for carrying out the works.			
25.	GTP compliance (Pole/conductor/insulators/VCB/Lightning Arrestor with Surge Monitor/ GoAB switch/XLPE cables/Isolator/CT-PT/HT TVM/DCDB/Battery Charger/Battery Bank), as mentioned in Section VI: Technical Specifications		√	

Section IV:

Scope of Work and Bill of Quantity (BoQ)

1.1.Name of Work:

- 1.1.1.Construction of a new separate 11kV feeder at North Bank of NH31 under Nalbari Electrical Sub-Division-I along with construction of Bay, Installation & commissioning of Terminal Equipments
Starting point: 33/11kV sariohtoli SS-NH31, Milonpur, Nalbari
Route: (i) Sariohtoli S/S to MalakarSupa:-600 mtr, MalakarChupa to Ahingsha Chemical:-800 Mtr (Double Ckt), Ahingsha Chemical-LR Mill:-300 mtr
(ii) Sariohtoli SS-SIRD:-600 Mtr (Double ckt), SIRD-Bhuyarkuchi-650 Mtr, Bhurkuchi- Milonpur NH31: 700 Mtr**(Overall Line Length: 3.65 KM)**
- 1.1.2. Construction of 11kV Dedicated Feeder for DIC under Nalbari ESD-I **(Line Length : 3.55 KM)**
- 1.1.3. Construction of 11kV Chamata Town feeder in order to bifurcate the existing 11kV Chamata feeder under Chamata Electrical Sub-Division **(Line Length: 3.5 KM)**
- 1.1.4.Construction of New 11kV Dedicated Industry Feeder, Installation &Commissioning of Terminal Equipments + Construction of one RCC Control Room (120Sqm) as per specification (including internal electrification, water supply, sanitation etc) at 33/11 KV Ramhari Sub Station under Mangaldai ESD **(Line Length : 7.0 KM)**
- 1.1.5. Construction of new River Crossing of 11 KV Overhead line for Bahipukhuri TE at SimtiBasti to fed power from 11 KV Dedicated Betybari feeder under Mazbat ESD **(Line Length: 0.6 Km)**
- 1.1.6. Construction of dedicated 11kV Feeder for Orang TE under Mazbat ESD **(Line Length : 3.6 KM(1.26kM double ckt+2.340 single ckt))**

1.2. Scope of Work

The various activities under the scope of work shall cover the following-

- 1.2.1 Site survey work.
- 1.2.2 Procurement and supply of all materials required for the work. Procurement of the BOQ materials shall be as per the Technical specifications mentioned in the Bid (Section: VI).
- 1.2.3 Arrangeinspection/testingofany/allitemsorderedatmanufacturer'sworks for officer deputed by APDCL for such inspection/testing.
- 1.2.4 Site delivery, loading, unloading, storage and handling of all materials supplied including watch and ward for safe custody till handover.
- 1.2.5 Site fabrication work as per requirement.
- 1.2.6 Submission of implementation schedule from the date of award of contract for Erection, testing and commissioning of all materials/equipment supplied/system installed.
- 1.2.7 Project management and site organization.
- 1.2.8 Obtaining all statutory clearances from Government Departments, Village Panchayats etc. wherever necessary.

- 1.2.9 Submission of technical specification/Test Certificate/Drawings etc. of all materials supplied.
- 1.2.10 A list of various items normally involved in proposed type of work is provided in this document. This, however, is not to be considered as limiting but only typical. Bidders' scope will include all other items and materials as may be required to effectively complete the work.
- 1.2.11 Return of dismantled materials of dismantled lines, if any, to the concerned divisional store. Bidder shall compulsorily consider the dismantling charges at the time of submission of bid.
- 1.2.12 Required jungle cutting.
- 1.2.13 Prior to starting of the physical work, the successful bidder shall carry out route survey through GPS (Global positioning System) and shall submit (in A2 paper) to office of the CGM (PP&D) for approval.

Above all, the scope of work of the bidder/contractor will include all items and facilities as may be necessary to complete the electrification work on turnkey basis and as binding requirement.

1.3.Bill of Quantity (BoQ)

The schedule of items against the aforesaid work are as follows:

1.3.1. **BOQ No. 1:** Construction of a new separate 11kV feeder at North Bank of NH31 under Nalbari Electrical Sub-Division-I

Starting point: 33/11kV sariohtoli SS-NH31, Milonpur, Nalbari

Route: (i) Sariohtoli S/S to MalakarSupa:-600 mtr, MalakarChupa to Ahingsha Chemical:-800 Mtr (Double Ckt), Ahingsha Chemical-LR Mill:-300 mtr

(ii) Sariohtoli SS-SIRD:-600 Mtr (Double ckt), SIRD-Bhuyarkuchi-650 Mtr, Bhurkuchi- Milonpur NH31: 700 Mtr **(Overall Line Length: 3.65 KM)**

SI No	Items & Description	Unit	Qty
1	Steel Tubular pole SP 66 with Grouting & Muffling	Nos.	88
2	GI V cross arm channel size 100x50x6mm	Nos.	51
3	GI 11kV T cross Arm	Nos.	29
4	11 kV Polymeric Pin Insulator	Nos.	315
5	GI Channel 100x50x6x2200mm	Nos.	58
6	11kV Disc insulator polymeric 70 kn	Nos.	160
7	Hardware fittings for Disc insulator	Nos.	160
8	Suspension clamp for ABC as per NFC standards	Nos.	10
9	Anchor clamp wedge type ABC as per NFC standards	Nos.	10
10	GI LT angle cross arm 40x40x6x500 mm	Nos.	50
11	Shackle insulator	Nos.	120
12	GI Shackle strap set w/bolts	Nos.	120
13	LT pin insulator with GI pin	Nos.	40
14	Cable Tie	Nos.	8
15	GI Angle 50x50x6mm (for double cross bracing)	mtrs	140
16	GI pole clamp 50x6mm	Nos.	120
17	HT Stay set	Set	40
18	GI pipe 3 mtr length 50mm dia for Earthing	Nos.	30
19	GI Stay wire 7/10 SWG	Kg	480
20	11Kv Guy insulator Porcelain	Nos.	40
21	ACSR Racocon Conductor	Km	11.6
22	GI Wire 8 SWG for guarding	Kg	220
23	GI Nuts & Bolts with washer (assorted)	Kg	450

1.3.2. **BOQ No. 2:** Construction of Bay, Installation & Commissioning of Terminal Equipments at 33/11 kV Soriohtali DSS for dedicated feeder under Nalbari ESD-I

Sl. No.	Items Description	Unit	Qty
1	GI Tubular Pole, SP 66	No.	4
2	ACSR Wolf conductor for Switch Yard & jumpering works	Km	0.2
3	GI Channel (100x75x6)mm	Mtr.	70
4	11 KV Outdoor VCB with GI Structure & marshalling box	Set	1
5	11 KV Outdoor CT with marshalling box & GI mounting structure	Set	1

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6	11 KV Isolator with earth switch & GI mounting structure	Set	2
7	Battery Charger Suitable for 150 AH, 110V Battery Bank	Set	1
8	150 AH, 110V Maintenance Free Battery Bank	Set	1
9	DCDB	Set	1
10	C&R Panel for 11 KV Outdoor VCB	No	1
11	11 KV Station Type LA	Set	1
12	11 KV LINE Type LA	Set	1
13	11 KV Combined CTPT Set,(400-200, 5-5 A)	Set	1
14	Cu. Control Cable, 7-core, 2.5 sq. mm.	Mtr.	300
15	Cu. Control Cable, 10-core, 2.5 sq. mm.	Mtr.	10
16	3 Ph 4 W ICS DLMS HT Trivector meter	No.	1
17	Metering Cabinet	No	1
18	11 KV XLPE 1 Core 240 sqmm (Aluminium)	Mtr.	120
19	11KV Cable Kit for XLPE 1 Core 240sqmm (outdoor)	No	8
20	G.I angle Cross arm (50x50x6 mm)	No.	60
21	11 KV Disc Insulator, 70 KN, T&C Porcelian	No.	24
22	Hardware Fittings for 11 KV Disc Insulator 70 KN B&S type	Set	24
23	Tension Clamp for Wolf	No.	24
24	PG Clamp for ACSR Wolf conductor	No.	30
25	GI Pipe 50mm dia 3m length	No	15
26	Hot dip G. I. wire, 6 SWG for earthing	Kg	25
27	GI nuts and bolts with GI washer	Kg	200
28	RCC Foundation for VCB	No	1
29	RCC Foundation for Isolator Set	No	2
30	Installation of earthing system with GI flat 50x10mm for mat and 25x6mm flat for riser with 50mm GI electorodes of length 3 mtr size etc.	sqm	50
31	PCC Foundation (1:2:4) for 11 KV CT, PT, LA	Cu. Mtr	20
32	Construction of Cable Trenches size: (1260x650)mm control cable including supply of all materials and labour as per specification and drawing	Mtr.	50
33	Switch yard gravelling of 0.15mtr(thickness) by 40mm crushed stone	sqm	100

1.3.3 **BOQ No. 3:** Construction of 11kV Dedicated Feeder for DIC under Nalbari ESD-I (Line Length : 3.55 KM)

Sl. No.	Item	Unit	Qty.
1	GI Steel Tubular pole SP 66 with Grouting & Muffling	No	114
2	GI Channel cross arm (100x50x6x2200) mm	No	57
3	GI Channel cross arm (75x40x6x2200) mm	No	89
4	GI Channel cross arm (75x40x6) mm for guarding	Mtr.	53
5	GI Angle cross arm (50x50x6) for side bracing	Mtr	192
6	GI Angle cross arm (50x50x6) for cross bracing	Mtr	341
7	11 KV Disc insulator 45 kN, T&C (Polymeric)	No	107

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8	H/W fittings for Disc insulator T&C (45KN) tension type	No	107
9	11 KV Polymeric pin insulator	No	341
10	ACSR "Raccon" conductor	Km	12
11	Tension clamp for "Raccon" conductor	No	107
12	11 KV DO fuse 150 A	No	4
13	11 KV GOAB 400 A	No	4
14	11Kv XLPE cable 1-core 300 Sqmm (al)	Mtr	71
15	CI Earth Pipe	No	114
16	Hot dip G. I. wire, 8 SWG for guarding	Kg	213
17	Hot dip G. I. wire, 6 SWG for earthing	KG	114
18	HT Stay Set with Grouting	No	43
19	HT Guy Insulator	No	43
20	PG clamp, for "Raccoon" (Alcon 81)	No	107
21	Danger plate HT	No	114
22	GI nuts and bolts (Assorted) with GI washer	Kg	213
23	Barbed wire	Kg	178
24	GI wire Stay wire , 7/10 SWG	Kg	639
25	I Hook GI	No	64
26	GI pole clamp	No	426

1.3.4 **BOQ No. 4:** Construction of 11kV Chamata Town feeder in order to bifurcate the existing 11kV Chamata feeder under Chamata Electrical Sub-Division **(Line Length: 3.5 KM)**

SI No	Items & Description	Unit	Qty
1	GI Steel Tubular pole SP 66 with Grouting & Muffling	Nos.	48
2	PSC Pole 9.75 Mtr with Grouting	Nos.	45
3	GI Ch X Arm 75x40x6x2200 mm (Guarding +X arm)	Nos.	102
4	11kV DO fuse 150 Amps	Nos.	2
5	11kV GOAB switch 400A	Nos.	2
6	I hook GI	Nos.	10
7	ACSR Raccoon Conductor	Km	11.5
8	ACSR Rabbit Conductor	km	0.2
9	GI 11kV T cross arm	Nos.	50
10	GI Angle (50x50x6)mm	mtr	300
11	GI pole clamp (round type)	Nos.	240
12	GI top cleat	Nos.	48
13	CI Earth pipe 1.8 mtr Nominal dia 100 mm	Nos.	60
14	GI Channel (50x50x6) mm	Nos.	113
15	GI Nuts & Bolts with washer (assorted)	Kg	270
16	GI Wire 8 SWG for guarding	Kg	1900
17	GI Wire 6 SWG	Kg	2600
18	11kV Polymeric pin insulator	Nos.	410
19	11kV Polymeric disc insulator 70KN	Nos.	130
20	H/W fitting for disc insulator (tension type)	Nos.	130
21	11Kv Guy insulator Porcelain	Nos.	26
22	shackle insulator porcelain	Nos.	300

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23	HT Stay set	Set	25
24	GI Stay wire 7/10 SWG	Kg	500
25	HT danger plate	Nos.	93

1.3.5 BOQ No. 5: Construction of New 11kV Dedicated Industry Feeder under Mangaldai ESD
(Line Length : 7.0 KM)

Sl. No.	Item	Unit	Total Qty.
1	GI Steel Tubular pole SP 66 with Grouting & Muffling	No	224
2	GI Channel cross arm (100x50x6x2200) mm	No	112
3	GI Channel cross arm (75x40x6x2200) mm	No	175
4	GI Channel cross arm (75x40x6) mm for guarding	Mtr.	105
5	GI Angle cross arm (50x50x6) for side bracing	Mtr	378
6	GI Angle cross arm (50x50x6) for cross bracing	Mtr	672
7	11 KV Disc insulator 45 kN, T&C (Polymeric)	No	210
8	H/W fittings for Disc insulator T&C (45KN) tension type	No	210
9	11 KV Polymeric pin insulator	No	672
10	ACSR "Raccoon" conductor	Km	23.1
11	Tension clamp for "Raccoon" conductor	No	210
12	11 KV DO fuse 150 A	No	4
13	11 KV GOAB 400 A	No	4
14	11Kv XLPE cable 1-core 300 Sqmm (al)	Mtr	140
15	CI Earth Pipe	No	224
16	Hot dip G. I. wire, 8 SWG for guarding	Kg	420
17	Hot dip G. I. wire, 6 SWG for earthing	KG	224
18	HT Stay Set with Grouting	No	84
19	HT Guy Insulator	No	84
20	PG clamp, for "Racon" (Alcon 81)	No	210
21	Danger plate HT	No	224
22	GI nuts and bolts (Assorted) with GI washer	Kg	420
23	Barbed wire	Kg	350
24	GI wire Stay wire , 7/10 SWG	Kg	1260
25	I Hook GI	No	126
26	GI pole clamp	No	840

1.3.6. BOQ No. 6: Installation & Commissioning of Terminal Equipments + Construction of one RCC Control Room (120Sqm) as per specification (including internal electrification, water supply, sanitation etc) for New 11kV dedicated Industry Feeder at 33/11 KV Ramhari Sub Station under Mangaldai ESD

Sl. No.	Items	Unit	Qty
1	11 kv Outdoor VCB with GI mounting Structure & marshalling box	set	1
2	11KV Outdoor CT with marshaling box & GI mounting structure with connector 200-100/5-5A	set	1
3	11 KV Isolator with earth switch & GI mounting structure	set	1

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4	11KV Cable Kit for XLPE,1 Core,300 Sq.mm(Outdoor)	No.	6
5	12KV 9KA Lightning Arrestor Station Type	Set	1
6	Control Cable Copper 10 Core 2.5 Sq mm	mtr	200
7	Control Cable Copper 7 Core 2.5 Sq mm	mtr	200
8	Control Cable Copper 4 Core 2.5 Sq mm	mtr	200
9	Control Cable Copper 2 Core 2.5 Sq mm	mtr	200
10	11kv XLPE Cable 1-Core,300 Sq. mm(Aluminium)	mtr	200
11	C& R panel for 11 kv outdoor VCB	No.	1
12	Installation of Earthing system with MS flats 50x10 mm for earthing mat with GI flat riser 25x6mm(for earthing conductor) and GI pipe 50mm dia of length 3000mm (for earth electrodes) including excavation of earth welding etc as necessary	sqmtr	30
13	Construction of Cable Trenches Size (950x450)mm for control cable including supply of all materials and labour as per specification and drawing	Mtr	50
14	Construction of cable Cable Trenches Size (1260x650)mm for Power cable including supply of all materials and labour as per specification and drawing	Mtr	50
15	Battery charger suitable for 150 AH,110 V Battery Bank	Set	1
16	150 AH 110 V Maintenance Free Battery Bank	Set	1
17	Danger plate	No.	20
18	Construction of RCC control Room building (120 sqm) as per drawing and specification including internal electrification, water supply & sanitary works etc. complete per direction.	job	1

1.3.7 **BOQ NO. 7:** Construction of new River Crossing of 11 KV Overhead line for Bahipukhuri TE at SimtiBasti to fed power from 11 KV Dedicated Betybari feeder under Mazbat ESD (Line Length: 0.6 Km, 0.15Km river crossing, 0.45 Km OH)

Sl.	ITEM DESCRIPTION	Unit	Qty
1	GI Steel Tubular pole SP 80 with Grouting & Muffling	Nos.	8
2	ACSR Racocon Conductor	Km.	1.98
3	GI Channel Cross Arm, 100 x 50 x 6 x 2.2mm	Nos.	18
4	GI Pole Clamp	Nos.	36
5	11 KV Pin Insulator (Polymer)	Nos.	78
6	11 KV Disc Insulator	Nos.	21
7	Hardware Fitting	Nos.	21
8	CI Earth Pipe 100 mm dia	Nos.	8
9	HT Danger Plate	Nos.	8
10	GI Nut & Bolts with Washer (Assorted)	Kg.	35
11	GI Wire 8 SWG (for guarding& Earthing)	Kg.	30
12	HT Stay Set with Grouting	Nos.	8
13	11 KV Guy Insulator (Porcelain)	Nos.	8
14	GI Stay Wire 7/14 SWG	Kg.	120
15	Barbed Wire	Kg.	25

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16	GI Angle 100 x 50 x 6 x 2000 mm	Nos.	32
17	11 KV DO Fuse	Set	2

1.3.8. **BOQ No. 8:** Construction of RCC foundation for supporting 4 pole structure at SimtiBasti for Bahipukhuri TE (Feeder Side of the River Bank) under Mazbat ESD

Sl. No. / Item No	Description	Unit	Quantity
1/1.1	Earthwork in excavation for foundation trenches of walls, retaining walls, footings of column, steps, septic tank etc. including refilling (return filling) the quantity as necessary after completion of work, breaking clods in return filling, dressing, watering and ramming etc. and removal of surplus earth with all lead and lifts as directed and specified in the following classification of soils including bailing out water where necessary as directed and specified. (A) Up to a depth of 2.00m below the existing ground level. (b) In hard/ dense soil		
	No.s	Length(L)	Breadth(B)
	4	2	1.2
	1	8	0.25
	Total		12
		Cum	12.02
2/4.1.1	Providing soling in foundation and under floor with stone/ best quality picked jhama brick, sand packed and laid to level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete. (a).Brick on flat soling.		
	No.s	Length(L)	Breadth(B)
	4	1.2	1.2
	1	8	0.25
	Total		7.76
		Sqm	7.76
3/2.1.1	Plain cement concrete works with coarse aggregate of sizes 13mm to 32mm in foundation bed for footing steps, walls, brick works etc. as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). (a) In prop 1cement: 3 sand :6 coarse aggregate by volume		
	No.s	Length(L)	Breadth(B)
	4	1.2	1.2
	1	8	0.25
	Total		0.78
		Cum	0.776
4/2.2.1	Providing and laying plain/reinforced cement concrete works cement, coarse sand & 20mm down graded stone aggregate including dewatering if necessary, and curing complete but excluding cost of form work and reinforcement for reinforced cement concrete work (form work and reinforcement will be measured and paid separately) (I) Using Mixer Machine (A) In substructure up to plinth level Foundation, footing, columns with base tie and plinth beam, pile cap, base slab, retaining walls, walls of septic tank, inspection pit and the like and other works not less than 100mm thick up to plinth level. b) M20 grade concrete or Prop. 1:1.5:3		
	No.s	Length(L)	Breadth(B)
		Cum	4.46

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	4				2.15	0.6	0.6	3.1		
	1				8	0.25	0.25	0.5		
	4				0.15	1.2	1.2	0.86		
	Total								4.46	
5/18.1.1	Supplying, fitting and fixing in position reinforcement bars conforming to relevant I.S. Code for R.C.C. work/ R.B. walling including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (No extra measurement for lap, hook, chair, anchor etc. will be entertained in the measurement as they are included in the rate) (Upto 1st floor level) b) Other ISI approved TMT reinforcement bar (SAI/BISCON/THERMAX) (For Assam Type Bldg., drain works,,retaining wall& boundary wall etc.								Qtl	4.89
	No.s				Length(L)	Breadth(B)	Height(H)	Total		
	1 x4.89 = 4.89 qtl.								4.89	
	Total								4.89	
6/18.2.1	Structural steel work in single sections including cutting, hoisting, fixing in position and applying a priming coat of red lead paint (up to 4.6m height) from plinth level including drilling holes, supplying, fitting and fixing with bolts and nuts or welding, if necessary as directed. c) In M.S. angles, channels, Tees etc.								Qtl	2.512
	No.s				Length(L)	Breadth(B)	Height(H)	Total		
	1 x2.512 = 2.512 qtl.								2.51	
	Total								2.51	

1.3.9. **BOQ No. 9:** Construction of RCC foundation for supporting 4 pole structure at SimtiBasti for Bahipukhuri TE (Tea Garden Side of the River Bank) under Mazbat ESD

Sl. No. / Item No	Description	Unit	Quantity				
1/1.1	Earthwork in excavation for foundation trenches of walls, retaining walls, footings of column, steps, septic tank etc. including refilling (return filling) the quantity as necessary after completion of work, breaking clods in return filling, dressing, watering and ramming etc. and removal of surplus earth with all lead and lifts as directed and specified in the following classification of soils including bailing out water where necessary as directed and specified. (A) Up to a depth of 2.00m below the existing ground level. (b) In hard/ dense soil						
	No.s	Length(L)	Breadth(B)	Height(H)	Total	Cum	12.02
	4	2	1.2	1.2	11.52		
	1	8	0.25	0.25	0.5		
	Total				12.02		
2/4.1.1	Providing soling in foundation and under floor with stone/ best quality picked jhama brick, sand packed and laid to level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete. (a).Brick on flat soling.						

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		No.s	Length(L)	Breadth(B)	Height(H)	Total		
		4	1.2	1.2	-	5.76	Sqm	7.76
		1	8	0.25	-	2		
		Total				7.76		
3/2.1.1		Plain cement concrete works with coarse aggregate of sizes 13mm to 32mm in foundation bed for footing steps, walls, brick works etc. as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). (a) In prop 1 cement: 3 sand :6 coarse aggregate by volume						
		No.s	Length(L)	Breadth(B)	Height(H)	Total	Cum	0.776
		4	1.2	1.2	0.1	0.576		
		1	8	0.25	0.1	0.2		
		Total				0.776		
4/2.2.1		Providing and laying plain/reinforced cement concrete works cement, coarse sand & 20mm down graded stone aggregate including dewatering if necessary, and curing complete but excluding cost of form work and reinforcement for reinforced cement concrete work (form work and reinforcement will be measured and paid separately) (I) Using Mixer Machine (A) In substructure up to plinth level Foundation, footing, columns with base tie and plinth beam, pile cap, base slab, retaining walls, walls of septic tank, inspection pit and the like and other works not less than 100mm thick up to plinth level. b) M20 grade concrete or Prop. 1:1.5:3						
		No.s	Length(L)	Breadth(B)	Height(H)	Total	Cum	4.46
		4	2.15	0.6	0.6	3.096		
		1	8	0.25	0.25	0.5		
		4	0.15	1.2	1.2	0.864		
		Total				4.46		
5/18.1.1		Supplying, fitting and fixing in position reinforcement bars conforming to relevant I.S. Code for R.C.C. work/ R.B. walling including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (No extra measurement for lap, hook, chair, anchor etc. will be entertained in the measurement as they are included in the rate) (Upto 1st floor level) b) Other ISI approved TMT reinforcement bar (SAI/BISCON/THERMAX) (For Assam Type Bldg., drain works,, retaining wall& boundary wall etc.						
		No.s	Length(L)	Breadth(B)	Height(H)	Total	Qtl	4.89
		1 x4.89 = 4.89 qtl.				4.89		
		Total				4.89		

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6/18.2.1	Structural steel work in single sections including cutting, hoisting, fixing in position and applying a priming coat of red lead paint (up to 4.6m height) from plinth level including drilling holes, supplying, fitting and fixing with bolts and nuts or welding, if necessary as directed. c) In M.S. angles, channels, Tees etc.					
	No.s	Length(L)	Breadth(B)	Height(H)	Total	Qtl
	1 x 2.512 = 2.512 qtl.				2.512	
	Total				2.512	
						2.512

1.3.10. BOQ No. 10: Construction of dedicated 11kV Feeder for Orang TE under Mazbat ESD
(Line Length : Total 3.6 KM(1.26kM double ckt+2.340 single ckt))

Sl. No.	Item	Unit	Total qty
1	GI Steel Tubular pole SP 76 with Grouting & Muffling	No	45
2	PSC Pole 9.75m with Grouting	No	75
3	GI Channel cross arm (100x50x6x2200) mm	No	48
4	GI Channel cross arm (75x40x6x2200) mm	No	132
	GI 11 KV "T"- cross arm with angle size (50x50x6)mm	No	47
5	GI Channel cross arm (75x40x6) mm for guarding	Mtr.	54
6	GI Angle cross arm (50x50x6) for side bracing	Mtr	194
7	GI Angle cross arm (50x50x6) for cross bracing	Mtr	346
8	11 KV Disc insulator 45 kN, T&C (Polymeric)	No	108
9	H/W fittings for Disc insulator T&C (45KN) tension type	No	108
10	11 KV Polymeric pin insulator	No	346
11	ACSR "Raccoon" conductor	Km	12
12	Tension clamp for "Raccoon" conductor	No	108
14	11 KV GOAB 400 A	No	1.00
16	CI Earth Pipe	No	40
17	Hot dip G. I. wire, 8 SWG for guarding	Kg	180
18	Hot dip G. I. wire, 6 SWG for earthing	KG	96
19	HT Stay Set with Grouting	No	36
20	HT Guy Insulator	No	36
21	PG clamp, for "Raccoon" (Alcon 81)	No	90
22	Danger plate HT	No	96
23	GI nuts and bolts (Assorted) with GI washer	Kg	216
24	Barbed wire	Kg	150
25	GI wire Stay wire , 7/10 SWG	Kg	540
26	I Hook GI	No	54
27	GI pole clamp	No	432

1.3.11. BOQ No. 11: Installation and Commissioning of Terminal Equipment at 33/11 kV S/S for 11 kV Dedicated Orang feeder under Mazbat ESD

Section IV: Scope of Work & BOQ

Sl. No.	Items Description	Unit	Qty
1	GI Steel Tubular pole SP 66 with Grouting & Muffling	No.	2
2	ACSR Wolf conductor for Switch Yard & jumpering works	Km	0.2
3	11 KV Outdoor VCB with GI Structure & marshalling box	Set	1
4	11 KV Outdoor CT with marshalling box & GI mounting structure	Set	1
5	11 KV Isolator with earth switch & GI mounting structure	Set	1
6	11 KV Isolator without earth switch & GI mounting structure	Set	1
7	C&R Panel for 11 KV Outdoor VCB	No	1
8	11 KV Station Type LA	Set	1
9	11 KV LINE Type LA	Set	1
10	11 KV Combined CTPT Set, (400-200, 5-5 A)	Set	1
11	Cu. Control Cable, 7-core, 2.5 sq. mm.	Mtr.	400
12	Cu. Control Cable, 10-core, 2.5 sq. mm.	Mtr.	10
13	3 Ph 4 W ICS DLMS HT Trivector meter	No.	1
14	Metering Cabinet	No	1
15	11 KV XLPE 1 Core 240 sqmm (Aluminium)	Mtr.	300
16	11KV Cable Kit for XLPE 1 Core 240sqmm (outdoor)	No	8
17	G.I angle Cross arm (50x50x6 mm)	No.	60
18	11 KV Disc Insulator, 70 KN, T&C Porcelian	No.	24
19	Hardware Fittings for 11 KV Disc Insulator 70 KN B&S type	Set	24
20	Tension Clamp for Wolf	No.	24
21	PG Clamp for ACSR Wolf conductor	No.	30
22	GI Pipe 50mm dia 3m length	No	15
23	Hot dip G. I. wire, 6 SWG for earthing	Kg	25
24	GI nuts and bolts with GI washer	Kg	200
25	RCC Foundation for VCB	No	1
26	RCC Foundation for Isolator Set	No	1
27	Installation of earthing system with GI flat 50x10mm for mat and 25x6mm flat for riser with 50mm GI electorodes of length 3 mtr size etc.	sqm	50
28	PCC Foundation (1:2:4) for 11 KV CT, PT, LA	Cu. Mtr	20
29	Construction of Cable Trenches size: (950x450)mm control cable including supply of all materials and labour as per specification and drawing	Mtr.	65
30	Construction of Cable Trenches size: (1260x650)mm control cable including supply of all materials and labour as per specification and drawing	Mtr.	50
31	Switch yard gravelling of 0.15mtr(thickness) by 40mm crushed stone	sqm	100

Section V: General Conditions of Contract (GCC)

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1. General Introduction

1.1 Definitions & Interpretations

The following terms appearing in the Bid Document shall have the meaning herein indicated unless there is anything repugnant in the subject or context.

- 1.1.1 Employer/Purchaser/Owner means Assam Power Distribution Company Limited (in short APDCL)
- 1.1.2 "Contractor" means the firms whose bid to perform the Contract has been accepted by the Employer and is named in the Contract Agreement, and includes the legal successors or permitted assigns of the Contractor.
- 1.1.3 "Contract" shall mean and include the general conditions, specifications, schedules, drawings, tender forms, bidding schedules, covering letter, schedule of prices, any special conditions applying to the particular contract specification, amendments if any, letter of award, letter of acceptance and contract agreement to be entered into.
- 1.1.4 "Contract Period" means the period from the Contract commencement date to the date on which Warranty Period is over. Date of Awarding of LOA shall be treated as the "date of commencement of contract".
- 1.1.5 "Facilities" means the Materials and Equipment to be supplied and installed/erected, as well as all the Installation Services to be carried out by the Contractor under the Contract.
- 1.1.6 "Site" means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the Contract as forming part of the Site.
- 1.1.7 "Subcontractor" means firms/ corporations/government entities to whom execution of any part of the Facilities, including preparation of any design or supply of any Plant and Equipment, is sub-contracted directly or indirectly by the Contractor with the consent of the Employer in writing, and includes its legal successors or permitted assigns.
- 1.1.8 "Taking Over" means the Employers' written acceptance of the Facilities under the Contract, after successful Operation and acceptance of the facilities by the Employer.
- 1.1.9 "Time for Completion" means the time within which Completion of the Facilities is to be attained in accordance with the scope of work and specifications, as a whole and "Taking Over" by the Employer is to be attained.
- 1.1.10 "Day" shall mean a calendar day.
- 1.1.11 "Month" shall mean a calendar month.

1.2 Language

- 1.2.1 The official language of the Contract is English. Contract as well as all correspondence and documents relating to the Contract exchanged by the Contractor and APDCL shall be written in English. Supporting documents and printed literature that are part of the Contract may be in another language provided they are accompanied by an accurate translation of the

relevant passages in English, in which case, for purposes of interpretation of the Contract, the English translation shall govern.

- 1.2.2 The Contractor shall bear all costs of translation to English and all risks of the accuracy of such translation. The Contractor shall be bound to the English translation and what has been stated therein.

1.3 Governing Laws

- 1.3.1 The Contract shall be governed by and interpreted in accordance with the laws of the India. The Gauhati High Court shall have exclusive jurisdiction in respect of any disputes relating to the tendering process, award of Contract and execution of the Contract.
- 1.3.2 In all cases, this contract shall be governed by and interpreted in accordance with the Law of the Union of India. In this context, the expression 'Law' takes within its fold statutory law, Judicial Decisional Law, Delegated Legislation and relevant regulations as well.

1.4 Intellectual Property

1.4.1 Copy Right

The Contractor shall indemnify APDCL against all claims, actions, suits and proceedings for the infringement or alleged infringement of any patent, design or copyright protected either in the country of origin or in India for the use of any equipment supplied by the Contractor but such indemnify shall not cause any use of the equipment other than for the purposes indicated by or reasonably to be inferred from the specification.

1.4.2 Confidential Information

- 1.4.2.1 Both Contractor and APDCL shall undertake to each other to keep confidential all information (written as well as oral) concerning the business and affairs of the other, which has been obtained or received as a result of the discussions leading up to or the entering of the Contract.
- 1.4.2.2 After the entering of the contract, APDCL and the Contractor shall keep confidential and shall not, without the written consent of the other Party hereto, divulge to any third party any documents, data, or other information furnished directly or indirectly by the other Party hereto in connection with the Contract, whether such information has been furnished prior to, during or following completion or termination of the Contract. Notwithstanding the above, the Contractor may furnish to its subcontractor such documents, data, and other information it receives from APDCL to the extent required for the subcontractor to perform its work under the Contract, in which event the Contractor shall obtain from such subcontractor an undertaking of confidentiality similar to that imposed on the Contractor under this Clause.
- 1.4.2.3 APDCL shall not use such documents, data, and other information received from the Contractor for any purposes unrelated to the Contract.

Similarly, the Contractor shall not use such documents, data, and other information received from APDCL for any purpose other than the design, procurement, or other work and services required for the performance of the Contract.

1.4.2.4 The obligation of a Party under Clauses 1.4.2.1 and 1.4.2.2 above, however, shall not apply to information that:

- APDCL or Contractor need to share with the institutions participating in the financing of the Contract;
- now or hereafter enters the public domain through no fault of that Party;
- can be proven to have been possessed by that Party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other Party; or
- Otherwise lawfully becomes available to that Party from a third Party that has no obligation of confidentiality.

1.4.2.5 The above provisions of this Section 1.4.2 shall not in any way modify any undertaking of confidentiality given by either of the Parties hereto prior to the date of the Contract in respect of the Supply or any part thereof.

1.4.2.6 Each of the Parties to this contract, undertakes to the other to take all such steps as shall from time to time be necessary to ensure compliance with the provisions of the above clauses by its employees, agents and sub-contractors.

1.4.2.7 The provisions of this Section 1.4.2 survive completion or termination, for whatever reason, of the Contract.

2. Subject Matter of Contract

2.1 Scope of Works

As stipulated under clause no. 1.2 (under Section IV) of the Bid Document.

2.2 Contractor's Responsibilities

2.2.1 The Contractor shall successfully implement this project as per the Scope of Work, Functional Requirements, Minimum Technical Standards (MTS) mentioned in this BIDDOCUMENT.

2.3 APDCL's Responsibilities

2.3.1 The CGM(PP&D) of APDCL shall act as the nodal point for implementation of the contract and for issuing necessary instructions, approvals, commissioning, acceptance certificates, payments etc. to the Contractor.

- 2.3.2 APDCL may provide on Contractor's request, particulars/ information / or documentation that may be required by the Contractor for proper planning and execution of Scope of Work under this Contract.

2.4 Estimated Cost of the Project

As mentioned in the Section I: Invitation for Bid (IFB) of the Bid Document.

2.5 Funding of the project

The proposed work is funded by GOA under UDAY 2017-18 Scheme.

3. Execution of the Project

3.1 Project Completion Period

The entire project as mentioned in the scope of works section must be completed within **240 (Two hundred Forty) days** from the date of issue of LOA.

Note: The project being a time bound priority scheme, the intending bidder who feel competent enough to complete within the stipulated period shall only participate.

3.2 Project implementation Schedule

Sl. No	Description	EXECUTION PERIOD					
		7 days	10 days	40 days	80 days	80 days	23 days
1	Signing of Agreement						
2	Survey works & submission of drawings/GTP						
3	Manufacture & supply of materials						
4	Erection of equipments						
5	Testing & commissioning						

3.3 Extension of time for Completion

Primarily, there shall not be any extension of time for project completion irrespective of size & volume of work except under the following circumstances:-

- 3.3.1 If at any time during performance of the Contract, the Contractor encounters conditions impeding timely delivery of the Goods or completion of related Services under the purview of the contract, the Contractor shall promptly notify APDCL in writing of the delay, its likely duration, and its cause. As soon as practicable after receipt of the Contractor's notice, APDCL shall

evaluate the situation and may at its discretion extend the Contractor's time for performance, in which case the extension shall be ratified by the Parties by amendment of the Contract.

- 3.3.2 Any occurrence of Force Majeure as provided under sub-section 8.2 under this section of the Bid Document.

3.4 Project Management and Site Organizations

In Consideration of the stringent schedule of the project, the successful bidder(s)/Contractor(s) shall exercise systematic and tightly controlled project management system with the aid of commonly used soft tools. Following are the major activities/deliverables to be organized /generated for submission to the Employer.

- 3.4.1 Liaison/Construction offices will be established in the concerned Circle of APDCL.

- 3.4.2 Work Progress Report:

- i. Progress monitoring by the contractor as per implementation schedule and approved milestones.
- ii. Fortnightly progress report (as per the format to be enclosed with LOA) shall be submitted to the concerned Deputy General Manager, Asst. General Manager & Sub-Divisional Engineers with a copy to the Chief General Manager (PP&D), APDCL.
- iii. The progress report will highlight the points like, work completion vis-à-vis planned, plan for next working period, delay analysis vis-à-vis committed schedule with reasons and remedies, etc.

- 3.4.3 Site Organization-

The bidder at each working site shall establish the following: -

- i. Storehouse
- ii. Site fabrication facilities
- iii. Construction supervision office.

- 3.4.4 All offices shall be adequately furnished and staffed so as to take all site decisions independently without frequent references to head Work's/offices.

3.5 Subcontracting

The Contractor shall not be permitted to subcontract its obligations under the Contract with APDCL.

3.6 Site Regulation & Safety

3.6.1 Contractor's Supervision

The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.

3.6.2 Environmental Considerations

While carrying out the assignment, no damage to environment /forests will be caused by the contractor. If so done, the contractor will have to compensate the same to the satisfaction of the concerned Authority.

3.6.3 Adherence to Safety Provisions

3.6.3.1 The contractor shall be held responsible for non-compliance of the safety measures, implications, injuries, fatalities and compensation arising out of such situations or incidence as per regulation 7(4) of the Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric lines) Regulations, 2011. The Contractor shall strictly comply the following:-

- i. All the electrical installation works including additions, alternations, repairs and adjustments to existing installations shall be carried out by an electrical contractor licensed in this behalf by the state government and under direct supervision of a person holding a valid certificate of electrical competency and by a person holding a valid workman permit issued or recognized by the Government.
- ii. All the aforesaid electrical works at site shall be carried by engaging competent & designated person having valid electrical workman permit issued or recognised by the Govt. of Assam.
- iii. The Contractor shall furnish list of designated and competent persons having valid electrical workman permits before execution of the electrical works at site to APDCL.
- iv. The contractor shall maintain a register of designated persons wherein the names of the designated persons and purpose for which they are designated shall be entered along with their valid registered electrical workman permit or certificate number.
- v. The register of designated persons shall be produced before competent officials of APDCL/Electrical Inspector when required by him for verification or removal of names from the aforesaid register on direction by an electrical Inspector.
- vi. No person shall work on lines and apparatus and no person assist such person unless he is designated in this behalf and takes safety precautions as per the safety Regulations of Central Electricity Authority(CEA).
- vii. Only persons designated in this behalf by the APDCL shall be allowed to carry out works on live lines and apparatus of APDCL.
- viii. The Contractor shall, from the commencement of work on site till commissioning and handing over to APDCL, provide Fencing, Lighting, guarding and watching of the Works.

3.6.3.2 In the event of any electrical accident occurring due to use of poor quality/sub-standard material/item or due to poor workmanship on the part of the contractor/supplier leading to death or injury of any person or livestock/animal, the contractor/supplier shall be held responsible and shall be liable to pay compensation for the same. In such conditions, APDCL may at its discretion debar the concerned contractor/supplier from participating in any future bid for such period as deemed fit without prejudice to its authority to take any other legal action.

3.6.3.3 APDCL will be indemnified for all the situations mentioned as above.

3.7 Compliance with Labour Regulations

3.7.1.1 During continuance of the contract, the Contractor and his sub-contractors shall abide at all times by all applicable existing labour enactments and rules made thereunder, regulations notifications and byelaws of the State or Central Government or local authority and any other labour law (including rules). The employees of the Contractor in no case shall be treated as the employees of APDCL at any point of time.

3.7.1.2 The Contractor shall keep APDCL indemnified in case any action is taken against the Contractor by the competent authority on account of contravention of any of the provisions of any Act or rules made thereunder, regulations or notifications including amendments.

3.7.1.3 If APDCL is caused to pay under any law as principal employer such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/ byelaws/Acts/ Rules/regulations including amendments, if any, on the part of the Contractor, APDCL shall have the right to deduct any money due to the Contractor under this contract or any other contract with APDCL including his amount of performance security for adjusting the aforesaid payment. APDCL shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by APDCL.

3.7.1.4 Notwithstanding the above, the Contractor shall furnish to APDCL, the details/documents evidencing the Contractor's compliance to the laws applicable to establishments engaged in building and other construction works, as may be sought by APDCL.

4. QUALITYCONTROL

4.1 Inspection and Testing

All the equipments/materials to be supplied and erected shall be tested/inspected at manufacturer's works by authorized officer/ Engineers of APDCL before dispatching them to worksite at the discretion of APDCL. The contractor shall intimate APDCL sufficiently in advance (at least 15 days) regarding the date of inspection of materials/ equipments at manufacturer's works. The materials are to be dispatched to site only after receipt of dispatch clearance issued by the CGM (PP&D), APDCL after satisfactory testing of the same. Each lot of materials must be

inspected by the concerned field officials of APDCL before deploying in the site.
The following points are to be noted in addition to the above:

- 4.1.1 Prior to the inspection, the Contractor shall ensure that the number of materials offered for inspection are ready in exact quantities.
- 4.1.2 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the Owner in writing. In the latter case also, the material shall be dispatched only after satisfactory testing for all tests specified in clause 4.2 under this section have been completed.
- 4.1.3 APDCL may reject any Goods or related Services or any part thereof that fail to pass any test and/or inspection or do not conform to the specifications. The Contractor shall either rectify or replace such rejected Goods or related Services or parts thereof or make alterations necessary to meet the specifications at no cost to APDCL, and shall repeat the test and/or inspection, at no cost to APDCL, upon giving a notice as per the procedure specified above.
- 4.1.4 The acceptance of any quantity of material shall be no way relieve the Contractor of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

4.2 Additional Tests

- 4.2.1 APDCL reserves the right of having at his own expense any other test(s) of reasonable nature carried out at Contractor's premises, at site, or in any other place in addition to the type, acceptance and routine tests specified in these bidding documents against any equipments to satisfy himself that the material comply with the required technical specifications.
- 4.2.2 APDCL also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Contractor's premises or at any other test centre. In case of evidence of noncompliance, it shall be binding on the part of the Contractor to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies, or replacement of defective items, all without any extra cost to APDCL.

4.3 Test Reports

- 4.3.1 Copies of type test reports shall be furnished in at least six (6) copies along with one original. One copy shall be returned duly certified by APDCL only after which the commercial production of the concerned materials shall commence.
- 4.3.2 Copies of acceptance test reports shall be furnished in at least six (6) copies. One copy shall be returned duly certified by APDCL, only after which the material shall be dispatched.

- 4.3.3 Record of routine test reports shall be maintained by the Contractor at his works for periodic inspection by the APDCL's representative.
- 4.3.4 Test certificates of test during manufacturing shall be maintained by the Contractor. These shall be produced for verification as and when desired by APDCL.

5. PAYMENT

5.1 Contract Price

- 5.1.1 The Bill of Quantities shall contain priced items for the Works to be performed by the Contractor. The Bill of Quantities is used to calculate the Contract Price. The Contractor will be paid for the quantity of the work accomplished at the rate in the Bill of Quantities for each item.
- 5.1.2 The Contract Price shall be as specified in the Contract subject to any additions and adjustments thereto, or deductions there from, as may be made pursuant to the Contract as also subject to provisions of sub-section 5.3 under this section.
- 5.1.3 Prices charged by the Contractor for the scope of work performed under the Contract shall not vary from the prices quoted by the Contractor in its Bid, with the exception of any price adjustments authorized in the Bid Document.
- 5.1.4 Prices shall not be subject to any upward/downward revision on any account whatsoever throughout the period of contract. Provided that any revision in taxes, statutory levies, duties which is not occasioned due to any change in place, method and time of supply or non-performance/ non-fulfilment of any condition of any exemption considered by the vendor at the time of proposal, shall be considered for price adjustments.

5.2 Terms of Payment

- 5.2.1 During the continuance of the Contract, maximum 3(three) nos. of Progressive bills shall be entertained. The progressive payments shall be made for the actual volume of work including supply as well as erection of the materials under the following conditions:
- 5.2.2 **1st Progressive Bill:** - 80% (eighty percent) payment against 1st progressive bill shall be released retaining the balance 20% (twenty percent) amount, subject to the condition that minimum 35% (thirty five percent) BOQ materials of the LOA have been erected successfully. The bill shall be supplemented by the following documents, satisfactory verification and acceptance of which shall make the Contractor eligible for receipt of payment against the progressive bill:
 - i) Unconditional acceptance of the Letter of Award (LOA) and signing of Contract Agreement by the Contractor.
 - ii) Submission of an unconditional and irrevocable Bank Guarantee for 10% (ten percent) of the Contract price in pursuant to clause 6.3.1 under Section II: ITB of the Bid.
 - iii) Submission of invoice in GST format i.e. the GSTIN & PAN No. of the Contractor as well as APDCL must be mentioned in the Bill in printed form along with the Name of Work, LOA No., HSN/SAC code etc.
 - iv) Copy of the Material Inspection & Clearance Certificate (MICC) and Material Receipt and Handing Over Voucher

(MRHOV) duly signed by the concerned consignee location and duly countersigned by the CEO of the Electrical Circle.

- v) Manufacturer's copy of the Delivery Challan.
- vi) Manufacturer's Warranty Certificate for the materials under bill submission.
- vii) Photographic evidences of the supplied materials duly signed by the concerned consignee location and duly countersigned by the CEO of the Electrical Circle.
- viii) Submission of Physical Progress Report as per the proforma provided along with the LOA duly signed by the concerned consignee location and duly countersigned by the CEO of the Electrical Circle.
- ix) Submission of Certificate on Measurement Book by the consignee field officials that the items have been received.
- x) Submission of Certificate on Measurement Book by the consignee field officials and duly countersigned by the CEO to the effect that the materials under consideration have been erected, tested and commissioned as per technical specification, scope of work & approved drawings, which mean completion of erection, testing and commissioning of all materials for which bill has been raised.
- xi) Verification of the actual physical progress through APDCL Project Management System (PMS). The Contractor is required to upload the up to date information of supplied quantities and materials erected in the PMS portal at the time of bill submission.

5.2.3 **2nd Progressive Bill:** - 80% (eighty percent) payment against the 2nd progressive bill shall be released retaining the balance 20% (twenty percent) amount, subject to the condition that minimum 25% (twenty five percent) BOQ materials of the LOA have been erected successfully in addition to the 35% materials erected earlier against 1st progressive bill. The documents indicated against point 5.2.2 above (SL No. i to xi) shall also require to be submitted along with the bill, satisfactory verification and acceptance of which shall make the Contractor eligible for receipt of the progressive payment.

5.2.4 **3rd Progressive Bill:** - 80% (eighty percent) payment against the 3rd progressive bill shall be released retaining the balance 20% (twenty percent) amount, subject to the condition that minimum 25% (twenty five percent) BOQ materials of the LOA have been erected successfully in addition to the 60% materials erected earlier against 1st & 2nd progressive bill. The documents indicated against point 5.2.2 above (SL No. i to xi) shall also require to be submitted along with the bill, satisfactory verification and acceptance of which shall make the Contractor eligible for receipt of the progressive payment.

5.2.5 **4th and Final Bill:** - 100% (hundred percent) payment against the 4th and final bill shall be released along with the 20 % (twenty percent) retention amount of respective 1st, 2nd and 3rd Progressive bills after successful completion and commissioning of the project subject to submission, acceptance and validity of the Performance Bank Guarantee in accordance to clause no. 6.4 under Section II: ITB. The documents indicated against point 5.2.2 above (SL No. i to xi) shall also require to be submitted along with the

bill, satisfactory verification and acceptance of which shall make the Contractor eligible for receipt of final payment.

- 5.2.6 All the aforesaid bills after due verification by the concerned Sub-divisional Engineer, 100% of the bill passed by the concerned Electrical Division and countersigned by the concerned Chief Executive Officer (CEO) of the Electrical Circle, shall be placed before the CGM (PP&D), APDCL for payment.
- 5.2.7 All the material and billing related transactions must be executed through ERP system only. In this context, the respective consignee locations are requested to undertake necessary steps to perform the goods receipt/service acceptance related transactions against the PO/WO number. No supply/erection bills shall be processed for payment unless the necessary transactions in ERP are performed by the concerned consignee locations.
- 5.2.8 The right of the contractor/supplier to have payment or reimbursement of any cost for execution of works/supply of materials as the case may be, against this order will be forfeited or deemed to have been relinquished if the claim for it is not referred to the appropriate authority within 6(Six) months from the date of completion or deemed completion as per clause of Company's GCSE.

5.3 Taxes and Duties

- 5.3.1 For goods supplied from outside India, the Contractor shall be entirely responsible for all taxes, duties, stamp duties, license fees, and other such levies imposed outside India.
- 5.3.2 For goods supplied from within India, the Contractor shall be entirely responsible for all the taxes, duties, license fees, other levies/ cess etc, incurred until the complete implementation of the turnkey project for APDCL.
- 5.3.3 The bidder shall be required to show separately the applicable rate and amount, of the Goods & Service Tax (GST) or other applicable indirect taxes in respect of the execution of the composite Turnkey works contracts, in their quoted bid price and APDCL would not bear any separate liability on these accounts. In case, the quoted information related to various taxes, duties&leviessubsequentlyproveswrong,incorrectormisleading,APDCLwill have no liability to reimburse the difference in the duty/ tax, if the finally assessed amount is on the higher side and APDCL will have right to recover the difference in case the rate of duty/ taxes finally assessed is on the lower side. APDCL shall deduct such taxes at source at applicable rates from time to time in accordance with direct and indirect taxation laws and will issue Tax Deducted at Source (TDS) Certificate to the bidder thereafter.
- 5.3.4 The contractor shall provide a copy of all paid tax challans to APDCL for record.

6. GUARANTEES AND PENALTIES

6.1 Liquidated Damages and Penalty

- 6.1.1 Except as provided under the provision of "Force Majeure", if a Contractor fails to deliver any or all of the Goods or perform the related Services within

the period specified in the Contract, APDCL shall without prejudice to all its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, a sum equivalent to 1% of the value of the Goods or related Services of contract value for each week or part thereof of delay until actual delivery or performance, subject to a maximum of 10% of contract value.

- 6.1.2 If the goods and related services do not comply to the technical specifications as per the Contract or in case of detection of any defect in individual equipment or in the system as a whole, the same shall be replaced /corrected by the contractor free of cost within 15(fifteen) days from the date of receipt of the communication
- 6.1.3 In the event of non-compliance of the point 6.1.2, APDCL shall be free to impose any penalty as deemed fit. In addition, APDCL shall reserve the right to terminate the contract and recover liquidated damages by forfeiting the Performance Guarantee submitted to APDCL.

6.2 Warranty

- 6.2.1 All the Equipment & materials installed shall be guaranteed individually and also for integrated operations for a period of 60(sixty) months from the date of commissioning of the system.
- 6.2.2 In case of detection of any defect in individual equipment or in the system as a whole within this warranty period, the Contractor shall replace the defective materials/equipments free of cost within 15(fifteen) days from the date of receipt of the APDCL's intimation.
- 6.2.3 Warranty from the manufacturer shall be produced along with manufacturer's test certificate for all equipment/materials covered under Manufacturer's warranty.

6.3 Liability/Indemnity

The Contractor hereby agrees to indemnify APDCL, for all conditions and situations mentioned in this clause, in a form and manner acceptable to APDCL. The Contractor agrees to indemnify APDCL and its officers, servants, agents ("APDCL Indemnified Persons") from and against any costs, loss, damages, expense, claims including those from third parties or liabilities of any kind howsoever suffered, arising or incurred inter alia during and after the Contract period out of:

- a) any negligence or wrongful act or omission by the Contractor or its agents or employees or any third Party associated with Contractor in connection with or incidental to this Contract; or
- b) Any infringement of patent, trademark/copyright or industrial design rights arising from the use of the supplied Goods and Related Services or any part thereof.

7. RISKDISTRIBUTION

7.1 Loss of/ Damage to Property; Accident or Injury to Workers; Indemnification

The Contractor shall indemnify and hold harmless the Employer and its

employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property (other than the Facilities whether accepted or not), arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of the Employer, its contractors, employees, officers or agents.

7.2 Insurance

The Goods supplied under the Contract shall be fully insured by the Contractor, in INR, against loss or damage incidental to manufacture or acquisition, transportation, storage, and delivery.

7.3 Force Majeure

- 7.3.1 The Contractor shall not be liable for forfeiture of its Performance Security, liquidated damages, or termination for default if and to the extent that its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.
- 7.3.2 For purposes of this Clause, "Force Majeure" means an event or situation beyond the control of the Contractor that is not foreseeable, is unavoidable, and its origin is not due to negligence or lack of care on the part of the Contractor. Such events may include, but not be limited to wars or revolutions, earthquake, fires, floods, epidemics, quarantine restrictions, and freight embargoes.
- 7.3.3 If a Force Majeure situation arises, the Contractor shall promptly and no later than 10 (ten) days from the first occurrence thereof, notify APDCL in writing of such condition and the cause thereof. Unless otherwise directed by APDCL in writing, the Contractor shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.
- 7.3.4 The decision of APDCL with regard to the occurrence, continuation, period or extent of Force Majeure shall be final and binding on the Contractor.

8. Change in Contract Elements

8.1 Quantity Variation

There may be increase or decrease in quantity of individual item subject to the condition that the corresponding change in total contract value does not increase or decrease by more than 10% (ten percent). The quantity variation is allowed at the unit rate of individual material quoted at the time of bidding or prevailing rates of those item in the Schedule of Rates, APDCL, whichever is lower. However, for consequential change in labour portion on account of such quantity variation, the price quoted in the original price schedule at the time of bidding shall only be applicable. In the event of requirement of a new material which was earlier not

included in the BOQ, but now has become an integral component towards successful execution of the project, the unit rate of those materials/services shall be incorporated based on the prevailing Schedule of Rates (SOR). The variation which may occur must have the approval of CGM (PP&D),APDCL.

8.2 Change in Laws & Regulations

Unless otherwise specified in the Contract, if after the date of the Invitation for Bids, any law, regulation, ordinance, order or bylaw having the force of law is enacted, promulgated, abrogated, or changed in India where the site is located (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the Delivery Date, then such Delivery Date shall be correspondingly increased or decreased, to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract.

8.3 Change Orders and Contract Amendments

8.3.1 APDCL may at any time order the Contractor through Notice to make changes within the general scope of the Contract in any one or more of the following:

- a) drawings, designs, or specifications, where Goods to be furnished under the Contract are to be specifically manufactured for APDCL;
- b) Specifications for hardware, software and Related Services;
- c) the method of shipment or packing;
- d) the place of delivery; and
- e) the Related Services to be provided by the Contractor.

8.3.2 If any such Change Order causes an increase or decrease in the cost of, or the time required for, the Contractor's performance of any provisions under the Contract, an equitable adjustment shall be made in the Contract Price or in the Delivery and Completion Schedule, or both, and the Contract shall accordingly be amended. Any claims by the Contractor for adjustment under this Clause must be asserted within twenty-eight (28) days from the date of the Contractor's receipt of APDCL's Change Order.

8.3.3 No variation or modification of the terms of the contract shall be made except by written amendment signed by the Parties.

9. Resolution of Disputes

9.1 Settlement of Disputes

9.1.1 APDCL and the Contractor shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract.

9.1.2 If the Parties fail to resolve such a dispute (the date of commencement of the dispute shall be taken from the date when this clause reference is quoted by either Party in a formal communication clearly mentioning existence of dispute or as mutually agreed) or difference by mutual consultation within twenty-eight (28) days from the commencement of such consultation, either

Party may require that the dispute be referred for resolution to the formal mechanisms specified in the subsequent Clauses 9.2 and 9.3 under this BID DOCUMENT.

9.2 Arbitration

All disputes or differences in respect of which the decision, if any, of the Employer has not become final or binding as aforesaid shall be settled by arbitration in the manner provided in the Company's General Conditions of Supply and Erection (GCSE).

9.3 Legal Jurisdiction

For any litigation arising out of the Contract which cannot be resolved through mutual agreement or through Arbitration, the Gauhati High Court will have the sole jurisdiction.

10. Termination of Contract

10.1 Termination of Contract for Contractor's default

10.1.1 If the Contractor shall neglect to execute the Works with due diligence and expertise or shall refuse or neglect to comply with any reasonable order given to him, in the Contract by the Engineer in connection with the works or shall contravene the provisions of the Contract, the owner may give notice in writing to the contractor to make good the failure, neglect or contravention complained of. Shall the contractor fail to comply with the notice within thirty (30) days from the date of serving the notice, then and in such case the Owner shall be at liberty to employ other workmen and forthwith execute such part of the works as the Contractor, may have neglected to do or if the owner shall think fit, without prejudice to any other right he may have under the Contract to take the work wholly or in part out of the contractor's hands and re-contract with any other person or persons to complete the works or any part thereof and in that event the Owner shall have free use of all Contractor's equipment that may have been at the time on the site in connection with the works without being responsible to the Contractor for fair wear and tear thereof and to the exclusion of any right of the contractor over the same, and the Owner shall be entitled to retain and apply any balance which may otherwise be due on the Contract by him to the contractor, or such part thereof as may be necessary, to the payment of the cost of executing the said part of the work or of completing the Works as the case may be. If the cost of completing of Works or executing a part thereof as aforesaid shall exceed the balance due to the contractor, the contractor shall pay such excess. Such payment of excess amount shall be independent of the liquidated damages for delay which the contractor shall have to pay if the completion of works' is delayed.

10.1.2 In addition, such action by the Owner as aforesaid shall not relieve the Contractor of his liability to pay liquidated damages for delay in completion of works as defined Company's General Conditions of Supply and Erection (GCSE).

10.1.3 Such action by the Owner as aforesaid, the termination of the Contract under

this clause shall neither entitle the contractor to reduce the value of the contract Performance Guarantee nor the time thereof. The contract Performance Guarantee shall be valid for the full value and for the full period of the contract including guarantee period.

10.2 Termination of Contract on Owner's initiative

- 10.2.1 The Owner reserves the right to terminate the Contract either in part or in full due to reasons other than those mentioned under clause entitled "Contractor's Default." The Owner shall in such an event give 15 (fifteen) days notice in writing to the Contractor of his decision to do so.
- 10.2.2 The Contractor upon receipt of such notice shall discontinue the work on the date and to the extent specified in the notice, make all reasonable efforts to obtain cancellation of all orders and contracts to the extent they are related to the work terminated and terms satisfactory to the Owner, stop all further sub-contracting or purchasing activity related to the work terminated, and assist the Owner in maintenance, protection, and disposition of the Works acquired under the Contract by the Owner.
- 10.2.3 In the event of such a termination, the Contractor shall be paid compensation, equitable and reasonable, dictated by the circumstances prevalent at the time of termination.
- 10.2.4 If the Contractor is an individual or a proprietary concern and the individual or the proprietor dies and if the contractor is a partnership concern and one of the partners dies then unless the Owner is satisfied that the legal representatives of the individual contractor or of the proprietor of propriety concern and in the case of partnership, the surviving partners, are capable of carrying out and completing the Contract, the Owner shall be entitled to cancel the Contract as to its incomplete part without being in any way liable to payment of any compensation to the estate of deceased Contractor and/or to surviving partners of the contractor's firm on account of the cancellation of the contract. The decision of the owner that the legal representatives of the deceased contractor or surviving partners of the contractor's firm cannot carry out and complete the contract shall be final and binding on the parties. In the event of such cancellation, the Owner shall not hold the estate of the deceased Contractor and/or the surviving partner of the Contractor's firm liable to damages for not completing the Contract.

11. Assignment

The Contractor shall not assign, in whole or in part, their obligations under this Contract.

12. Disclaimer

While the Company will make every endeavour to extend necessary facilitation in expediting the work, the contractor shall be responsible to organize and arrange all necessary inputs right from mobilization activities up to completion of the project. Company will not entertain any failure / delay on such accounts. Also, Company will not be responsible for any compensation, replenishment,

Section V: GCC

damage, theft etc. as may be caused due to negligent working, insufficient coordination with Government / non-Government / Local Authority by the contractor and/ or his personnel deputed for work. The contractor shall take necessary insurance coverage under LIC/GIC etc. for his working personnel and the goods in store as well as in transit. The contractor will be deemed to have made him acquainted with the local working conditions at site(s) and fully provide for into the bid submitted.

----- End of Section-V (GCC) -----

SECTION VI

TECHNICAL SPECIFICATION

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TECHNICAL SPECIFICATION FOR

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(1)

**TECHNICAL SPECIFICATION FOR STEEL TUBULAR STEEL POLES FOR
OVERHEADLINES**

1 SCOPE:

This specification covers the general requirements towards design, manufacture, testing at manufacturers works, supply and delivery for tubular steel poles of circular cross section (swaged type) for overhead lines.

2 STANDARD:

The tubular steel poles shall conform to the latest edition of Indian Standard specification IS: 2713 (Part – I, III): 1980 or any other authoritative standards (as amended up-to- date) except where specified otherwise in this specification.

3 Topography and ClimaticCondition:

The materials offered, shall be suitable for operation in tropical climate and will be subjected to the sun and inclement weather and shall be able to withstand wide range of temperature variation. For the purpose of design, average atmospheric temperature may be considered to be 50°C with humidity nearing saturation.

4 Materials:

The materials used in construction of tubular steel poles shall be of the tested quality of steels of minimum tensile strength 540 MPa (: 55Kg/mm²).

The materials, when analysed in accordance with IS:228(Part-III:1972) and IS:228(Part-IX) shall not show sulphur and phosphorous contents of more than 0.060 percent each.

5 Types, Size and construction:

Tubular Steel Poles shall be swaged type. GI climbing rungs each 700 mm long fabricated out of ISA 60x60x6 mm angles shall be fixed to the pole above 5 mtr .Height at an interval of 450 mm with 10 mm dia. GI u BOLT, spring washers & nuts.

Swaged poles shall be made of seamless or welded tubes of suitable lengths swaged and jointed together. No circumferential joints shall be permitted in the individual tube lengths of the poles. If welded tubes are used they shall have one longitudinal weld seam only: and the longitudinal welds shall be staggered at each swaged joint.

Swaging may be done by any mechanical process. The upper edge of each joint shall be chamfered if at an angle of about 45°. The upper edge need not be chamfered if a circumferential weld is to be deposited in accordance with clause No. 5.3 2 of IS: 2713 (Part-I):1980.

The length of joints on swaged poles shall be in accordance with clause No. 5.4 of IS: 2713 (Par-I): 1980.

Poles shall be well-finished, clean and free from harmful surface defects. Ends of the poles shall be cut square. Poles shall be straight, smooth and cylindrical. The weld joints, if any, shall be of good quality, free from scale, surface defects, cracks, etc.

Tolerances for outside diameter, thickness, length, weight and straightness shall be in accordance with IS: 2713 (Part-I) :1980.

The poles shall be **GALVENISED** and coated with black bituminous paint conforming to IS : 158-1968 throughout, internally and externally, upto the level which goes inside the earth.

6 Earthing Arrangements:

For earthing arrangement, a through hole of 14mm diameter shall be provided in each pole at a height of 300mm above the planting depth.

7 Tests and Test Certificates:

The following tests shall be conducted on finished poles:

- IX) Tensile test and chemical analysis for sulphur and phosphorous,
- X) Deflection test,
- XI) Permanent set test, and
- XII) Drop test.

In addition to above verification of dimensions as per IS: 2713 (Part-III) : 1980 shall be carried out during acceptance lots.

Number of poles selected for conducting different tests shall be in accordance to clause No. 10.1.1 and No. 10.1.12: of IS: 2713 (Part-I) 1980.

Tests shall be carried out before supply of each consignment at the manufacturer's works and test certificates should be submitted to the purchaser for approval prior to delivery.

Re-tests, if any, shall be made in accordance with IS: 2713 (Part-I) 1980.

Purchaser reserves the right to inspect during manufacturing and depute his representative to inspect/test at the works.

If any extra cost is required for carrying out the above specified tests, the same shall be borne by the manufacturer.

8 Marking:

The poles shall be marked with designation, manufacturer's identification, year of manufacture and name of the purchaser: APDCL(IPDS)

The poles may also be marked with the ISI certification mark.

9 Guaranteed technical particulars:

The manufacturer shall furnish all necessary guaranteed technical particulars in the prescribed Form enclosed hereinafter.

10 Performance:-

The manufacturer shall furnish a list of the major supplies effected during the last 3 (three) years indicating the volume of supply and actual delivery dates.

Manufacturer may not be considered if the past manufacturing experience is found to be less than 3 (three) years.

11 Deviation:-

Any deviation in technical specification shall be clearly indicated with sufficient reasons thereof. Purchaser shall however reserve the right to accept and/or reject the same without assigning any reasons what-so-ever.

ANNEXURE –‘A’

SPECIFIC TECHNICAL REQUIREMENTS FOR TUBULAR STEEL POLES : SWAGED TYPE

	14.5 meters long	12 meters long
1) Standard	IS: 2713 (Pat-I and III): 1980 as amended upto date	
2) Type of Pole	Swaged Type	
3) Designation	540 SP 76	540 SP 66
4) Overall Length	14.5 meters	12 meters
5) Planting depth	2.0 meters	2.0 meters
6) Height above ground	12.5 meters	10.0 meters
7) Effective length of Each section.		
a) Bottom	6.50 meters	5.80 meters
b) Middle	4.00 meters	3.10 meters
c) Top	4.00 meters	3.10 meters
8) Outside diameter and Thickness of each Section.		
a) Bottom	219.1x5.90 mm	219.1x5.90 mm
b) Middle	193.7x4.85 mm	193.7x4.85 mm
c) Top	165.1x4.50 mm	165.1x4.50 mm
9) Joint Length (in cm.):		
a) Bottom (J2)	45 cm.	45 cm.
b) Top (J1)	40 cm.	40 cm.
10) Approximate weight of Pole	380 Kg.	322 Kg.
11) Point of application of load below/top (mtr.)	0.6 mtr	0.6 mtr
12) Breaking load (inKgf)	947	1199
13) Working load with factor of Safety : 2.5 (inKgf)	379	480
14) Crippling load (inKgf)	672	851
15) Load for permanent set Not exceeding 13mm (in Kgf)	460	583
16) Load for Temporary Deflection of 157.5 mm (in Kgf)	81	169
Base Plate	A Mild Steel base plate of size 400 mm x 500 mm x 20mm shall be welded at the bottom of the pole.	A Mild Steel base plate of size 400x400x10mm shall be welded at the bottom of the pole.
Galvanization : as per IS:2629/1985, IS:2633/1986 & IS: 4736/1986 with amendment	Not less than 610g /sqm (86 micron aprox.)	Not less than 610g /sqm (86 micron aprox.)
17) Tolerance	As per IS : 2713 (Part-I & Part-III): 1980	
18) Finish	-do-	
19) Manufacturing clause	-do-	

(2)

TECHNICAL SPECIFICATION FOR PSC POLES [9.75 M]**1.0 SCOPE**

This covers design manufacturing, testing at works, transport to site, insurance, storage, erection and commissioning of PSC poles shall be of solid rectangular with an overall length of 9.75M suitable for use in overhead 33KV / 11 KV lines

2.0 Applicable Standards

The pre-stressed concrete (PSC) pole shall comply with the relevant provisions mentioned' in the' following Indian Standards or the latest versions thereof:

IS: 1678, Specification for pre-stressed concrete poles for overhead power, traction and telecommunication lines.

IS: 2905, Method of test for concrete poles for overhead power and telecommunication lines.

IS: 7321, Code of Practice for selection, handling and erection of concrete poles for overhead power and telecommunication lines.

REQUIRED TECHNICAL PARAMETERS FOR 9.75 M PSC POLES:**Terminology**

For the purpose of this specification, following definitions shall apply.

Average Permanent Load

That fraction of the working load which may be considered of long duration over a period of one year.

Load Factor

The ratio of ultimate transverse load to the transverse load at first crack.

Transverse

The direction of the line bisecting the angle contained by the conductor at the pole. In the case of a straight run, this will be normal to the run of the line.

Transverse Load at First Crack

For design, the transverse load at first crack shall be taken as not less than the value of the working load.

Working Load

The maximum load in the transverse direction, that is ever likely to occur, including the wind pressure on the pole. This load is assumed to act at a point 600 mm below the top with the butt end of the pole planted to the required depth as intended in the design.

Ultimate Failure

The condition existing when the pole ceases to sustain a load increment owing to either crushing of concrete, or snapping of the pre-stressing tendon or permanent stretching of the steel in any part of the pole.

Ultimate Transverse Load

The load at which failure occurs, when it is applied at a point 600 mm below the top and perpendicular to the axis of the pole along the transverse direction with the butt end of the pole planted to the required depth as intended in the design.

4.0 Application (9.75 meter PSC pole)

These poles shall be used for 33 kV lines, and for special locations in 11 kV lines, such as road crossings, etc.

5.0 Material**6.0 Cement**

The cement used in the manufacture of pre-stressed concrete poles shall be ordinary or rapid hardening Portland cement conforming to IS: 269 (Specification for ordinary and low heat Portland cement) or IS: 8041 E (Specification for rapid hardening Portland cement), or high strength ordinary Portland cement conforming to IS: 8112 (Specification of high strength ordinary Portland cement).

7.0 Aggregates

Aggregates used for the manufacture of pre-stressed concrete poles shall confirm to IS: 383 (Specification for coarse and fine aggregates from natural sources for concrete). The nominal maximum size of aggregates shall in no case exceed 10 mm (for poles above 9.0 M) and 12 mm (for 7.5 and 8.0 M poles).

Water

Water should be free from chlorides, sulphates, other salts and organic matter, Potable water will be generally suitable.

Admixture

Admixture should not contain Calcium Chloride or other chlorides and salts which are likely to promote corrosion of pre-stressing steel.

Pre-stressing Steel

The pre-stressing steel wires including those used as un-tensioned wires (See Annexure. I, II & III), should conform to IS: 1785 (part-I) (Specification for plain hard-drawn steel wire for pre-stressed concrete. Part-I cold drawn stress relieved wire), IS: 1785 (part-II) (Specification for plain hard-drawn steel wire) or IS: 6003 (Specification for indented wire for pre-stressed concrete). The type designs given in Annexure-I, II and III are for plain wires of 4 mm diameter with a guaranteed ultimate strength of 175 kg/mm².

The concrete mix shall be designed to the requirements laid down for controlled concrete (also called design mix concrete) in IS: 1343 (Code of practice for pre-stressed concrete) and IS: 456 (Code of practice for plain and reinforced concrete), subject to the following special conditions:

- a.** Maximum works cube strength at 28 days should be at least 400 kg/cm² (for poles above 9.0 M) and 420 kg/cm² (for 7.5 and 8.0 M poles).
- b.** The concrete strength at transfer should be at least 200 kg/cm² (for poles above 9.0 M) and 210 kg/cm² (for 7.5 and 8.0 M poles).

- c. The mix should contain at least 380 kg of cement per cubic meter of concrete.
- d. The mix should contain as low as water content as is consistent with adequate workability. If it becomes necessary to add water to increase the workability, the cement content also should be raised in such a way that the original value of water cement ratio is maintained.

DESIGN REQUIREMENTS

The poles shall be designed for the following requirements:

- a. The poles shall be planted directly in the ground with a planting depth as per IS:1678.
- b. The working load on the poles should correspond to those that are likely to come on the pole during their service life. Designs given in Annexure I, II and III are for 140 kg, 200 kg, 300 kg, and 400 kg., applied at 0.6 M from top.
- c. The factor of safety for all poles above 9.5 M shall not be less than 2.0. For 7.5 M and 8.5 M poles, the factor of safety shall not be less than 2.5.
- d. The average permanent load shall be 40% of the working load.
- e. The F.O.S. against first load shall be 1.0.
- f. At average permanent load, permissible tensile stress in concrete shall be 30 kg/cm^2 .
- g. At the design value of first crack load, the modulus of rupture shall not exceed 53.0 kg/cm^2 for M-400 concrete and 55.2 kg/cm^2 for M-420 concrete.
- h. At the design value of first crack load, the modulus of rupture shall not exceed 53.0 kg/cm^2 for M-400 concrete.
- i. The ultimate moment capacity in the longitudinal direction should be at least one fourth of that in the transverse direction.
- j. The maximum compressive stress in concrete at the time of transfer of pre-stress should not exceed 0.8 times the cube strength.
- k. The concrete strength at transfer shall not be less than half the 28 days strength ensured in the design, i.e., $400 \times 0.5 = 200 \text{ kg/cm}^2$ or $420 \times 0.5 = 210 \text{ kg/cm}^2$.

Service Conditions

PSC poles have to be designed to suit the following climatic conditions:

- a) Maximum temperature of air in shade 40°C
- b) Minimum temperature of air in shade 2°C
- c) Maximum temperature of air in sun 45°C
- d) Maximum humidity 93%
- e) Average number of thunder storm days per annum 45 Days
- f) Maximum rainfall per annum 3500 mm
- g) Average rainfall per annum 2200 mm
- h) Wind pressure 97.8 Kg/m^2
- i) Altitude above MSL to 1000 M

11.0 Dimensions and Reinforcements

The cross-sectional dimensions and the details of pre-stressing wires should conform to the particulars given in Annexure-I, II and III.

The provisions of holes for fixing cross-arms and other fixtures should conform to the REC standards.

12.0 Manufacture

Attire--stressing wires and reinforcements shall be accurately fixed as shown in drawings and maintained in position during manufacture. The un-tensioned reinforcement, as indicated in the drawings, should be held in position by the use of stirrups which should go round all the wires.

All wires shall be accurately stretched with uniform pre-stress in each wire. Each wire or a group of wires shall be anchored positively during casing. Care should be taken to see that the anchorages do not yield before the concrete attains the necessary strength.

13.0 Cover

The cover of concrete measured from the outside of pre-stressing tendon shall be normally 20 Nm.

14.0 Welding and Lapping of Steel

The high tensile steel wire shall be continuous over the entire length of the tendon. Welding shall not be allowed in any case. However, jointing or coupling may be permitted provided the strength of the joint or coupling is not less than the strength of each individual wire.

15.0 Compacting

Concrete shall be compacted by spinning, vibrating, shocking or other suitable mechanical means. Hand compaction shall not be permitted.

16.0 Curing

The concrete shall be covered with a layer of sacking, canvass, Hessian or similar absorbent material and kept constantly wet up to the time when the strength of concrete is at least equal to the minimum strength of concrete at transfer of pre-stress. Thereafter, the pole may be removed from the mould and watered at intervals to prevent surface cracking of the unit, the interval should depend on the atmospheric humidity and temperature.

The pre-stressing wires shall be de-tensioned only after the concrete has attained the specified strength at transfer (i.e., 200 or 210 kg/cm² as applicable). The cubes cast for the purpose of determining the strength at transfer should be cured, as far as possible, under conditions similar to those under which the poles are cured. The transfer stage shall be determined based on the daily tests carried out on concrete cubes till the specified strength indicated above is reached. Thereafter the test on concrete shall be carried out as detailed in IS: 1343 (Code of practice for pre-stressed concrete). The manufacturer shall supply, when required by the owner or his representative, result of compressive test conducted in accordance with IS: 456 (Code of practice for plain and reinforced concrete) on concrete cubes made from the concrete used for the poles. If the owner so desired, the manufacturer shall supply cubes for test purposes and such cubes shall be tested in accordance with IS: 456 (Code of practice for plain and reinforced concrete).

The de-tensioning shall be done by slowly releasing the wires, without imparting shock or sudden load to the poles. The rate of de-tensioning may be controlled by any suitable means either mechanical (screw type) or hydraulic.

The poles shall not be de-tensioned or released by cutting the pre-stressing wires using flames or bar croppers while the wires are still under tension.

Separate eye-hooks or holes shall be provided for handling the transport, one each at a distance of 0.15 times the overall length, from either end of the pole. Eye-hooks, if provided, should be properly anchored and should be on the face that has the shorter dimension of the cross-section. Holes, if provided for lifting purposes, should be perpendicular to the broad face of the pole.

Stacking should be done in such a manner that the broad side of the pole is vertical. Each tier in the stack should be supported on timber sleeper located as 0.15 times the overall length, measured from the end. The timber supported in the stack should be aligned in a vertical line.

Poles should be transported with their broad faces placed vertically and, in such a manner that the shocks are avoided. Supports should be so arranged that they are located approximately at a distance equal to 0.15 times the overall length from the ends. The erection of the pole should be carried out in such a way that the erection loads are applied so as to cause moment with respect to the major axis, i.e., the rope used for hoisting the pole should be parallel to the broader face of the pole.

Earthing

Earthing shall be provided by having length of 8 SWG GI wire embedded in concrete during manufacture and the ends of the wires left projecting from the pole to a length of 100 mm at 250 mm from top and 150 mm below ground level.

Earth wire shall not be allowed to come in contact with the pre-stressing wires.

18.0 Transverse Strength Test

Poles made from ordinary Portland cement shall be tested only on the completion of 28 days and poles made from rapid hardening cement only on the completion of 14 days, after the day of manufacture.

The poles may be tested in either horizontal or vertical position. If tested in horizontal position, provisions shall be made to compensate for the overhanging weight of the pole, for this purpose, the overhanging portion of the pole may be supported on a movable trolley or similar device.

The pole shall be rigidly supported at the butt end for a distance equal to the agreed depth of planting.

Load shall be applied at a point 600 mm from the top of the pole and shall be steadily and gradually increased to the design value of the transverse load at first crack. The deflection at this load shall be measured.

A pre-stressed concrete pole shall be deemed not to have passed the test if visible cracks appear at a stage prior to the application of the design transverse load for the first crack.

The load shall then be reduced to zero and increased gradually to a load equal to the first crack load plus 10% of the minimum ultimate transverse load, and held up for 2 minutes. This

procedure shall be repeated until the load reaches the value of 80 per cent of the minimum ultimate transverse load and thereafter increased by 5 per cent of the minimum ultimate transverse load until failure occurs. Each time the load is applied, it shall be held for 2 minutes. The load applied to pre-stressed concrete pole at the point of failure shall be measured to the nearest five kilograms.

The pole shall be deemed not to have passed the test if the observed ultimate transverse load is less than the design ultimate transverse load.

19.0 Measurement of Cover

After completion of the transverse strength test, the sample pole shall be taken and checked for cover. The cover of the pole shall be measured at 3 points, one within 1.8 meter from the butt end of the pole, the second within 0.6 meters from the top and the third at an intermediate point and the mean value compared with the specified value.

The mean value of the measured cover should not differ by more than (\pm) 1 mm from the specified cover. The individual values should not differ by more than (\pm) 3 mm from the specified value.

If these requirements are not met, the workmanship with reference to aligning of the end plates and pre-stressing wires and assembly of moulds should be improved and inspection at pre-production stage tightened suitably.

20.0 Marking

The pole shall be clearly and indelibly marked with the following particulars either during or after manufacture but before testing at a position so as to be easily read after erection in position:

Month and year of manufacture

Transverse strength of pole in Kg

Maker's serial no. and mark and Project.

21.0 Inspection

Inspection may be carried out by the purchaser or third party nominee at any stage of manufacture. The supplier shall grant free access to the purchaser's representative or third party nominee at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found defective.

SL NO	ITEM	PARAMETERS
1	Type of Pole	9.75 M PSC pole
2	Length of pole	9.75 Mts.
3	Depth of Plantation	1.8 Mts.
4	Bottom Depth	350 mm
5	Top Depth	175 mm
6	Breath	120 mm

7	Diameter of pre-stressing wire	4 mm
8	No. of tensioned wire per pole	22 Nos of 4mm dia.
9	Minimum Ultimate Tensile strength of 4 mm. HT wire	175 KG / SQMM
10	Minimum initial pull of 4 mm wire	1865 kg / wire
11	Spacing HT wires	As per IS : 1343 /1960
12	Quantity of HT wire/ pole	21.45 KG
13	Link & spiral	3.540 KG (4nos ,5 mm in bottom & 4 nos ,5 mm in top
14	M.S spiral	3 mm dia of 150 c/c
15	Maximum Aggregate size	12 mm
16	Total weight per pole	750 KG
17	Minimum clear cover	20 mm
18	Factor of safety	2.5
19	Concrete grade	M-420
20	Ultimate Load	675 KG
21	Earthing shall be provided by 4 MM dia. Galvanized iron wire embedded in concrete	Projecting from the pole at length of 50 MM at 215 from top & 150 MM below ground level
22	one marks to be provided at ground level	at 1.8 M
23	28 days cube strength of concrete (min) as per IS : 456/2000.	420 Kg / sq.cm.

TECHNICAL SPECIFICATION FOR ACSR CONDUCTORS

A. ACSR CONDUCTOR

1. SCOPE

This section covers design, manufacture, testing before dispatch, packing, supply and delivery for destination of Kms of “WEASEL” " RABBIT", "RACOON", "DOG", “WOLF” and "PANTHER" ACSR Conductor of size 6/1/2.59mm, 6/1/3.35mm, 6/1/4.09 mm, 6/4.72mm, 7/1.57mm, 30/7/2.59 mm and 30/7/3.00mm respectively.

2. STANDARDS

The Conductor shall also comply in all respects with the IS: 398 (Part-II) - 1996 with latest amendments unless otherwise stipulated in this specification or any other International Standards which ensure equal or higher quality material.

Sl. No.	Indian Standards	Title	International
1	IS:209-1979	Specification for Zinc	BS-3436-1961
2	IS:398-1996	Specification for Aluminum conductors for overhead transmission purposes.	
	Part-II	Aluminum conductors	IEC-209-1966

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		Galvanized steel reinforced	BS-215(Part-II)
3	IS:1521-1972	Method of Tensile Testing of Steel wire	ISO/R89-1959
4	IS:1778-1980	Reels and Drums for Bare conductors	BS-1559-1949
5	IS:1841-1978	E.C. Grade Aluminum rod produced by rolling	
6	IS:2629-1966	Recommended practice for Hot Dip Galvanizing of iron and steel	
7	IS:2633-1986	Method of testing uniformity of coating of zinc coated articles.	
8	IS:4826-1968	Galvanized coatings on round steel wires.	ASTM A472-729
9	IS:5484-1978	E.C. Grade Aluminum rod produced by continuous casting and rolling.	
10	IS:6745-1972	Methods of determination of weight of zinc-coating of zinc coated iron and steel articles	BS-443-1969

The ACSR Conductor shall also conform to the following standards: Offer Conforming to standards other than IS-398 shall be accompanied by the English version of relevant standards in support of the guaranteed technical particulars to be furnished as per format enclosed.

3. GENERAL TECHNICAL REQUIREMENTS

The General Technical Requirements are given in Section-II. The Conductor shall conform to these technical requirements.

The Bidder shall furnish guaranteed technical particulars in Section-III.

MATERIALS/WORKMANSHIP

The material offered shall be of best quality and workmanship. The steel cored Aluminum conductor strands shall consist of hard drawn Aluminum wire manufactured from not less than 99.5% pure electrolytic Aluminum rods of E.C. grade and copper content not exceeding 0.04%. They shall have the same properties and characteristics as prescribed in IEC: 889-1987. The steel wire shall be made from material produced either by the acid or basic open hearth process or by electric furnace process or basic oxygen process. Steel wire drawn from Bessemer process shall not be used.

The steel wires shall be evenly and uniformly coated with electrolytic high grade, 99.95% purity zinc complying with the latest issue of IS-209 for zinc. The uniformity of zinc coating and the weight of coating shall be in accordance with Section-II and shall be tested and determined according to the latest IS-2633 or any other authoritative standard.

The steel strands shall be hot dip galvanized and shall have a minimum zinc coating of 250 gm/sq.m after stranding. The coating shall be smooth, continuous, and of uniform thickness, free from imperfections and shall withstand minimum three dips after stranding in standard preece test. The steel strands shall be preformed and post-formed in order to prevent spreading of strands in the event of cutting of composite core wire. The properties and characteristics of finished strands and individual wires shall be as prescribed in IEC: 888-1987.

4. CONDUCTOR PARAMETERS

The Parameters of individual strands and composite steel cored aluminium conductor shall be in accordance with the values given in Section-II.

Creep in a conductor is attributed partly due to settlement of strands and partly due to non-elastic elongation of metal when subjected to load. The manufacturer of conductor shall furnish the amount of creep which will take place in 10, 20, 30, 40 and 50 years along with the supporting calculations. The calculations shall be based on everyday temperature of 32°C and everyday tension of 25% of UTS of conductor of 11/33 KV Lines.

5. TOLERANCES

The tolerances on standard diameter of Aluminium and Steel wires shall be as detailed in specific technical requirements.

The cross-section of any wire shall not depart from circularity by more than an amount corresponding to the tolerance on the standard diameter.

The details of diameters, lay ratios of Aluminium and steel wires shall be in accordance with the Section-II "Technical Requirements".

6. SURFACECONDITIONS

All Aluminum and steel strands shall be smooth, and free from all imperfections, spills/and splits. The finished conductor shall be smooth, compact, uniform and free from all imperfections including spills and splits, die marks, scratches, abrasions, scuff marks, kinks (protrusion of wires), dents, pressmarks, cut marks, wire cross-over, over-riding looseness, pressure and/or unusual bangle noise on tapping, material inclusions, white rust, powder formation or black spots (on account of reaction with trapped rain water etc.), dirt, grit, etc. The surface of conductor shall be free from points, sharp edges, abrasions or other departures from smoothness or uniformity of surface contour that would increase radio interference and corona losses. When subjected to tension upto 50% of the ultimate strength of the conductor, the surface shall not depart from the cylindrical form nor any part of the component parts or strands move relative to each other in such a way as to get out of place and disturb the longitudinal smoothness of the conductor.

7. JOINTS INWIRES**Aluminumwires**

During stranding, no Aluminum wire welds shall be made for the purpose of achieving the required conductor length.

No joint shall be permitted in the individual Aluminum wires in the outer most layer of the finished Conductor. However, joints in the 12 wire & 18 wire inner layer of the conductor are permitted but these joints shall be made by the cold pressure butt welding and shall be such that no two such joints shall be within 15 meters of each other in the complete stranded conductor.

Steelwires

There shall be no joints in finished steel wires forming the core of the steel reinforced Aluminium conductor.

8. STRANDING

The wires used in construction of the stranded conductor, shall, before stranding, satisfy all requirements of IS-398 (Part-II) 1996.

In all constructions, the successive layers shall be stranded in opposite directions. The wires

in each layer shall be evenly and closely stranded round the underlying wire or wires. The outer most layer of wires shall have a right hand lay. The lay ratio of the different layers shall be within the limits given under Section-II.

9. PACKING

The conductor shall be supplied in non-returnable strong wooden drums provided with lagging of adequate strength constructed to protect the conductor against any damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The drums shall generally conform to IS-1778-1980 and latest version except as otherwise specified hereinafter. The conductor drums shall be adequate to wind one standard length of 2500 meters of WEASEL/RABIT/RACoon/DOG/PANTHER ACSR conductor.

The drums shall be suitable for wheel mounting and for letting off the conductor under a minimum controlled tension of the order of 5KN. The conductor drums shall be provided with necessary clamping arrangements so as to be suitable for tension stringing of power conductor.

The bidders shall submit their drawings of the conductor drums along with the bid. After placement of letter of intent the Manufacturer shall submit four copies of fully dimensioned drawing of the drum for Employer's approval. After getting approval from the Employer, Manufacturer shall submit 30 more copies of the approved drawings for further distribution and field use.

All wooden components shall be manufactured out of seasoned soft wood free from defects that may materially weaken the component parts of the drums. Preservative treatment for anti-termite/anti fungus shall be applied to the entire drum with preservatives of a quality which is not harmful to the conductor.

All flanges shall be 2-ply construction with 64 mm thickness. Each ply shall be nailed and clenched together at approximately 90 degrees. Nails shall be driven from the inside face of the flange, punched and then clenched on the outer face. Flange boards shall not be less than the nominal thickness by more than 2 mm. There shall not be less than 2 nails per board in each circle.

The wooden battens used for making the barrel of the conductor shall be of segmental type. These shall be nailed to the barrel supports with at least two nails. The battens shall be closely butted and shall provide a round barrel with smooth external surface. The edges of the battens shall be rounded or chamfered to avoid damage to the conductor.

Barrel studs shall be used for construction of drums. The flanges shall be holed and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end, sufficient to accommodate washers, spindle plates and nuts for fixing flanges at the required spacing.

Normally, the nuts on the studs shall stand protruded of the flanges. All the nails used on the inner surface of the flanges and the drum barrel shall be countersunk. The ends of the barrel shall generally be flushed with the top of the nuts.

The inner cheek of the flanges and drum barrel surface shall be painted with bitumen based paint.

Before reeling, card board or double corrugated or thick bituminized waterproof bamboo paper shall be secured to the drum barrel and inside of flanges of the drum by means of a suitable commercial adhesive material. The paper shall be dried before use. Medium grade craft paper shall be used in between the layers of the conductor. After reeling the conductor

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the exposed surface of the outer layer of conductor shall be wrapped with thin polythene sheet across the flanges to preserve the conductor from dirt, grit and damage during transportation and handling and also to prevent ingress of rain water during storage/transport.

A minimum space of 75 mm shall be provided between the inner surface of the external protective lagging and outer layer of the conductor. Outside the protective lagging, there shall be minimum of two binders consisting of hoop iron/galvanised steel wire. Each protective lagging shall have two recesses to accommodate the binders.

Each batten shall be securely nailed across grains as far as possible to the flange edges with at least 2 nails per end. The length of the nails shall not be less than twice the thickness of the battens. The nail shall not protrude above the general surface and shall not have exposed sharp edges or allow the battens to be released due to corrosion.

The conductor ends shall be properly sealed and secured with the help of U-nails on one side of the flanges.

Only one standard length of conductor shall be wound on each drum. The method of lagging to be employed shall be clearly stated in the tender.

As an alternative to wooden drum Bidder may also supply the conductors in non-returnable painted steel drums. The painting shall conform to IS:9954-1981, reaffirmed in 1992. Wooden/ steel drum will be treated at par for evaluation purpose and accordingly the Bidder shall quote the package.

10. LABELLING AND MARKING

The drum number shall be branded or gauged or stenciled into the flange. An arrow shall be marked on the sides of the drum, together with the words "Roll this way". Each drum shall have the following information provided on the outside of the flange stenciled with indelible ink.

- i) Manufacturer's name and address.
- ii) Contract/Specification number.
- iii) Size and type of conductor.
- iv) Net weight of the conductor.
- v) Gross weight of the conductor and drum.
- vi) Length of the conductor.
- vii) Position of the conductor end.
- viii) Drum and lot number.
- ix) Name and address of the consignee.
- x) Month and year of manufacture.
- xi) The drum may also be marked with standard specification as per which the conductor is manufactured.

11. STANDARD LENGTHS

The standard length of the conductor shall be 2500 meters. Bidder shall indicate the standard length of the conductor to be offered by them. A tolerance of plus or minus 5% on the standard length offered by the bidder shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.

Random lengths will be accepted provided no length is less than 70% of the standard length and total quantity of such random length shall not be more than 10% of the total quantity order. When one number random length has been manufactured at any time, five (5) more individual lengths, each equivalent to the above random length with a tolerance of +/-5% shall

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also be manufactured and all above six random lengths shall be dispatched in the same shipment. At any point, the cumulative quantity supplied including such random length shall not be more than 12.5% of the total cumulative quantity supplied including such random lengths. However, the last 20% of the quantity ordered shall be supplied only in standard length as specified.

Bidder shall also indicate the maximum single length, above the standard length, he can manufacture in the guaranteed technical particulars of offer. This is required for special stretches like river crossing etc. The Employer reserves the right to place orders for the above lengths on the same terms and conditions applicable for the standard lengths during the pendency of the Contract.

12. QUALITY ASSURANCE PLAN

A Quality Assurance Plan including customer hold points covering the manufacturing activities of the material shall be required to be submitted by the tenderer to the Employer along with the tender. The Quality Assurance Plan after the same is found acceptable, will be approved by the Employer.

The contractor shall follow the approved Quality Assurance Plan in true spirit. If desired by the Employer, he shall give access to all the documents and materials to satisfy the Employer that the Quality Assurance Plan is being properly followed.

SECTION - II

SPECIFIC TECHNICAL REQUIREMENTS

1. SCOPE

This section of the specification covers climatic and isoceraunic conditions, specific technical particulars, schedule of requirements & desired deliveries, for conductor for 11/33 kV lines.

2. CLIMATIC & ISOCERAUNIC CONDITIONS

2.1 Maximum Temperature	
a) Conductor	°C.
2.2 Minimum Temperature	°C.
2.3 i) Max. ambient temperature	°C
ii) Mean annual / every day temperature	°C
2.4 Basic wind speed m/s	
2.5 Relative humidity	
i) Maximum	%
ii) Minimum	%
2.6 Average Rainfall (Max.) mm per annum	
2.7 a) Rainy months	May to Sept. 15 Rainy days in a year (days)

CONDUCTOR		
1. Conductor: RaccoonACSR		
2. ISApplicable: IS-398 (part-II) 1996 latest revision		
3. Wire Diameter	Raccoon	
Aluminium (mm)	6/4.09	
Steel(mm)	1/4.09	
4. Number of strands:		
Steel centre	1	
1st steel layer		
1st Aluminium layer	6	
2nd Aluminium layer		
5. Sectional Area of Aluminium (sq. mm.)	78.83	
6. Total Sectional Area(sq.mm.)	91.97	
7. Overall diameter(mm)	12.27	
8. Approximate weight(Kg./Km.)	319	
9. Calculated D.C resistance at 20 degrees C., maximum. (Ohms/Km)	0.371	
10. Ultimate tensile strength (KN)	26.91	
11. Final modulus of elasticity (GN/sq.m)	79	
12. Coefficient of linear expansion x 10-6 per°C	19.1	
13. Lay ratio	Max /Min	
Steel core 6 wire layer		
Aluminium 1st layer	14	
2 nd layer	10	
14. Technical Particulars		
a. Diameter-mm	Al	Steel
Standard(mm)	4.09	4.09
Maximum (mm)	4.17	4.17
Minimum (mm)	4.01	4.01
b. Cross-sectional area of nominal diameter wire (mm ²)	13.14	13.14
c. Weight (Kg./Km)	102.48	35.51
d. Min. breaking load (KN)		

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Before stranding	17.27	2.08
After Stranding	16.4	1.98
e. D.C resistance at 20°C min. (Ohm/Km)	0.371	

15. Zinc coating of steel core:

- (i) Number of 1minutedips: 3
- (ii) Minimum weight of Zinc: 260 gms/sqmCoating
- (iii) Process of Galvanizing: Hotdip.
- (iv) Quality of Zinc: IS-209/1979 or latest edition.

16. Joints in strands

Steel : Not permitted

Aluminium: No joint shall be permitted in the Aluminium wires in the outer most layer of the ACSR conductor. But permitted in the inner layers such that no two such joints are within 15 meters of each other in the complete stranded conductor.

17 Chemical composition of high carbon steel wire:

Element	% Composition
i) Carbon	0.5 to 0.85
ii) Manganese	0.5 to 1.10
iii) Phosphorus	Not more than 0.035
iv) Sulphur	Not more than 0.045
v) Silicon	0.10 to 0.35

TECHNICAL SPECIFICATION FOR 11 KV AND 33 KV ISOLATORS

1. SCOPE

This specification provides for design, manufacture, testing at manufactures works, inspection, packing and delivery of outdoor station type 12kV and 36kV (Local) manual operating mechanism air break disconnects (Isolators) with/without earthing blades and complete in all respect with bi-metallic connectors and other accessories and auxiliary equipment for installations in various substations in Assam. Operating mechanism, fixing details etc. shall be as described herein.

2. SERVICE CONDITIONS

The Isolators to be supplied against this Specification shall be suitable for satisfactory continuous operation under the following climatic conditions.

1	Location	At various locations within the state of Assam
2	Maximum ambient air temperature (°C)	45
3	Minimum ambient air temperature (°C)	2
4	Maximum average daily ambient air temperature (°C)	35
5	Maximum yearly weighted average ambient temperature (°C)	32
6	Maximum altitude above mean sea level (Metres)	1000
7	Maximum Humidity	93%
8	Average number of thunderstorm days	45->50

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9	Average numbers of dust storms per annum	10
10	Maximum rainfall/annum	3500 mm
11	Average rainfall	2280 mm
12	Wind Pressure	97.8 Kg/Sq.mm
13	Altitude above MSL	100 m to 1000 m
14	Seismic Level	0.24g to 0.48g

Note:

The equipment shall generally be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth unless otherwise specified.

3. SYSTEM CONDITIONS

The isolators shall be suitable for outdoor installation with 3-phase 50 Hz, 11 kV/33kV systems and they should be designed suitable for service under fluctuations in supply voltage up to $\pm 12\%$. Permissible under Indian Electricity Supply Act and rules made there under.

4. STANDARDS

The isolators and isolator-cum-earthling switches shall comply with the requirements of IS 9921 (as amended up to date) and the latest edition of IEC 62271-102 (IEC 60129). The Insulators shall comply with the requirement of latest edition of IS 2544/1973 and IEC 60168/1988 (as amended up to date)

Sr.No.	Standard No.	Title
2	IS 9921 (Part 1 to 4)	Alternating Current Disconnectors (Isolators) and Earthing Switches for Voltages Above 1 000 V - Part I
3	IEC 62271-102 (IEC/ 60129)	Alternating current disconnectors and earthing switches
	IEC 62271-1 (IEC 60694)	High-voltage switchgear and controlgear - Part 1: Common specifications
4	IS 2544/ IEC 60168	Porcelain post insulators for systems with nominal voltage greater than 1000 V olts
	IS 5350	Dimensions of Indoor and Outdoor Porcelain Post Insulators and Post Insulator Units for Systems with Nominal Voltages Greater than 1000 V
	IS 2629	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
	IS 4736	Hot-dip Zinc Coatings on Mild Steel Tubes
	IS 4759	Hot-dip zinc coatings on structural steel and other allied products
	IS 6745	Method for determination of mass of zinc coating on zinc coated iron and steel articles
	IS 2633	Methods for testing uniformity of coating of zinc coated articles
	IS 9530/1980	Recommended practice for silver plating

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	IS 5925/1970	Recommended practice for silver plating for general engineering purposes
	BS 2816/1964	Testing of silver plating thickness
	IS 6735/1994	Spring lock washers
	IS 2016	Plain washers
	IS 1161	Steel tubes for structural purposes
	IS 1239	GI pipe('B' class or Medium class)
5	IS 2147	Degree of protection provided for enclosures for low voltage control gear
6	IS:4691	Degree of protection provided by enclosures for rotating electrical machinery
17	IS: 5561	Electrical Power Connectors

5. KEY TECHNICAL PARAMETERS

The equipment covered in this specification shall meet the technical requirements listed below. The Isolator must be Double Break, center pole rotating type

Sl. No.	Parameter	Unit	Requirements for (33kV)	Requirements for (11kV)
1	Rated Freq.	Hz.	50	50
2	System Neutral Earthing		Solidly earthed	Solidly earthed
3	No. of phase(poles)	No.	3	3
4	Temp. rise	Deg. C	As per standards IS/IEC	As per standards IS/IEC
5	Safe duration of overload	Minutes		
	a) 150 % of rated current		5	5
	b) 120 % of rated current		30	30
6	Rated voltage	KV rms	36	12
7	Type of isolator (AB)		DBCR	DBCR
8	Rated normal current	Amps.	800 / 1250	400/ 630
9	Rated short time withstand current for 3 second	KA rms	25	25
10	Rated peak current	KA peak	63	63
11	Rated short circuit make current	KA peak	63	63
12	Derating factor		unity	Unity
13	Basic Insulation Level			
	1) Lightning Impulse withstand voltage			
	a) Pole to earth & between poles	KV peak	170	75
	b) Across isolating distance	KV peak	195	85
	2) Rated power freq. withstand voltage			

Sl. No.	Parameter	Unit	Requirements for (33kV)	Requirements for (11kV)
	a) Pole to earth & between poles	KV rms	70	28
	b) Across isolating distance	KV rms	80	32
14	Min. creepage distance (The protected creepage distance shall not be less than 50% of total)	mm	900	300
15	Phase to phase spacing for installation	mm	1500	900
16	Min. clearances	mm		
	a) Phase to earth		430	AS per IE rule
	b) Between rotating post and fixed post on one phase		485	AS per IE rule
17	Height of centre line of terminal pad above ground level	mm	3700	3700
18	<p>Special Requirements:</p> <p>Isolator main switch (MS) shall be required to make or break the line charging current when no significant change in voltage occurs across the isolating distance on account of make or break.</p> <p>The isolator required is not with "Turn and twist mechanism". It must be rotating type.</p>			

6. GENERAL TECHNICAL REQUIREMENTS

6.1. TYPE & RATING

Isolators shall have three posts per phase, triple pole single throw, gang operated out-door type silver plated contacts with horizontal operating blade and isolators posts arranged vertically. The isolators will be double break type. Rotating blade feature with pressure relieving contacts is necessary i.e. the isolator shall be described in detail along-with the offer. All isolators shall operate through 90 degree from their fully closed position to fully open position, so that the break is distinct and clearly visible from the ground level.

The equipment offered by the tenderer shall be designed for a normal current rating of 400A, 630 A for 11 KV & 800 A, 1250 A for 33 KV suitable for continuous service at the system voltage specified herein. The isolators are not required to operate under load but they must be called upon to handle magnetization currents of the power transformers and capacitive currents of bushings, bus-bars connections, very short lengths of cables and current of voltage transformers.

The rated insulation strength of the equipment shall not be lower than the levels specified in IS9921 IEC publication No. IEC 62271-102 (IEC 60129), which are reproduced below:

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Standard declared voltage kv/rms	Rated voltage of the Isolator	Standard withstand positiveV (peak)	Impulse Voltage polarity	One minute power frequency withstand voltage KV (RMS)	
		Across the isolating distance	To earth and between poles	Across the isolating distance	To earth and between poles
11 KV	12	85	75	32	28
33 KV	36	195	170	80	70

The 11 KV and 33 KV isolators are required with post insulators but with mounting structures. The isolators should be suitable for mounting on the Boards standard structures. The isolators shall be supplied with base channels along with fixing nuts, bolts and washers for mounting on the structured.

6.2 TEMPRATURERISE

The maximum temperature attained by any part of the equipment when in service at site under continues full load conditions and exposed to the direct rays of Sun shall not exceed 45 degree centigrade above ambient temperature.

6.3 ISOLATORINSULATION

Isolation to ground, insulation between open contacts and the insulation between phases of the completely assembled isolating switches shall be capable of withstanding the dielectric test voltage specified above.

6.4 MAINCONTACTS

All isolators shall have heavy duty self-aligning and high pressure line type fixed contacts of modern design and made of hard drawn electrolytic copper. The fixed contact should be of reverse loop type. The various parts shall be accordingly finished to ensure inter- changeability of similarcomponents.

The fingers of fixed contacts shall be preferably in two pieces and each shall form the reverse loops to hold fixed contacts. The fixed contacts would be placed in 'c' clamp. The thickness of 'C' clamp shall be adequate. This channel shall be placed on a channel of adequate thickness. This channel shall be welded on an insulator mounting plate of 8mmthickness. The spring of fixed contact shall have housing to hold in place. This spring shall be made of stainless steel with adequate thickness. The pad for connection of terminal connector shall be ofAluminum with thickness not less than 12mm.

The switch blades forming the moving contacts shall be made from tubular section of hard drawn electrolytic copper having outer diameter not less than 38 mm and thickness 3 mm. These contacts shall be liberally dimensioned so as to withstand safely the highest short circuit and over voltage thatmay be encountered during service. The surfaces of the contacts shall be rendered smooth and silver plated. The thickness of silver plating shall not be less than 15 microns for 11 KV and 25 microns for 33 KV. In nut shell, the male and female contact assemblies shall be of robust construction and design of these assemblies shall ensure thesame.

- a) Electro-dynamic withstands ability during short circuit without any risk of repulsion ofcontacts.

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- b) The current density in the copper parts shall not be less than 2 Amp/sq.mm and aluminium parts shall be less than 1 Amp /sq.mm.
- c) Thermal withstand ability during shortcircuit.
- d) Constant contact pressure even when the live parts of the insulator stacks are subjected to tensile stresses due to linear expansion of connected bus bar of flexible conductors either because of temperature variation or strong winds.
- e) Wiping action during closing and opening.
- f) Self-alignment assuring closing of the switch without minute adjustment.

The earthing switch should be provided with three sets of suitable type of fixed contacts below the fixed contacts assemblies of the main switch on the incoming supply side and the sets of moving contacts having ganged operation. These contacts shall be fabricated out of electrolytic copper for 33 KV isolators with earth switch and designed to withstand current on the line.

Arcing contacts/Horn: Arcing contacts are not required.

Auxiliary switches : Auxiliary switches are not required

6.5 CONNECTORS

The connectors for 11KV isolator shall be made of Aluminium alloy LM-9 or LM-25 and shall be suitable for Raccoon/Dog ACSR Conductors for 11KV and Wolf conductors for 33 KV with horizontal and vertical takeoff arrangement. The details in regard to dimensions, the number of bolts to be provided, material and manufacture shall be furnished by the bidder for owner approval before manufacturing. The groove provided in the connection should be able to accommodate conductor size mentioned above smoothly.

The clamp to be offered should be manufactured by gravity die-casting method only and not by sand casting process. It is necessary that suitable clamps are offered along with the isolator and also it is obligatory to give complete technical particulars of clamps along with the drawing, as per details given above and also as per following detail:

- a) The terminal connector shall be manufactured and tested as per IS:5561.
- b) All castings shall be free from blow holes, surface blisters, cracks and cavities.
- c) All the sharp edges shall be blurred and rounded off.
- d) No part of the clamp shall be less than 12 mm thick.
- e) All current carrying parts shall be designed and manufactured to have minimum contact resistance.
- f) Connectors shall be designed to be corona free in accordance with the requirement of IS:5561.
- g) All nuts and bolts shall be made of stainless steel only. Bimetallic sleeve/liner shall be 2 mm thick

Wherever necessary, bi-metallic strip of standard quality and adequate dimension shall be used.

6.6 POST INSULATOR

11KV/33KV insulators shall

be of reputed make subject to owner approval. The post insulators for the above 11KV isolators shall comprise of three numbers 11 KV insulators per stack and 9 such stack shall be supplied with each

isolator. Similarly, for 33KV isolators, two numbers 33KV insulators per stack and 9 stacks shall be supplied with each isolator. The insulator stack shall conform to the latest applicable Indian or IEC standard and in particulars to the IS; 2544 specification for porcelain post insulators. The porcelain used for manufacture of insulators shall be

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homogeneous, free from flaws or imperfections that might affect the mechanical or dielectric quality, and they shall be thoroughly vitrified, tough and impervious to moisture. The glazing of the porcelain shall be uniform brown colour, free from glisters, burns and other similar defects. Insulators of the same rating and type shall be interchangeable.

The porcelain and metal parts should be assembled in such a manner that any thermal expansion differential between the metal and the porcelain parts throughout the range of temperature variation shall not loosen the parts or create undue internal stresses which may affect the electrical or mechanical strength and rigidity. Each cap and base shall be of high-grade cast steel or malleable steel casting and they shall be machine faced and smoothly galvanized. The cap and base of the insulators shall be interchangeable with each other.

The tenders shall in variably enclose with the offer, the type test certificate and other relevant technical guaranteed particulars of insulators offered by them. Please note that insulators without type test certificates will not be accepted.

Each 11KV / 33KV Post Insulators used in the isolators should have technical particulars as detailed below:

Sl.No.	Particulars	11KV	33KV
1	Nominal system voltage KV (rms)	11	33
2	Highest system voltage KV (rms)	12	36
3	Dry P.F. One minute with stand KV (rms)	35	75
4	Wet PF one minute withstand KV (rms)	35	75
5	P.F. Puncture withstand test voltage KV	1.3 times the actual dry flash over voltage of the unit	
6	Impulse voltage withstand test KV (peak)	75	170
7	Visible discharge test KV voltage	9	27
8	Creepage distance mm (min)	300	900
9	Tensile strength in KN	10	16
10	Short time current rating for 3 Secs KA	25	25

For 33 KV Isolators: In place of 33 KV Post Insulator the composition of 2 units of 22KV Post Insulators per stack complying with the following parameters are acceptable:

a	Nominal system voltage	33 KV
b	Highest system voltage	36 KV
c	Impulse voltage withstand	170 KV
d	Power frequency wet withstand voltage	75 KV
e	Height of stack	500 mm
f	Creepage distance (Minimum)	900 mm
g	Tensile Strength	30KN
h	Bending strength	4.5KN

6.7 OPERATING MECHANISM FOR 11KV / 33KV ISOLATORS:

All Isolators and earthing switches shall have separate dependent manual operation. The Isolator should be provided with padlocking arrangements for locking in both end position to avoid unintentional operation. For this purpose Godrej make 5 lever brass padlocks having high neck with three keys shall be provided. The isolating distances should be visible for isolators.

The Isolators and Isolators with earth switch inclusive of their operating mechanism should be such that they cannot come out of their open or close position by gravity wind pressure, vibrations reasonable shocks or accidental touching of connecting rods of the operating mechanism. Isolators should be capable of resisting in closed position, the dynamic and thermal effects of maximum possible short circuit current at the installation point. They shall be so constructed that they do not open under the influence of the short circuit current. The operating mechanism should be of robust construction and easy to operate by a single person and conveniently located for local operation in the switchyard. Provision for earthing of operating handle by means of 8 SWG GS wire must be made.

6.7 PIPES

Tandem pipes operating handle shall be class BIS marked type having at least 24mm internal diameter for 11KV/33KV isolator. The operating pipe shall also be class B ISI marked with internal diameter of at least 32 mm and 38 mm for 11 KV and 33KV isolators respectively.

The pipe shall be terminated in to suitable universal type joints between the insulator bottom bearing and operating mechanism.

6.8 BASE CHANNEL

The Isolator shall be mounted on base fabricated from steel channel section of adequate size not less than 75x40x6 mm for 11KV and 100x50x6 mm for 33KV.

To withstand total weight of isolator and insulator and also all the forces that may encounter by the isolator during services, suitable holes shall be provided on this base channel to facilitate its mounting on our standard structures. The steel channel in each phase shall be mounted in vertical position and over it two mounting plates at least 8mm thick with suitable nuts and bolts shall be provided for minor adjustment at site.

6.9 CLEARANCES

We have adopted the following minimum clearance for isolators in our system. The bidder should therefore keep the same in view while submitting their offers:

Description	Center distance between Poles (Center to Center) i.e. Phase to Phase clearance	Distance between center lines of outer posts on same pole
11 KV Isolator	75 cm	60 cm
33 KV Isolator	12 cm	96 cm

7. TYPE TESTS

- 7.1 The equipment offered, shall be fully type tested as per the relevant standards. The tenderer shall furnish one set of the type test reports along with the offer. The purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative. For this purpose the tenderer may quote unit rates for carrying out each type test.
- 7.2 If type tests are carried out beyond 5 years, then the offer may be considered for placement of order however, successful bidders have to carry out the said type tests before commencement of the supply at their own expense.

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- 7.3 During the type test the isolator shall be mounted on its own support structure or equivalent support structure and installed with its own operating mechanism to make the type tests representative. Drawing of equivalent support structure if any and mounting arrangements made for type tests shall be furnished for purchaser's approval before conducting the type tests.
- 7.4 The type tests shall be conducted on the isolator along with approved insulators and terminal connectors.
- 7.5 Mechanical endurance test shall be conducted on the main switch as well as earth switch on one disconnect of each type.
- 7.6 The isolators shall be subjected to the following type test in accordance to with IS: 9920. Dielectric test (impulse and one minute) power frequency withstands voltage.
- a) Temperature rise test
 - b) Rated off load breaking current capacity
 - c) Rated active load breaking capacity
 - d) Rated line charging breaking capacity
 - e) Rated short time current
 - f) Rated peak withstand current
 - g) Mechanical and Electrical Endurance

The equipment shall be subjected to the following routine test.

- a) Power frequency voltage dry test.
- b) Measurement of resistance of the main circuit
- c) Operating test.

The porcelain will have pull out test for embedded component and beam strength of porcelain base.

8. PRE-COMMISSIONING TESTS

Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialties of the items as per the field instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Employer for approval.

- (a) Insulation resistance of each pole.
- (b) Manual operation and interlocks.
- (c) Insulation resistance of control circuits and motors.
- (d) Ground connections.
- (e) Contact resistance.
- (f) Proper alignment so as to minimize the vibration during operation to the extreme possible.
- (g) Measurement of operating Torque for isolator and Earth switch.
- (h) Resistance of operating and interlocks coils.
- (i) Functional check of the control schematic and electrical & mechanical interlocks.
- (j) 50 operations test on isolator and earth switch.

9. PERFORMANCE GUARANTEE:

The equipment shall be guaranteed for satisfactory performance for a period of 66 months from the date of receipt at site in good condition or 60 months from the date of commissioning, whichever is earlier. In case of failure within this period the supplier will make good the faulty equipment at no extra cost to the purchaser.

10. DOCUMENTATION:

- 12.1 All drawings shall conform to international standards. All drawings shall be "A3" size only. All dimensions and data shall be in System International units.
- 12.2 List of drawings and documents:

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The tenderer shall furnish four sets of following drawings alongwith his offer:

- a. General outline and assembly drawings of the isolator, operating mechanism, structure, insulator and terminal connector.
- b. Sectional views and descriptive details of items such as moving blades, contacts, arms, contact, pressure, contact support, bearing, housing of bearings, bushes, balancing of heights, phase coupling pipes, base plate, operating shaft, guides, swivel joint operating mechanism and its components, etc.
- c. Drawings with structure for the purpose of type tests.
- d. Name plate.
- e. Schematic drawing
- f. Type test reports in case the equipment has already been type tested.
- g. Test reports, literature, pamphlets of the bought out items, and raw material.

- 12.3 The successful tenderer shall, within 10 days from date of LOA get approval of above said drawings from office of CE (Stores), MSEDCL, Mumbai.
- 12.4 Six sets of the type test reports, duly approved by the purchaser, shall be submitted by the supplier for distribution, before commencement of supply. Adequate copies of acceptance and routine test certificates, duly approved by the purchaser, shall accompany the dispatched consignment.
- 12.5 The manufacturing of the equipments shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier's risk.
- 12.6 Approval of drawings/work by purchaser shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices.

11. INSTRUCTION MANUALS:

Twenty-five copies of the erection, operation and maintenance manuals in English shall be supplied for each type of the disconnect one month prior to dispatch of the equipment. The manual shall be bound volume and shall contain all drawings and information required for erection, operation and maintenance of the isolator including but not limited to the following particulars:

- a. Marked erection prints identifying the component parts of the disconnect asshipped with assembly drawings.
- b. Detailed dimensions and description of all auxiliaries.
- c. Detailed views of the insulator stacks, metallics, operating mechanism, structure, interlocks, spare parts etc.

12. SPARES

The tenderer shall furnish in his offer, a list of spares with unit rates for disconnect that may be necessary for maintenance of the isolator for a period of five years. The purchaser reserves the right for selection of items and quantities of these spares to be ordered.

The cost of following spares shall be quoted separately.

- a. Insulators
- b. Contacts
- c. Moving blades
- d. Springs
- e. Bearings

In addition list of optional spares may be enclosed.

15 PACKING AND FORWARDING

- 15.1 The equipment shall be packed in crates suitable for vertical/horizontal transport, as the case may be, and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided, Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

- 15.2 Each consignment shall be accompanied by a detailed packing list containing the following information.
- Name of the consignee
 - Details of consignment
 - Destination
 - Total weight of consignment
 - Sign showing upper/lower side of the crate.
 - Handling and unpacking instructions
 - Bill of material indicating contains of each package.
- 15.3 The supplier shall ensure that the packing list and bill of material are approved by the purchaser before dispatch.

TECHNICAL SPECIFICATION FOR 33 & 11 KV STATION CLASS LIGHTNING ARRESTOR & 11KV DISTRIBUTION CLASS SURGE ARRESTORS

1. 33kV VOLTAGE CLASS SURGEARRESTORS

Lightning Arrestors at Grid Substation shall be of Station class only in 33 & 11 KV System.

INTRODUCTION

The section covers the specification of 33kV voltage level, 10 kA, and Station class heavy duty, gapless metal (zinc) oxide Surge Arrestors complete with insulating base, terminal clamps, complete fittings & accessories for installation on outdoor type 33kV switchgear/transmission lines / transformers.

STANDARDS

The design, manufacture and performance of Surge Arrestors shall comply with IS: 3070 Part-3 and other specific requirements stipulated in the specification. Unless otherwise specified, the equipment, material and processes shall conform to the latest applicable Indian/International Standards as listed hereunder :

IS:2071-1993(Part-1)	Methods of High Voltage Testing General Definitions & Test Requirements.
IS:2071-1974(Part-2)	Test Procedures
IS:2629-1985	Recommended Practice for hot dip galvanizing on Iron & Steel
IS:2633-1986	Method for Testing uniformity of coating of zinccoated Articles.
IS:3070-1993 (Part – 3)	Specification for surge arrestor for alternatingcurrent systems. Metal-Oxide lightening Arrestors without gaps
IS:4759-1996	Specification for hot dip zinc coating on Structural Steel and Other allied products.
IS:5621-1980	Hollow Insulators for use in Electrical Equipment.
IS:6209-1982	Methods of Partial discharge measurement.
IS:6745	Method for determination of mass of zinc coating on zinc coated iron and steel articles

ANSI/IEEE-C.62.11	Metal oxide, Surge Arrestor for AC Power Circuits.
IEC –60099-4	Surge Arrestors

The equipment complying with any other internationally accepted standards shall also be considered if it ensures performance equivalent to or superior to the Indian Standards.

GENERAL REQUIREMENT

The metal oxide gap less Surge Arrestor without any series or shunt gap shall be suitable for protection of 33kV switchgear, transformers, associated equipment and 33 kV lines from voltage surges resulting from natural disturbance like lightning as well as system disturbances.

The surge arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.

The surge arrestor shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing / silicon polymeric of specified creepage distance.

The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.

The surge arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrestor shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrestor and second end to a separate ground electrode. The bidder shall also recommend the procedure which shall be followed in providing the earthing system to the Surge Arrestor.

The surge arrestor shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrestor shall change over to the conducting mode.

The surge arrestor shall be suitable for circuit breaker performing 0-0.3sec.-CO-3 min-CO-duty in the system.

Surge arrestors shall have a suitable pressure relief system to avoid damage to the porcelain/silicon polymeric housing and providing path for flow of rated fault currents in the event of arrestor failure.

The reference current of the arrestor shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

The arrestors for 33 kV system shall be suitable for mounting on transformers, Bus, Line & structure as per scheme. The supplier shall furnish the drawing indicating the dimensions, weights etc. of the surge arrestors for the design of mounting structure.

The arrestor shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.

ARRESTOR HOUSING

The arrestor housing shall be made up of **silicon polymeric** housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform Grey (**for silicon polymeric**) colour, free from blisters, burrs and other similar defects.

Arrestors shall be complete with fasteners for stacking units together and terminal connectors. The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching surge voltage up to the maximum design value for arrestor. The

arrestors shall not fail due to contamination. The 33 kV arrestors housing shall be designed for pressure relief class as given in Technical Parameters of the specification.

Sealed housings shall exhibit no measurable leakage.

FITTINGS & ACCESSORIES

The surge arrestor shall be complete with fasteners for stacking units together and terminal connectors.

The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible ends. The top metal cap and base of surge arrestor shall be galvanized. The line terminal shall have a built in clamping device which can be adjusted for both horizontal and vertical takeoff.

SURGE MONITOR : A self-contained discharge counter suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit. Leakage current meter with suitable scale range to measure leakage current of surge of surge arrestor shall also be supplied within the same enclosure. The number of operations performed by the arrestor shall be recorded by the suitable cyclometric counter and surge monitor shall be provided within the inspection window. There shall be a provision for putting ammeter to record the current/alarm contacts in the control room if the leakage current exceeds the permitted value. Similar provision shall be considered for the surge counter also. Surge monitor shall be mounted on the support structure at a suitable height so that the reading can be taken from the ground level through the inspection window and length connecting leads up to grounding point for 33kV class only.

TESTING:

Test on Surge Arrestors

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS : 3070 (Part-3)/IEC-60099-4. In addition, the suitability of the surge arresters shall also be established for the following:

i) Acceptance tests

- a) Measurement of power frequency reference voltage of arrester units.
- b) Lightning impulse residual voltage on arrester units (IEC clause 6.3.2)
- c) Internal ionization or partial discharge test

ii) Special Acceptance tests

- a) Thermal stability test (IEC 99-4 clause 7.2.2)
- b) Watt loss test.

iii) Routine tests

- a) Measurement of reference voltage
- b) Residual voltage test of arrester unit
- c) Internal ionization or partial discharge test
- d) Sealing test
- e) Verticality check on completely assembled surge arresters as a sample test on each lot if applicable.

iv) Type Tests

Following shall be type test as per IS 3070 (Part 3): 1993 or its latest amendment :

.	Insulation Withstandtest a) LightningImpulse b) Power Frequency(Dry/Wet)
	Residual Voltage Test a) Steep current impulse residual voltagetest b) Lightning impulse residual voltagetest
	Long duration current impulse withstand test
	Switching surge operating duty test
	Power frequency voltage Vs. Time characteristics
	Accelerated Ageing test
	Pressure relief test a) HighCurrent b) LowCurrent
	Artificial pollution test (for porcelain housing)
	Seismic Test
	Partial Discharge test
	Bending test
	a) Temperature cycle test (for porcelainhousing) b) Porosity test (for porcelainhousing)
	Galvanising test on metal parts
	Seal Leakage test (for porcelain housing)
	Seal leak test and operation tests (for surge monitor)
	Weather ageing test (for polymer housing)

The maximum residual voltages corresponding to nominal discharge current of 10 kA for steep current, impulse residual voltage test, lightning impulse protection level and switching impulse level shall generally conform to **Annex-K of IEC-99-4**.

The contractor shall furnish the copies of the type tests and the characteristics curves between the residual voltage and nominal discharge current of the offered surge arrester and power frequency voltage v/s time characteristic of the surge arrester subsequent to impulse energy consumption as per clause 6.6.7 of IS:3070 (Part-3) offered along with the GTP/Drawing.

The surge arrester housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS:5621.

Galvanization Test

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS:2633 & IS 6745.

NAMEPLATE

The name plate attached to the arrester shall carry the following information:

- Rated Voltage
- Continuous Operation Voltage
- Normal discharge current
- Pressure relief rated current
- Manufacturers Trade Mark
- Name of Sub-station

- Year of Manufacture
- Name of the manufacture
- Name of Client : “““
- Purchase Order Number along with date

DRAWINGS AND INSTRUCTION MANUALS

Within 15 days of receipt of the order, the successful tenderer shall furnish to the purchaser the following drawings and literature for approval :

- (i) Outline dimensional drawings of Surge Arrestor and all accessories.
- (ii) Assembly drawings and weights of main component parts.
- (iii) Drawings of terminal clamps.
- (iv) Arrangement of earthing lead.
- (v) Minimum air clearance to be maintained of line components to ground.
- (vi) Nameplate.
- (vii) Instructions manual.
- (viii) Drawing showing details of pressure relief valve.
- (ix) Volt-time characteristics of surge arrestors.
- (x) Detailed dimensional drawing of porcelain housing/Silicon polymeric i.e. internal diameter, external diameter, thickness, height, profile, creepage distance, dry arcing distance etc.

1.0 TECHNICAL PARTICULARS

The surge arrestors shall conform to the following standard technical requirements. The Insulation values shall be enhanced considering the altitude of operation & other atmospheric conditions.

System Parameters :

Nominal system voltage	33 kV
Highest system voltage	36 kV
System earthing	Solidly earthed
Frequency (Hz)	50
Lightning Impulse withstand Voltage (kVP)	170
Power frequency withstand Voltage (kV rms)	70
Connection to system	Phase to earth

Surge Arrestors

Type of Surge Arrestor	Gapless Metal oxide
Arrestor rating (kV rms)	30
Continuous Operating voltage (kV rms)	25
Standard Nominal Discharge Current Rating (kA) (8x20 micro	10
Line discharge class	2
Degree of protection	IP-67
Lightning Impulse at 10 kA	85
Partial discharge at 1.05 COV not greater than	50 (PC)
Energy capability corresponding to	

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a) Arrestor rating (kj/kV)	4.5
b) COV(kJ/kV)	4.9
Peak current for high current impulse operating duty of arrestor classification 10 kA	100

InsulatorHousing

Power frequency withstand test voltage (wet) (kV rms)	70
Lightning impulse withstand/tests voltage (kVP)	170
Pressure Relief Class	40
Creepage distance not less than	900 mm

Galvanisation

<u>Fabricated Steel Articles</u>	
-- 5 mm thick cover	610 g/m ²
-- Under 5 mm but not less than 2 mm thickness	460 g/m ²
-- Under 2 mm but not less than 1.2 mm thickness	340 g/m ²
<u>Castings</u>	
-- Grey Iron, malleable iron	610 g/m ²
<u>Threaded works other than tubes & tube fittings</u>	
-- Under 10 mm dia	270 g/m ²
-- 10 mm dia& above	300 g/m ²

11kV VOLTAGE CLASS SURGEARRESTORS**INTRODUCTION**

This section covers the specification of 11kV voltage station Surge Arrestors for installation on outdoor type 11kV switchgear, transmission lines, transformers etc. 11kV side of which is not enclosed in a cable box. Station class surge arrestors shall be complete with fasteners for stacking units.

STANDARDS

The design, manufacture and performance of Surge Arrestors shall comply with IS: 3070 Part-3 and other specific requirements stipulated in the specification. Unless otherwise specified, the equipment, material & processes shall conform to the latest amendments of the following:

IS:2071-1993(Part-1)	Methods of High Voltage Testing General Definitions & Test Requirements.
IS:2071-1974 (Part-2)	Test Procedures.
IS: 2629-1985	Recommended Practice for hot dip galvanizing on Iron & Steel.
IS: 2633-1986	Method for Testing uniformity of coating of zinc coated Articles.
IS:3070-1993 (Part – 3)	Specification for surge arrestor for alternating current systems. Metal-Oxide lightning Arrestors without gaps.
IS: 4759-1996	Specification for hot dip zinc coating on structural steel and other allied products.
IS: 5621-1980	Hollow Insulators for use in Electrical Equipment.
IS: 6209-1982	Methods of Partial discharge measurement.

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IS: 6745	Method for determination of mass of zinc coating on zinc coated iron and steel articles.
ANSI/IEEE-C.62.11	Metal oxide, Surge Arrestor for AC Power Circuits.
IEC –60099-4	Surge Arrestors.

The equipment complying with any other internationally accepted standards shall also be considered if it ensures performance equivalent to or superior to the Indian Standards.

GENERAL REQUIREMENT

The metal oxide gap less Surge Arrestor without any series or shunt gap shall be suitable for protection of 11 kV side of power transformers, associated equipment and 11kV lines from voltage surges resulting from natural disturbance like lightning as well as system disturbances.

The surge arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.

The surge arrestor shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing / silicon polymeric of specified Creepage distance.

The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.

The surge arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrestor shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrestor and second end to a separate ground electrode. The bidder shall also recommend the procedure which shall be followed in providing the earthing system to the Surge Arrestor.

The surge arrestor shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrestor shall change over to the conducting mode.

The surge arrestor shall be suitable for circuit breaker performing 0-0.3 min-CO-3 min-CO-duty in the system.

Surge arrestors shall have a suitable pressure relief system to avoid damage to the porcelain/ silicon polymeric housing and providing path for flow of rated fault currents in the event of arrestor failure.

The reference current of the arrestor shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

The Surge Arrestor shall be thermally stable and the bidder shall furnish a copy of thermal stability test with the bid.

The arrestor shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.

The surge arrestor shall be provided with line and earth terminals of suitable size.

ARRESTOR HOUSING

The arrestor housing shall be made up of **silicon polymeric** housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform **Grey (for silicon polymeric)** colour, free from blisters, burrs and other similar defects.

Arrestors shall be complete with fasteners for stacking units together and terminal connectors.

The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching surge voltage upto the maximum design value for arrestor. The arrestors shall not fail due to contamination. The 11kV arrestors housing shall be designed for pressure relief class as given in Technical Parameters of the specification. Sealed housings shall exhibit no measurable leakage.

SURGE MONITOR : A self-contained discharge counter suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit. Leakage current meter with suitable scale range to measure leakage current of surge of surge arrestor shall also be supplied within the same enclosure. The number of operations performed by the arrestor shall be recorded by the suitable cyclometric counter and surge monitor shall be provided within the inspection window. There shall be a provision for putting ammeter to record the current/alarm contacts in the control room if the leakage current exceeds the permitted value. Similar provision shall be considered for the surge counter also.. Surge monitor shall be mounted on the support structure at a suitable height so that the reading can be taken from the ground level through the inspection window and length connecting leads up to grounding point for 11kV class only.

ARRESTOR MOUNTING

The arrestors shall be suitable for mounting on 4 pole/2 pole structure used for pole/plinth mounted transformer and for incoming and outgoing lines. Arrestor may also be required to be mounted on a bracket provided in the Transformers.

FITTINGS & ACCESSORIES

The surge arrestor shall be complete with fasteners and terminal connectors.

The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrestor shall be galvanized. The line terminal shall have a built in clamping device which can be adjusted for both horizontal and vertical takeoff.

TESTS

Test on Surge Arrestors

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS : 3070 (Part-3)-/IEC:600994. In addition, the suitability of the surge arresters shall also be established for the following:

- i) **Acceptance tests:**
 - a) Measurement of power frequency reference voltage of arrester units.
 - b) Lightning impulse residual voltage on arrester units (IEC clause 6.3.2).
 - c) Internal ionization or partial discharge test
- ii) **Special Acceptance tests:**
 - a) Thermal stability test (IEC clause 7.2.2).
 - b) Watt loss test.
- iii) **Routine tests:**
 - a) Measurement of reference voltage.
 - b) Residual voltage test of arrester unit.
 - c) Internal ionization or partial discharge test.
 - d) Sealing test.
 - e) Verticality check on completely assembled surge arresters as a sample test on each lot if applicable.

iv) **Type Tests :**

Following shall be type test as per IS 3070 (Part 3): 1993 or its latest amendment :

1.	Insulation Withstandtest a) LightningImpulse b) Power Frequency(Dry/Wet)
2.	Residual Voltage Test a) Steep current impulse residual voltagetest b) Lightning impulse residual voltagetest c) Switching Impulse Residual voltagetest
3.	Long duration current impulse withstand test
4.	Switching surge operating duty test
5.	Power frequency voltage Vs. Time characteristics
	Accelerated Ageing test
7.	Pressure relief test a) HighCurrent b) LowCurrent
8.	Artificial pollution test (for porcelain housing)
9.	Seismic Test
10.	Partial Discharge test
11.	Bending test
12.	a) Temperature cycle test (for porcelainhousing) b) Porosity test (for porcelainhousing)
13.	Galvanising test on metal parts
14.	Seal Leakage test (for porcelain housing)
15.	Seal leak test and operation tests (for surge monitor)
16.	Weather ageing test (for polymer housing)

The maximum residual voltages corresponding to nominal discharge current of 10 kA for steep current, impulse residual voltage test, lightning impulse protection level and switching impulse level shall generally conform to Annex-K of IEC-99-4.

The contractor shall furnish the copies of the type tests and the characteristics curves between the residual voltage and nominal discharge current of the offered surge arrester and power frequency voltage v/s time characteristic of the surge arrester subsequent to impulse energy consumption as per clause 6.6 of IS:3070 (Part-3) offered alongwith the bid.

The surge arrester housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS:5621.

Galvanization Test:

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS:2633 & IS 6745.

NAMEPLATE

The name plate attached to the arrester shall carry the following information:

- RatedVoltage
- Continuous OperationVoltage
- Normal discharge current
- Pressure relief ratedcurrent
- Manufacturers TradeMark
- Name ofSub-station
- Year ofManufacturer
- Name of themanufacture
- Name ofClient
- Purchase Order Number along withdate

DRAWINGS AND INSTRUCTIONMANUALS

Within 15 days of receipt of the order, the successful tenderer shall furnish to the purchaser, the following drawings and literature for approval :

- (i) Outline dimensional drawings of Surge Arrestor and allaccessories.
- (ii) Assembly drawings and weights of main componentparts.
- (iii) Drawings of terminalclamps.
- (iv) Arrangement of earthinglead.
- (v) Minimum air clearance to be maintained of line components toground.
- (vi) Name plate.
- (vii) Surge monitor, if applicable.
- (viii)Instructionsmanual.
- (ix) Drawing showing details of pressure reliefvalve.
- (x) Volt-time characteristics of surgearrestors.
- (xi) Detailed dimensional drawing of porcelain housing/Silicon polymeric i.e. internal diameter, external diameter, thickness, height, profile, creepage distance, dry arcing distanceetc.

TECHNICALPARTICULARS

The surge arrestors shall conform to the following standard technical requirements. The Insulation values shall be enhanced considering the altitude of operation & other atmosphericconditions.

System Parameters

- i) Nominalsystemvoltage 11kV
- ii) Highestsystem voltage 12 kV
- iii) System earthing Effectively earthedsystem
- iv) Frequency(Hz) 50
- v) LightningImpulsewithstand 75 Voltage(kVP)
- vi) Powerfrequencywithstand 28 Voltage (kVrms)
- vii) Arrestorduty
 - Connectiontosystem Phase toearth
 - Type of equipment tobeprotectedtransformers &switchgear

Surge Arrestors

i)	Type	Gapless Metal oxide outdoor
ii)	Arrestor rating (kVrms)	9
iii)	Continuous Operating voltage	7.65 (kVrms)
iv)	Standard Nominal Discharge Current	10 Rating (kA) (8x20 micro impulse shape)
v)	Degree of protection	IP 67
vi)	Line discharge Class	2
vii)	Steep current at 10 kA	45
viii)	Lightning Impulse at 10kA	40
ix)	Energy capability corresponding to	
	a) Arrestor rating (kJ/kV)	4.5
	b) COV (kJ/kV)	4.9
x)	Peak current for high current impulse operating duty of Standard TS for arrestor classification	100 10 kA

Insulator Housing

i)	Power frequency withstand test voltage (Wet) (kVrms)	28
ii)	Lightning impulse withstand/test voltage (kVP)	75

Galvanisation

i)	Fabricated Steel Articles	
	a) 5 mm thick cover	610 g/m ²
	b) Under 5 mm but not less than 2 mm thickness	460 g/m ²
	c) Under 2 mm but not less than 1.2 mm thickness	340 g/m ²
ii)	Castings	
	Grey Iron, malleable iron	610 g/m ²
iii)	Threaded works other than tubes & tube fittings	
	a) Under 10 mm dia	270 g/m ²
	b) 10 mm dia & above	300 g/m ²

NOTE : Surge Monitor shall have to be provided if covered in BPS.

DISTRIBUTION CLASS SURGE ARRESTORS

Distribution class surge arrestors are generally used in distribution Transformer Substations only.

INTRODUCTION

This section covers the specification of Distribution class Surge Arrestor for 11kV transmission lines, transformers etc.

STANDARDS

The design, manufacture and performance of Surge Arrestors shall comply with IS: 3070 Part-3 and other specific requirements stipulated in the specification. Unless otherwise specified, the equipment, material and processes shall conform to the latest applicable Indian/International Standards as listed hereunder :

IS:2071- 1993 (Part-	Methods of High Voltage Testing General Definitions & Test
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IS:2071-1974 (part-	Test Procedures
IS:2629-1985	Recommended Practice for hot dip galvanizing on Iron & Steel
IS:2633-1986	Method for Testing uniformity of coating of zinc coated Articles.
IS3070-1993 (Part-3)	Specification for surge arrestor for alternating currents systems. Metal-Oxide lightening arrestors without gaps
IS:4759-1996	Specification for hot dip zinc coating on Structural Steel and Other
IS:5621-1980	Hollow Insulators for use in Electrical Equipment.
IS:6209-1982	Methods of Partial discharge measurement.
IS:6745	Method for determination of mass of zinc coating on zinc coated iron
ANSI/IEEE-C.62.11	Metal oxide, Surge Arrestor for AC Power (1982) Circuits.
IEC –60099-4	Surge Arrestors

The equipment complying with any other internationally accepted standards shall also be considered if it ensures performance equivalent to or superior to the Indian Standards.

GENERAL REQUIREMENT

The metal oxide gap less Surge Arrestor without any series or shunt gap shall be suitable for protection of 11 kV side of Distribution Transformers, associated equipment and 11 kV lines from voltage surges resulting from natural disturbance like lightning as well as system disturbances.

The surge arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.

The surge arrestor shall consist of non-linear metal oxide resistor elements placed in series and housed in electrical grade porcelain housing / silicon polymeric of specified Creepage distance.

The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.

The surge arrestor shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrestor shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrestor and second end to a separate ground electrode. The contractor shall also recommend the procedure which shall be followed in providing the earthing/system to the Surge Arrestor.

The surge arrestor shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrestor shall change over to the conducting mode.

The surge arrestor shall be suitable for circuit breaker performing 0-0.3 min-CO-3 min-CO-duty in the system.

The reference current of the arrestor shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

The Surge Arrestor shall be thermally stable and the contractor shall furnish a copy of thermal stability test with the bid.

The arrestor shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.

ARRESTOR HOUSING

Section VI: Technical Specs

The arrester housing shall be made up of *silicon polymeric* housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform **Grey (for silicon polymeric)** colour, free from blisters, burrs and other similar defects.

The housing shall be so coordinated that external flashover shall not occur due to application of any impulse or switching surge voltage upto the maximum design value for arrester. The arresters shall not fail due to contamination.

Sealed housings shall exhibit no measurable leakage.

ARRESTOR MOUNTING

The arresters shall be suitable for mounting on 4 pole/2 pole structure used for pole mounted transformer and for incoming and outgoing lines.

FITTINGS & ACCESSORIES

The surge arrester shall be complete with disconnect and terminal connectors and all other accessories.

The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrester shall be galvanized. The line terminal shall have a built in clamping device which can be adjusted for both horizontal and vertical takeoff.

TESTS

Test on Surge Arresters

The Surge Arresters offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS : 3070 (Part-3)-1993. In addition, the suitability of the surge arresters shall also be established for the following :

a) Acceptance tests:

- i) Measurement of power frequency reference voltage of arrester units.
- ii) Lightning impulse residual voltage on arrester units (IEC clause 6.3.2).
- iii) Internal ionization or partial discharge test.

b) Special Acceptance tests:

- i) Thermal stability test (IEC clause 7.2.2)

c) Routine tests:

Measurement of reference voltage

- i) Residual voltage test of arrester unit.
 - ii) Internal ionization or partial discharge test.
 - iii) Sealing test.
 - iv) Verticality check on completely assembled surge arresters as a sample test on each lot if applicable.
- d) **Type tests** : Following shall be type test As per IS 3070 (Part 3)/IEC:60094 or its latest amendment:

1.	Insulation Withstand test <ul style="list-style-type: none">a) Lightning Impulse voltage testb) Power Frequency (Dry & Wet)
2.	Residual Voltage Test <ul style="list-style-type: none">a) Steep current impulse residual voltage testb) Lightning Impulse Residual Voltage Test

3.	Long duration current impulse withstand test
4.	High current impulse operating duty test
5.	Power frequency voltage Vs. Time characteristics
6.	Accelerated Ageing test
7.	Artificial pollution test (for porcelain housing)
8.	Partial discharge test
9.	Visual Examination (for porcelain housing)
10.	a) Temperature cycle test (for porcelain housing)
11.	Mechanical Failing Load test (Bending Strength test)
12.	Uniformity of Zinc coating, Mass of zinc coating
13.	Time versus current curve (for disconnector)
14.	Weather ageing test (for polymer housing)

The maximum residual voltages corresponding to nominal discharge current of 5 kA for steep current, impulse residual voltage test, lightning impulse protection level and switching impulse level shall generally conform to Annex-K of IEC-99-4.

The contractor shall furnish the copies of the type tests and the characteristics curves between the residual voltage and nominal discharge current of the offered surge arrester and power frequency voltage v/s time characteristic of the surge arrester subsequent to impulse energy consumption as per clause 6.6.7 of IS:3070 (Part-3) offered along with the GTP.

The surge arrester housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS:5621

GALVANIZATION TEST

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS:2633 & IS 6745.

TEST ON SURGE ARRESTOR DISCONNECTORS

The test shall be performed on surge arrestors which are fitted with arrester disconnector or on the disconnector assembly alone if its design is such as to be un-affected by the heating of adjacent parts of the arrester in its normally installed portion in accordance with IS:3070 (Part-3).

NAMEPLATE

The name plate attached to the arrester shall carry the following information:

- Rated Voltage
- Continuous Operation Voltage
- Normal discharge current
- Manufacturers TradeMark
- Year of Manufacturer
- Name of the manufacture
- Name of Client
- Purchase Order Number along with date

DRAWINGS AND INSTRUCTION MANUALS

The successful bidder shall furnish to the purchaser the following drawings and literature for

approval :

- (i) Outline dimensional drawings of Surge Arrestor and all accessories.
- (ii) Assembly drawings and weights of main component parts.
- (iii) Drawings of terminal clamps.
- (iv) Arrangement of earthing lead.
- (v) Minimum air clearance to be maintained of line components to ground.
- (vi) Nameplate
- (vii) Instructions manual
- (viii) Drawing showing details of pressure relief valve
- (ix) Volt-time characteristics of surge arrestors
- (x) Detailed dimensional drawing of porcelain housing/Silicon polymeric i.e. internal diameter, external diameter, thickness, height, profile, creepage distance, dry arcing distance etc.

TECHNICAL PARTICULARS

The surge arrestors shall conform to the following standard technical requirements. The Insulation values shall be enhanced considering the altitude of operation & other atmospheric conditions.

System Parameters

i)	Nominal system voltage	11 kV
ii)	Highest system voltage	12 kV
iii)	System earthing	Solidly earthed system
iv)	Frequency (Hz)	50
vii)	Lightning Impulse withstand	75 Voltage (kVP)
viii)	Power frequency withstand	28 Voltage (kV rms)
vii)	Arrestor duty	
	-- Connection to system	Phase to earth
	-- Type of equipment to be protected	11 kV transformers &

switchgear

Surge Arrestors

i)	Type	Gapless Metal oxide outdoor
ii)	Arrestor rating (kVrms)	9
iii)	Continuous Operating voltage (kVrms)	7.65
v)	Nominal Discharge Current impulse shape)	5 Rating (kA) (8x20 micro
v)	Long Duration discharge class	Distribution class

vi)	Maximum residual voltage (kV peak)	
	a) at 5 kA	27
vii)	Partial discharge at 1.05 COV not greater than	50 (PC)
viii)	High current impulse withstand voltage at 5 kA (kVp)	65

INSULATORHOUSING

i)	Power frequency withstand test voltage (Wet) (kV rms)	28
ii)	Lightning impulse withstand/testsvoltage(kVP)	75
iii)	Creepage distance not lessthan(mm)	300

3.12 GALVANISATION

i)	Fabricated Steel Articles	
	a) 5 mm thickcover	610 g/m ²
	b) Under 5 mm but not less than 2 mm thickness	460 g/m ²
	c) Under 2 mm but not less than 1.2 mm thickness	340 g/m ²
ii)	Castings	
	Grey Iron, malleable iron	610 g/m ²
iii)	Threaded works other than tubes & tubefittings	
	a) Under 10 mmdia	270 g/m ²
	b) 10 mm dia& above	300 g/m ²

TECHNICAL SPECIFICATION FOR P.G CLAMP FOR AAA RACCOON /WOLF CONDUCTOR

1.0 Scope:

The scope covers design, manufacturing, testing at work, transport at site, insurance, storage, erection and commissioning of P.G. Clamp suitable for Conductor size Wolf/Raccoon/Weasel/3 Bolt Type strictly conforming to the following standards:

Standards:

- P.G. Clamps suitable for conductor size, wolf/raccoon/weasel 3 bolt types strictly conforming to IS : 2121 and galvanizing conforming to IS: 2633 or equivalent international specifications as per thefollowing:
- P.G. clamp body to be made from aluminiumalloy
- Clamps nuts and bolt and washer should be made of hot deep galvanizedsteel
- Spring washer be made of electro-galvanize specialsteel.

Style No.	Conduct or	Maximum conductor diameter in mm	Dimensions					No of Bolts	Approx. Weight Kg.
			A mm	B mm	C mm	D mm	E mm		

Section VI: Technical Specs

A-83	Wolf	20.78	140	76	42	5/8	1	3	0.51
A-81	Racoon	14.45	95	57	30	1/2	2	2	0.18

3.0 Inspection may be carried out by the purchaser or third party nominee at any stage of manufacture. The supplier shall grant free access to the purchaser's representative or third party nominee at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found defective.

TECHNICAL SPECIFICATION FOR CAST IRON EARTH PIPE

1.0 Scope

This specification covers design, manufacture, testing, transport to site, insurance, storage, erection and commissioning of the cast iron earth pipe for use on line & substation as earthing pipe

2.0 Standard

The Earth pipe shall comply with the Indian Standard specification IS: 1729/1964 and as amended from time to time except where they conflict with the specific requirements in this specification.

3.0 Manufacture

Metal used for the manufacture of pipes shall be good quality cast iron.
Casting shall be stripped with all precautions necessary to avoid warping and shrinkage defects. They shall be free from defects which effect the use of castings. By agreement between the purchaser and the manufacturer, minor defects may be rectified.
Pipes shall be such that they could be cut, drilled or machined.

Bolts, nuts & washers shall be made of Steel and well galvanized. The bolts shall be of 200 mm length, 16 mm diameter with 2(two) nos. plain washers, one locknut & one check nut. Threaded length of the bolts should be 50 mm.

4.0 Sizes

Dimensions of pipe & socket shall be conform to the sizes shown below and as per drawing enclosed:

Nominal length of the pipe with socket	1800 mm
Nominal diameter of pipe	100 mm
External diameter of pipe	110 mm
Thickness of pipe	5 mm
Projection of spigot bead	3 mm
Width of spigot bead	15 mm
Internal dia of socket	129 mm
Thickness of socket	6 mm
Internal depth of socket	70 mm
Internal Radius of socket	5 mm
Width of grooves of socket	10 mm
External dia of grooves socket	155 mm
Depth of grooves of socket	5 mm
Nominal weight of pipe (Exclusive of ear)	21.67 Kg

5.0 Tolerance

The Tolerance of the 100 mm nominal diameter pipe shall be ± 3.5 mm

The Tolerance of pipe thickness shall be - 15 percent

The Tolerance of length of the pipe shall be ± 20 mm

The Tolerance of weight of the pipe shall be - 10 Percent

Pipes weighing more than the nominal weight may be accepted provided they comply in every other respect with the requirements of this standard.

TEST

Hammer test: Each pipe when tested for soundness by striking with a light hand hammer shall emit a clear ringing sound.

Hydraulic test : If so required by the purchaser, pipe shall be tested hydraulically at a pressure of 0.4 kg/cm^2 without showing any sign of leakage, sweating or other defect of any kind. The pressure shall be applied internally and shall be maintained for not less than 15 seconds. The tests shall be conducted before coating of pipe.

7.0 Inspection

All tests and inspection shall be carried out at the place of manufacturers unless otherwise agreed by the purchaser and the manufacturer at the time of purchase. A manufacturer shall afford the inspector representing the purchaser or third party nominee all reasonable facilities without charge to satisfy that the materials are being purchased as per specification. The purchaser reserves the right to have the test carried out at his cost by an independent agency, whenever there is dispute regarding the quality of materials supplied. All incoming consignment shall be checked at stores.

8.0 Coating

Normally pipes, unless specially ordered, shall be supplied free of coating on surfaces.

9.0 Marking

Each pipe shall have the Trade mark of the manufacturer and nominal size suitably marked on it. The pipe marked with the ISI certificate mark, shall be preferred. The equipments shall be marked with name of manufacturer, year and name of project.

TECHNICAL SPECIFICATION FOR AAA “WOLF” & “RACCOON” CONDUCTOR**1.0 Scope**

This specification covers design, manufacture, testing at works, transport, insurance, storage, erection and commissioning of All Aluminum Alloy Stranded Conductors at site in 33 KV.

2.0 Conductor Size

- 1.0 19/3.40 mm (175 mm² Alloy Area) – wolf
2.0 7/3.81 mm (80 mm² Alloy Area) - Raccoon

3.0 Applicable Standards

Unless otherwise stipulated in this specification, the conductor shall comply with IS:398 (Part-IV)-1994 or the latest version thereof.

4.0 Properties of Wires

The properties of Aluminium alloy wires to be used in the construction of the stranded conductors shall be as in the following Table-1

Table-1

Diameter			Cross area of nominal Dia wire	Mass	Maximum breaking load after stranding	Resistance at 20° C	
Nominal	Min	Max				Max	Standard
Mm	mm	mm	mm ²	Kg/Km	KN	Ohm/Km	Ohm/Km
3.40	3.37	3.43	9.079	24.51	2.80	3.67	3.96
3.81	3.77	3.85	11.401	30.78	3.34	2.938	2.851

5.0 Properties of Conductors

The properties of stranded all aluminium alloy conductors of various sizes shall be as in the following table-II

All Aluminium Alloy Conductors (AAAC)

Nominal Alloy Area	Stranding & Wire dia	Sectional area	Approx. overall dia	Approx. Mass	Calculated resistance at 20° C (Max)	Approx calculated breaking load
1	2	3	4	5	6	7
mm ²	Mm	mm ²	Mm	Kg/Km	Ohm/Km	KN
173	19/3.40	172.52	17.00	474.02	0.1969	50.54
80	7/3.81	79.81	11.43	218.26	0.425	23.41

6.0 Free From Defects

The wire shall be smooth and free from all imperfection such as spills, splits etc.

7.0 Joints in Wires

Conductors containing three/seven wires. There shall be no joint in any wire of a stranded conductor containing three/seven wires except those made in the base rod or wire before final drawing.

8.0 Stranding

8.1 The wires used in the construction of a stranded conductor shall before stranding satisfy all the relevant requirements of this standard.

8.2 The lay shall be within the limits given in Table-III
Lay Ratios for Aluminium Alloy Stranded Conductors

No. of wires in conductors	Lay ration	
	Min.	Max
7	10	14
19	10	16

8.3 The outer layer shall be right handed. The wires in each layer shall be evenly and closely stranded.

9.0 Climatic Conditions

The conductor shall be designed to suit for the climatic conditions specified in these bidding documents.

10.0 Tests

The samples of individual wires for the test shall normally be taken before stranding. The manufacturer shall carry out test on samples taken out at least from 10% of aluminium wire spools. However, when desired by the purchaser, the test sample may be taken from the stranded wires. However the minimum breaking load test shall be done on a sample taken from stranded wires and the minimum breaking load shall not be less than the value indicated in Table-I.

The wires for alloy conductors shall comply with the following tests as per IS: 398(Part-IV)-1994

- i) Breaking loads test.
- ii) Elongation test
- iii) Resistance test

11.0 Packing and Marking

The conductors shall be owned in reels or drums conforming to the latest version of IS: 1778-1980 “Specification for reels and drums for bare wire and name of the project TDF shall be indicated clearly on the drums.

10.1 Packing

10.1.1 The gross mass of packing of various conductors shall not exceed by more than 10% of the values given in the following table:

Conductor size	Gross Mass
175 mm ² alloy area (19/3.40mm)	2500
80 mm ² Alloy Area (7/3.81 mm)	1600 KG

10.1.2 The normal length of various conductors shall be as given in the following table:

Conductor size	Normal Length
75 mm ² alloy area (19/3.40mm)	1.1 Km
80 mm ² Alloy Area (7/3.81 mm)	1.3 KM

10.1.3 Longer lengths shall be acceptable.

10.1.4 Short length , not less than 50% of the normal length shall be acceptable to the maximum extent of 10% of the quantity ordered 10.2 marking.

The following information be marked on each package.

- 2.1. Manufacturer's name.
- 2.2. Trade Mark, if any.
- 2.3. Drum or identification number.
- 2.4. Size of conductor
- 2.5. Number & lengths of conductor
- 2.6. Gross Mass of the package
- 2.7. Net mass of the conductor
- 2.8. ISI certification mark.
- 2.9. Name of the Project TDF

11 INSPECTION

All tests and inspection shall be made at the place of manufacture. The manufacturer shall afford the inspection representing the purchaser or third party nominee all reasonable facilities without charge to satisfy him that the material is being furnished in accordance with this specification.

TECHNICAL SPECIFICATION FOR XLPE POWER CABLES (11KV & 33 KV) :**SECTION I : STANDARD TECHNICAL REQUIREMENT****1.0 SCOPE:**

The specification covers the design, testing, supply and delivery in proper packed condition of different grade of 1 or 3 core. Aluminium Conductor, Cross-linked polyethylene (XLPE) insulated, PVC sheathed, armoured, screened Power Cables.

2.0 LOCATION:

1.1 The cables may be laid buried directly in ground at a depth of one metre in average, any where in Assam and terminate for outdoor connection to a power transformer or to overhead lines and also indoor connection for indoor switchgear.

1.2 The cables may also be laid within covered cable trenches, in cable racks or open-air ladder trays etc. for certain portion of lengths.

3.0 SYSTEM DETAILS:

3.1	Voltage grade (KV) of cable required	...	6.35/11
3.1	Service Voltage	...	11 KV
3.2	Highest Voltage	...	12 KV
3.3	Earthing System		Solidly Earthed
3.4	B.I.L. for Cables		75 KV for 11 KV
3.5	Fault Level (Maxim.)	...	See Clause Error! Reference source not found.
3.6	Frequency	...	50 C/S.

4.1 STARDARDS:

4.2 The cable shall conform to the following standards to the extent of LAEDCL requirement is fulfilled.

- | | | |
|----|--------------------------------|---|
| 1) | IS : 7098 (Part – II) (Latest) | :Specification for cross-linked polyethylene Insulated PVC Sheathed Cables for working Voltage from 3.3 KV up to and including 33 KV. |
| 2) | IS:8130 – 1984 | :Specification for Conductors for insulated electric cables and flexible cords. |
| 3) | IS:5830 – 1984 | :PVC insulation & sheath of electric cables. |
| 4) | IS:3975 – 1979 | : Armour for cables (for 3 Crore). |
| 5) | IS:10810 – 1984 | : Methods for test for cables. |
| 6) | IS:10418 – 1982 | : Cable Drum for Electric Cables. |

4.3 The cable, joints, outdoor and indoor termination and their accessories and fittings may conform to other Indian and/or equivalent standards or important publications to improve upon their performance, but shall not fall short of the requirement of this specification. The tenderer shall clearly indicate such standards in their offers.

4.0 ELECTRICAL CHARACTERISTICS & PERFORMANCE:**4.1 Description of Cable:**

- a) 6.35/11 KV Grade 3-Crore : Same as above but insulation shielding with black semi-conducting tape not necessary. Inner sheath to be wrapped not extruded and strip armoured. The design shall fully conform to IS:7098 (Part – II).

b) SPECIFIC TECHNICAL REQUIREMENTS

Technical parameters of the cable shall be as follows:

Sl No	Particulars	Unit	11 KV
1	Rated voltage	KV	11
2	Type of insulation	-	XLPE
3	Single Core	-	Single , three
4	Armoured /Unarmoured	-	Armoured
5	Material of Conductor		Material to IS: 8130, H4 Grade Aluminium Conductor, Stranded compacted Circular
6	System	-	11 KV Earthed
7	Highest System Voltage	KV	12
8	Material	-	Stranded Aluminium
9	Voltage Grade		6.35/11 KV
10	Conductor Size	Sq. mm	1x185,3x120 1x300
11	Nominal dimension of Al. round wire		2.0mm[for 1x300sqmm], 2.0mm [for 1x185sqmm & 2.5mm[3x120 sqmm],
12	Nominal thickness of XLE insulationr sheath		3.6 mm
13	Approx overall cable diameter		61.50mm [for 3x120sqmm], 35.50mm [for 1x185sqmm] 40.00 mm [for 1x300 sqmm],
14	Current rating		
a	In ground at 30 ^{0C}		219A(3x120sqmm), 296A(1x185sqmm) 381 A(1x300 sqmm)
b	In air at 40 ^{0C}		288A(1x120sqmm), 378A(1x185sqmm) 512 A(1x300 sqmm)
15	Maxm. Conductor Temp		90 °C at maxm. Continuous current
16	Short Ckt.Current for second duration		11.3KA-for120 sqmm, 17.5 KA-for 185 sqmm, 28.3 KA – for 300 sqmm.
17	Maxm.Permissible emergency overload temp. at 25% overload to 100 hrs. per year or 500 hrs. in life of cable		130 °C for one hour
18	Maxm. Permissible short circuit temperature		250 °C for one hour
19	Conductor Screening		Extruded, cross linked, semi-conducting compound of.5 mm for 11KV
20	Insulation Screening		
21	Conductor Screening	:	Extruded, cross linked, semi-conducting compound of.5 mm for 11KV
22	Insulation	:	XLPE of thickness, 3.6 mm (Nominal) for 11KV
a	Insulation Screening	For 33 KV :	Combination of black extruded semi-conducting tape as the non-metallic part and annealed copper 0.06 mm (minimum) thick tape lapping as metallic part. For 1 core cable, the non-magnetic metal Armour will act as metallic part insulation screening.
b		For 11 KV :	It is same but semi-conducting tape is not required
23	Inner Sheathing	:	Black extruded PVC, Type ST-2 compound for 33

			KV and wrapped PVC tape for 11 KV as per ISS. For 1 core there will be no inner sheath.
24	Armouring	:	Single layer of round galvanized steel wires/strip for 33 KV and galvanized steel strips/wire for 11 KV (3 core) as per IS. For 1 core, there will be non-magnetic metal Armour.
25	Overall Sheathing	:	Coloured PVC, type ST-2 compound to IS: 5831, extruded for both 33KV and 11KV thickness shall be as per ISS
26	Approx. length of cable in a Drum	:	250 metres with a tolerance of $\pm 5\%$ (for 3 core), 500 metres $\pm 5\%$ (for 1 core)
27	End Sealing		H.S. Caps (see clause 4.13.1) (Heat Shrinkable)
a	Max. 'Tan-delta' at room temp. At nominal phase to neutral voltage (Up):		0.004
b	Maxm. Increment of 'tan-delta' between 0.5 Up to 2 Up at room temp:	:	0.002
28	Partial discharge value		20 Pc (Maxm.) at 1.6 Uo.
29	Impulse Tests		170 KV for 33 KV and as per ISS for 11 KV
30	H.V. Tests between Conductors & Screen/Armour		48 KV (rms) for 33 KV for 5 minutes and as per ISS for 11 KV
31	Maxm. D.C. Rtnce/Km		As per relevant I.S.S

* NB the above parameters are applicable for three core and single core cable, if not otherwise specified.

4.2 CABLE CONSTRUCTION:

- 4.3 XLPE underground cable is to be manufactured in continuous catenaries process at controlled elevated temperature and pressure in inert atmosphere with use of suitable materials for XLPE semi-conducting, insulation and XLPE screen. The inner and outer semi-conducting sheaths and main polyethylene insulation between the sheaths are to be simultaneously extruded during the Triple Extrusion Process of manufacturing and main insulation of the Cable is to be extruded unified. The XLPE Cables in this specification does not have any metal sheath and the short circuit rating of the cable will depend on the conductivity and continuity of the strands of the armour wires, which shall be ensured by guarding against corrosion.

4.4 CONDUCTOR SCREENING

- 4.5 A semi-conducting cross-linked polyethylene (XLPE) screening shall be extruded over the conductor to act as an electrical shield which together with elimination of the so called "Strand Effect" prevents to a great extent air ionization on the surface of the conductor.

4.6 INSULATION:

The main insulation of the Cable shall be extruded unfilled, chemically cross-linked polyethylene (XLPE) inert gas cured satisfying the requirement of ISS: 7098 (Part- II)

4.7 INSULATING SCREEN:

The screen shall be made up as given in Clause 22 the metal screen eliminates tangential stress electrostatic field surrounding the conductor and uniform electrical stress in the insulation.

The semi conducting polyethylene (XLPE) screen shall be extruded over the main poly ethylene-insulating wall to prevent partial discharge at the surface of the insulation. The copper tape shall be wrapped over the semi conducting tape or extrusion as mentioned earlier for 3 core cables. The metal screen so formed around the cores shall be in contact with one another as the cores are laid up at triangular configuration. For single core cable, Aluminium wires armoring shall constitute the metallic part of insulation screen. Conductor screening, insulation and insulation screening shall be extruded in triple extrusion processes so as to obtain continuously smooth interfaces.

- 4.8 The mechanical and chemical properties of the materials for semi conducting screens are much more important than their electrical properties, but for obtaining the high overall degree of electrical properties of an E.H.V. cable, the inner and outer semi conducting, sheaths and the main polyethylene insulation

between the sheaths shall be simultaneously extruded during the manufacturing, process known as “**triple extrusion**”. The advantages are:

- i) The partial discharge level at the surface of the insulation is brought to a minimum.
- ii) There will be no displacement of the semi conducting screen and insulation during expansion and contraction due to load cycles and bending.
- iii) The semi conducting screens are easily removable during joining and termination operations.

Note: Manufacturers not having “triple extrusion” process will be disqualified. The Tenderer shall have to produce necessary process line at the time of bidding.

4.9 LAYING UP:

The phase identification of the cores shall be either by colour or numerals as per I.S.S. for 3 core cables only.

<u>Core Colour</u>	<u>Numeral</u>
Red	1
Yellow	2
Blue	3

The screen cores shall be laid up with interstices filled with PVC fillers and taped a binder tape as to obtain a reasonably circular cable.

4.10 INNER SHEATH:

The cable core shall be supplied with bedding of PVC (Inner sheath) in the form of extruded PVC sheath for 33 KV cables. Wrapped PVC tapes shall be used for 11KV thickness as per clause 23 of special technical parameters and as per relevant IS.

4.11 ARMOUR:

The cable shall be wire armoured /steel strip in case of 33KV and wire/strip armoured 11 KV, three core cables to insure an adequate return path for the flow of fault current and also provide suitable mechanical protection. Steel wires/aluminum wire / steel strips of required size in requisite number as per clause 24 of special technical parameters shall be laid closely in the spiral formation to protect the circumference of the cable fully and to provide adequate cores section area for flow of maximum fault current within limits of specified temperature rise and duration of fault. Direction of the lay of the armour shall be opposite to that of the cable cores in case of single core cable armour should be of non-metallic material.

4.12 OUTER SHEATH:

A reliable surving shall be necessary for maintaining conductivity of the armour particularly under corrosive condition in the form of jacket. Cable shall be therefore finished with extruded PVC over sheath of thickness as per clause 25 of special technical parameters.

The quality of PVC over sheath (jacket) shall be ensured for service reliability against moisture intrusion and shall confirm to type ST-2 of IS : 5831.

The colour of the outer sheath shall be follows:

For 11 KV cable : Blue

The sheaths shall be protected against white ants, vermin and termites by suitable, durable and reliable measures.

The suppliers shall suggest suitable materials for use, in the event of damage to the over sheath to prevent the passage of moisture along the cable.

4.13 CABLE IDENTIFICATION:

The following shall be embossed on the outer sheath for the identification.

- a) Manufacturer's Name or Trade Mark.
- b) Voltage Grade.
- c) Nominal section and material of conductors and number of cores.
- d) Year of manufacture.
- e) Inscription of length of cables at 1.0 mtr interval.
- f) Name of purchaser LAEDCL;
- g) Marking “Power” shall be embossed throughout the length of the cable at 10 mtr spacing.
- h) Type of insulation i.e. XLPE

4.13.1 CEILING OF CABLE ENDS:

The cable ends of the cable in the wooden drum for delivery shall be sealed with heat shrinkable caps.

5.0 WOODEN DRUMS:

The cable shall be packed in non-returnable wooden drums.

The following information shall be marked on each drum.

- a) Drum identification number.

- b) Manufacturer's name, Trade name / Trade mark, if any.
- c) Nominal sectional area of the conductor of the cable.
- d) Number of cores
- e) Type of cable and voltage grade with cable code
- f) Length of cable in cable drum
- g) Direction of rotation of drum (by means of an arrow)
- h) Appox. Weight: tare: gross:
- i) Year and country of manufacture
- j) Purchase order number
- k) Date of delivery
- l) Name of the purchaser.

Drum shall be proofed against attack by white ant or termite conforming to IS: 10418. The Drums may also be marked with ISI certificate mark, as applicable.

Safe pulling force : 30 N/mm² (for conductor)

6.0 Tests to be performed as per IS:7098 (part II)

Tenderer shall have to submit type test report (tested at CPRI Bangalore/Bhupal) along with the Bid. Bidder will be disqualified for non-submission of type test reports.

6.1 Type test all the test mentioned below are to be made as per details given in IS:10810

- a) Test on conductor
 - i. Tensile test (For aluminum)
 - ii. Wrapping test for aluminum
 - iii. Resistance test.
- b) Test for armuoring wire strips.
- c) Test for thickness of insulation and sheath.
- d) Physical test for insulation.
 - i. Tensile strength and elongation at break
 - ii. Ageing in air oven.
 - iii. Hot test
 - iv. Shrinkage test.
 - v. Water absorption (Gravimetric)
- e) Physical tests for outer sheath
 - i. Tensile strength and elongation at break
 - ii. Ageing in air oven.
 - iii. Shrinkage test.
 - iv. Hot deformation
 - v. Heat shock
 - vi. Loss of mass in air oven
 - vii. Thermal stability
 - viii. Thermal Stability
- f) Partial discharge test
- g) Bending test
- h) Dielectric power factor test
 - i. As a function voltage
 - ii. As a function of temperature
- i) Insulation resistance (volume resistivity) test
- j) Heating cycle test
- k) Impulse with stand test
- l) High voltage test
- m) Flammability test

6.2 The following test on screen cable shall be performed successfully on the same test sample of completed cable, not less than 10 m. in length between the test accessories.

- a) PD test
- b) Bending test followed by PD test
- c) Di-electric power factor as function of voltage
- d) Di-electric power factor as a function of temperature
- e) Heating cycle test followed by Di-electric power factor as a function of voltage and PD test.
- f) Impulse with stand test and

- g) High voltage test as per para 30 of special technical parameters
If a sample fails in test (g) one more sample shall be taken for this test, preceded by test (b) and (e)
- 6.3 **Acceptance test** : the following shall constitute acceptance test:
- Tensile test (For aluminum)
 - Wrapping test for aluminum
 - Conductor resistance test
 - Test for thickness of insulation and sheath
 - Hot set test for insulation
 - Tensile strength and elongation at break test for insulation and outer sheath
 - PD test (Screen enables) only on full drum length
 - High voltage test, and
 - Insulation resistance (volume resistivity) test
 - Spark test on extruded un-insulated outer PVC sheath as per provision clause no 3.2 IEC standard (Publication no.229 of 1982)
- 6.4 **Routine test:**
The routine test shall be carried out on all cables manufacturer in accordance with this specification. The following routine test shall be made on cable length as specified in ISS.
- Conductor resistance test
 - Partial discharge test on full drum length
 - High voltage test as per clause 29 of special technical parameters
- 6.5 **Test witness**
- All tests shall be performed in presence of purchaser representatives if so desired by the purchaser.
 - The contractor shall give at least 15 days advance notice for witnessing such tests.
- 7.0 **Test Certificate**
- 7.1 Certified copies of all routine test carried out at work shall be furnished in 6 copies for approval of the Purchaser.
 - 7.2 The cable shall be dispatched from works only after receipt of Purchaser's written approval of shop test report.
 - 7.3 Type test certificates of the cable offered shall be furnished. Otherwise the cable shall have to be type tested on similar rating as per clause 10 free of any charges to prove the design.
- 8.0 **Descriptive literatures test results etc.**
The following details for the cable shall be submitted with bid
- Manufacturers catalogue giving cable construction details and characteristics
 - Manufacturing process in details for cables highlighting the steps of control
 - Contamination
 - Formation of water trees
 - Effects of by products of cross linking
 - Stress control etc.
 - Cross section drawing of the cable
 - Cable current ratings for different types of installation inclusive of derating factors due to ambient temperature, grouping etc.
 - Over-load characteristics of the cable without endangering the normal life and electrical quality of the insulation.
 - Complete technical data of the cables.
 - Type test certificate from government testing units/government authorized testing units with the quality assurance plan submitted by the firm, the offer shall be liable for rejection.
- 9.0 **Guarantee:**
The guarantee period should either be 60 (Sixty) month from the date of commissioning or 68 (Sixty eight) month from the date of material received at site. The tenderer shall have to replace the damage cable (electrical damage/physical deformation) within 30 days from reporting.

TECHNICAL SPECIFICATION FOR 11 KV DROP OUT FUSE CUT OUTS

1. SCOPE

This specification covers outdoor, open, drop-out expulsion type Fuse Cutouts suitable for installation in 50 Hz, 11 KV distribution system.

2. APPLICATION

The distribution fuse cutouts are intended for use in distribution transformers and have no inherent load break capacity.

3. APPLICABLE STANDARD

Unless otherwise modified in this specification, the cutout shall conform to IS:9385 (Part-I to III) as amended from time to time.

4. RATED VOLTAGE

The rated voltage shall be 12 KV.

5. RATED CURRENT

The rated current shall be 100 A.

6. RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE VALUES FOR THE FUSE BASE

The rated lightning impulse withstand voltages both for positive and negative polarities shall be as given below :

- a) To earth and between poles 75 KV (Peak)
- b) Across the isolating distance of fuse base 85 KV (Peak)

7. RATED 1 MINUTE POWER FREQUENCY WITHSTAND VOLTAGE (DRY & WET) VALUES FOR THE FUSE BASE

- a) To earth and between poles 28 KV (rms)
- b) Across the isolating distance 32 KV (rms)

8. TEMPERATURE RISE LIMIT (In Air)

- a) Copper contacts silver faced 65°C
- b) Terminals 50°C
- c) Metal parts acting as springs. The temp. shall not reach such a value that elasticity of metal is changed

9. RATED BREAKING CAPACITY

The rated breaking capacity shall be 8 KA (asymmetrical).

10. GENERAL REQUIREMENTS/CONSTRUCTIONAL DETAILS

- 10.1 The cutouts shall be of single vent type (downward) having a front connected fuse carrier suitable for angle mounting.

10.2 All ferrous parts shall be hot dip galvanised in accordance with the latest version of IS:2633. Nuts and bolts shall conform to IS:1364. Spring washers shall be electro-galvanised.

10.3 Typical constructional details of the fuse cutout are shown in Fig. 1

11. FUSE BASE TOP ASSEMBLY

11.1 The top current carrying parts shall be made of a highly conductive copper alloy and the contact portion shall be silver plated for corrosion resistance and efficient current flow. The contact shall have a socket cavity for latching and holding firmly the fuse carrier until the fault interruption is completed within the fuse.

11.2 The top contact shall be actuated by a strong steel spring which keeps it under sufficient pressure to maintain a firm contact with the fuse carrier during all operating conditions. The spring shall also provide flexibility and absorbs most of the stresses when the fuse carrier is pushed into the closing position.

11.3 The current carrying parts of the assembly shall be protected from water and dust formation by a stainless steel top cover.

11.4 The top contact assembly shall have a robust galvanised steel hook to align and guide the fuse carrier into the socket latch even when the fuse carrier is closed at an off-centre angle.

11.5 The top assembly shall have an Aluminium alloy terminal connector (refer clause 19).

11.6 The top assembly shall be robust enough to absorb bulk of the forces during the fuse carrier closing and opening operations and shall not over-stress the spring contact. It shall also prohibit accidental opening of the fuse carrier due to vibrations or impact.

12. FUSE BASE BOTTOM ASSEMBLY

12.1 The conducting parts shall be made of high strength highly conductive copper alloy and the contact portion shall be silver plated for corrosion resistance and shall provide a low resistance current path from the bottom fuse carrier contacts to the bottom terminal connector.

12.2 The bottom assembly shall have hinge contacts made from highly conductive, anti-corrosive copper alloy and shall accommodate and make a firm contact with the fuse carrier bottom assembly. The fuse carrier shall be placed easily in or lifted from The hinges without any maneuvering. In addition, the bottom assembly shall perform the following functions :

- i) When opened manually or after fault interruption the fuse carrier shall swing through 180° to the vertical and its further travel shall be prevented by the fuse base bottom assembly.
- ii) The fuse carrier shall be prevented from slipping out of the self locking hinges during all operating conditions and only when the fuse carrier has reached its fully open position can it be removed from the hinge support.

12.3 The assembly shall have an aluminium alloy terminal connector (refer clause 19).

13. FUSE CARRIER TOP ASSEMBLY

- 13.1** The fuse carrier top contact shall have a solid replaceable cap made from highly conductive, anti-corrosive copper alloy and the contact portion shall be silver plated to provide a low resistance current path from the Fuse Base Top Contact to the Fuse Link. It shall make a firm contact with the button head of the fuse link and shall provide a protective enclosure to the fuse link to check spreading of arc during fault interruptions.
- 13.2** The fuse carrier shall be provided with a cast bronze opening eye (pull ring) suitable for operation with a hook stick from the ground level to pull-out or close-in the fuse carrier by manual operation.

14. FUSE CARRIER BOTTOM ASSEMBLY

- 14.1** The fuse carrier bottom assembly shall be made of bronze castings with silver plating at the contact points to efficiently transfer current to fuse base. It shall make smooth contact with the fuse base bottom assembly during closing operation.
- 14.2** The bottom assembly shall have a lifting eye for the hook stick for removing or replacing the fuse carrier.
- 14.3** The bottom assembly shall have a suitable ejector which shall perform the following functions :
- i) It shall keep the fuse link in the centre of fuse tube and keep it tensioned under all operating conditions.
 - ii) It shall be capable of absorbing the shock when the fuse carrier is pushed into the closed position and shall not allow the fuse link to be damaged. This is specially important when the fuse link is of low-ampere rating.
 - iii) The ejector at the instant of interruption shall retain the fuse carrier in the closed position long enough to ensure that the arc is extinguished within the fuse tube thereby excluding the possibility of arcing and subsequent damage at the contact surfaces.
 - iv) The ejector shall help the fuse link separation after fault interruption, allowing the fuse carrier to drop out and clearing the pigtail of the blown fuse link through the bore of fuse tube.

15. FUSE BASE (PORCELAIN)

The fuse base shall be a bird-proof, single unit porcelain insulator with a creepage distance (to earth) not less than 320mm. The top and bottom assemblies as also the middle clamping hardware shall be either embedded in the porcelain insulator with sulphur cement or suitably clamped in position. For embedded components, the pull out strength should be such as to result in breaking of the porcelain before pull out occurs in a test. For porcelain insulators, the beam strength shall not be less than 1000 Kg.

16. FUSE TUBE

The fuse tube shall be made of fibre glass coated with ultraviolet inhibitor on the outer surface and having arc quenching bone fibre liner inside. The tube shall have high bursting strength to sustain high pressure of the gases during fault interruption. The inside diameter of the fuse tube shall be 17.5mm. The solid cap of the fuse carrier shall clamp the button head of the fuse link, closing the top end of the fuse tube and allowing only the downward venting during fault interruption.

17. TYPE TESTS

The cutout shall be subjected to the following type tests :

- i) Dielectric tests (rated impulse withstands and rated one minute power frequency with stand test voltages)
- ii) Temperature rise test

The above tests shall be carried out in accordance with IS:9385 Part I & II.

For Porcelain Fuse Base only :

- iii) Pull out test for embedded components of the fuse base.
- iv) Beam strength of porcelain base.

18. MOUNTING ARRANGEMENT

- 18.1** The cutouts shall be provided with a suitable arrangement for mounting these on 75x40mm or 100x50mm channel cross arm in such a way that the centre line of the fuse base is at an angle of 15° to 20° from the vertical and shall provide the necessary clearances from the support. Mounting arrangement shall be made of high strength galvanised steel flat and shall be robust enough to sustain the various stresses encountered during all operating conditions of the cutout. For more details see enclosed figure 2.
- 18.2** Strength of the component marked 1 (see figure) shall be determined by clamping the member with the shorter leg at the top to a rigid support by M-10 carriage bolts. A downward force shall be applied along the axis of M-14 carriage bolt parallel to the longer leg and in the direction of longer leg of the member under test. A load of 50 Kg. shall be applied and then removed to take up any slack in the mounting arrangement before the measurement of position is taken, the permanent set measured at the axis of the M-14 carriage bolt shall not exceed 1.6mm when a load of 425 Kg. is applied and removed.
- 18.3** The strength of M-14 bolt shall not be less than 1900 Kg. and strength of M-10 bolts not less than 3500 Kg.

19. TERMINAL CONNECTIONS

The cut-out shall be provided with two aluminium alloy (alloy designation 2280 (A-11) as per IS:617-1975) terminal connectors at top and bottom of fuse base assemblies to receive aluminium conductors of diameters between 6.3mm to 10.05mm. These terminals shall be easily accessible irrespective of the cut-out location with respect to the pole. The terminals shall meet the test requirements of REC Construction Standard.

20. INSPECTION

All tests and inspection shall be made at the place of manufacture unless otherwise especially agreed upon by the manufacturer and the purchaser at the time to purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charge, to satisfy him that the material is being furnished in accordance with this specification.

The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever there is dispute regarding the quality of supply.

TECHNICAL SPECIFICATION OF 33 KV AND 11 KV GANG OPERATED SWITCH

1.0 SCOPE

- 1.1. This specification is intended to cover design manufacture, testing at manufacturer's works, transport to site, insurance, storage, erection and commissioning of 33 KV and 11 KV gang operated switch (Isolators) with all fittings and accessories.
- 1.2. The Gang operated air break switch/ isolator/ disconnectors are for outdoor installation suitable for both vertically and horizontally mounting on mounting structures or M.S. Channel and for use at sectionalizing/tapping points of 33 KV lines, 11KV line and at 33/11 KV sub-stations.
- 1.3. The successful bidders shall supply the necessary drawings and instructions for installation and commission of the Isolators.

2.0 CONSTRUCTIONAL DETAILS

- 2.1. The vertically mounted gang switches shall be manually operated triple pole type with single break operation. The operation of the equipment shall be through forward and backward motion of the mid-pole post insulator. The contacts shall be made of silver faced hard drawn copper.
- 2.2. The horizontally mounted switches, with or without earth switches shall have rotating blade features and pressure relieving features. Such isolators are required to be double break; three posts per phase, single through, gang operated three phase type. All isolators with/without earth switch shall operate through 90° from their fully closed position to fully open position.
- 2.3. The switch shall be fitted with arcing horns and the horns shall be easily replaceable. All isolators shall be provided with suitably rated terminal connectors to directly receive ACSR conductor of required size. The termination shall have at least 3 pairs of holes to hold the conductor tight with nuts & bolts. The terminals shall conform to all the test requirements of IS: 5561 and shall be designed as to avoid bimetallic corrosion.
- 2.4. The operating rod shall comprise of not less than 40 mm (nominal bore) Galvanised steel pipe as per IS 1161-1979. The length of the operating rod shall be suitable for operation as per installation methods. The rod shall be so threaded that the length can be adjusted.
- 2.5. The horizontal operation shaft shall be of solid Galvanised steel of square section suitable for fitting the insulator base of the switch. Length of the rod shall be such as to maintain the phase clearance as per I.S.
- 2.6. The operating handle shall have OFF/ON locking arrangement and provision for earthing the equipment.
- 2.7. The gang operating switch shall be provided with three post insulators per phase conforming to IS 5350 (Pt-III)-1971. The cast iron post shall be embedded in the insulators with sulphur cement. For embedded components, pull out strength should be such as to result in breakings of the porcelain insulators, the beam strength shall be as per relevant T.S. Creepage distance shall not be less than 900 mm and 300 mm for 33KV and 11 KV isolators respectively.
- 2.8. All similar materials and removable parts of similar equipments shall be interchangeable with each other.

3.0 APPLICABLE STANDARD

- 3.1. Unless otherwise stipulated in this specification, the Gang operated switch shall conform to IS. 9920 (Pt-I to Pt-IV).

4.0 Failure to meet guarantees and requirement of specification

- 4.1. If after installation, the operation of the switch proven to be unsatisfactory, to the purchaser, the tenderer shall have to take back or replace.

5.0 TEST AND INSPECTION

- 5.1. The switches shall be subjected to the following type test in accordance to with IS: 9920.
 - I) Dielectric test (impulse and one minute) power frequency withstands voltage.
 - II) Temperature rise test
 - III) Rated off load breaking current capacity
 - IV) Rated active load breaking capacity
 - V) Rated line charging breaking capacity
 - VI) Rated short time current
 - VII) Rated peak withstand current
 - VIII) Mechanical and Electrical Endurance
- 5.2. **The equipment shall be subjected to the following routine test.**
 - I) Power frequency voltage dry test
 - II) Measurement of resistance of the main circuit
 - III) Operating test.

5.3. The porcelain will have pull out test for embedded component and beam strength of porcelain base.

5.4. The manufacturer shall afford the inspection representing the purchaser or third party nominee all reasonable facilities, with charge, to satisfy him that the material is being furnished in accordance with this specification.

The purchaser has the right to have the test carried out at his own cost by an independent agency whenever there is dispute regarding the quality of supply.

6.0 GUARANTEE

The Bidder shall offer equipment performance guarantee for a minimum period of 18 months from the date of commissioning.

Any damaged part or defective part of the equipment, the bidder has to replace at his cost.

7.0 TECHNICAL SPECIFICATION

Sl No	Particular	33 KV GOAB	11 KV GOAB
1	Nominal system voltage, KV	33 KV	11 KV
2	Highest system voltage, KV	36 KV	12 KV
3	Nominal frequency, Hz	50HZ	50HZ
4	Rated normal current, Amp	400A, 630A	400A
5	Short time current rating & duration	25 KA for 3sec	16KA for 3 sec
6	Power frequency one minute withstand voltage,		
i	To earth and between pole, KV (RMS)	70	28
ii	Across the isolating distance, KV (RMS)	80	28
7	Rated lightning impulse withstand voltage		
i	To earth and between pole, KV (Peak)	170 KV	75
ii	Across the isolating distance, KV (Peak)	190KV	85
8	Minimum Clearance Between phase to phase	1350 mm	750 mm
	Minimum insulator creepage distance, mm	900 mm	320mm
	Electrical endurance	200 operation	200 operation
	Mechanical endurance	1000 operation	1000 operation
	Temperature rise		
	Applicable Standard	IS: 9921, IS;2544 &5350	IS: 9921, IS;2544 &5350

TECHNICAL SPECIFICATION FOR STAY SET (HT)

1. Scope:

This specification covers the design, manufacture testing at manufacturer's works, transport to site, insurance, storage, erection and commissioning of the Stay Sets (HT) required from the distribution lines at designated locations.

2.0 Standard:

All the materials of stay sets shall comply in all respects with the requirements of the latest edition of the relevant Indian or British Standard specification except in so far as they are modified this specification.

3.0 Design Consideration:

Stay Rods shall be galvanized and shall be of circular Cross-section with bow, thimble, nuts and bolts. The Rods shall be threaded at one end up to a minimum of 30 cm length and shall be complete with Galvanized M.S. Anchor Plates with all necessary accessories. All parts shall be heavily galvanized.

4.0 Testing:

Type and Routine Tests should be carried on different components of each stay sets as per relevant Indian Standard specification and certified copies of the above should be submitted along with the tender.

5.0 Schedule Requirement:

Stay sets complete with Thimble bow stay Rod/Anchor plate with nuts etc. and made of Rolled mild Steel Rod and plates as per detailed given below:

A) Anchor Plate:

- II) Thickness not below 5 mm.
- III) Size not below 300 mmX300 mm with smooth edges (for HT)
- IV) Well galvanized
- V) Materials M.S. Rolled plate
- VI) About 20 mm square hole at centre for locking the plate with the Anchor Rod (for HT)

A) Anchor Rod:

- 2.1 Length 1800 mm or above
- 2.2 Threaded length 30 cm or above
- 2.3 Diameter 18 mm or above (for HT)
- 2.4 Anchor plate and head: square size 30mm X 30mm with thickness 25 mm having matching square size shank for locking the Anchor plate.
- 2.5 One ratched lock nuts, grooves must match the grooves at bow flange
- 2.6 One check nut.
- 2.7 Materials H.S.
- 2.8 Component well galvanized with extra care for the threaded portion.
- 2.9 Both lock and check nuts should be matching to the Anchor Rod thread such that punching of thread after assembly at site safeguards them against removal.

B) **Thimble:** The match bow diameter and bend should be well galvanized.

C) **Bow:** Rod diameter 12mm/16mm or above overall length 35cm/40cm or above. Flange with well formed locking grooves matching the locking nut, bow ends will be riveted securely with the flange. All items to be galvanized.

6.0 Inspection:

All tests and inspections shall be carried out at the place of manufacturer unless otherwise agreed by the purchaser and the manufacturers at the time of purchase. A manufacturer shall afford the inspector representing the purchaser or third party nominee, all reasonable facilities, without charge to satisfy that the materials are being purchased as per specification. The purchaser reserves the right to have the test

carried out at his cost by an independent agency, whenever there is dispute regarding the quality of the materials supplied.

- 7.0 **Marking** The equipments shall be marked with name of manufacturer, year and name of project.

TECHNICAL SPECIFICATION FOR G.I. STAY WIRE

- 1.0 **Scope :** The specification covers design, manufacturing and testing, transporting to site, insurance, storage, erection and commissioning of G.I. Stay Wire 7/10SWG and 7/14SWG.

- 2.0 **Materials.** The wire shall be manufactured from steel, made by any suitable process and shall not contain sulphur and phosphorus exceeding 0.065 percent each.

The wires shall be coated with Zinc Grade Zn 98 of IS:209-1966

The general requirements for the supply of Galvanized stay strand shall be in accordance with IS:1387-1967

7.0 Construction

- 7.1 Grades: The wire shall be of Grade-I and tensile strength range 45 up to and including Kg/mm
- 7.2 The Galvanized stay strand shall be of 7/2 mm and 7/3.15 mm. the lay of the strands shall be of the length of 7/2 mm and Tables-I of IS: 2141-1963. the wires shall be so stranded together that when and evenly distributed pull is applied at the end of the completed strand each wire will take equal share of the pull.
- 7.3 The length of the strand which may be supplied without joints in the individual wires comprising it, depend on the length of wire which may be carried by the bobbin in a normal stranding machine. The normal lengths of strand which shall be supplied without joints in the individual wires, excluding welds made in the rod before drawing shall be as given below. The lengths may be exceeded by agreement between the manufacturer and the purchaser.

Diameter of wire in strand	Normal length without joints of weld
3.15 mm	1000 M
2.0 mm	3000 M

- 7.4 In cases where joints are permitted, they shall be made by welding or brazing joints in the same wire shall be separated by a length of not less than that shown in 3.3 and joints in different wires in a strand shall not be less than 20 M apart.

8.0 Freedom from Defects :

- 8.1 Each coil shall be warranted to contain no weld joint or splice other than in the rod before it is drawn and those permitted in 3.4. The wire shall be circular and shall be free scale, irregularities imperfections flaws splits and other defects. The Zinc coating shall be smooth, even the bright.

9.0 Tests:

- 9.1 Chemical Analysis: Unless otherwise agreed to between the purchaser and the supplier, the chemical analysis be carried out.
- 9.2 Tensile Test: The wire when tested in accordance with IS: 1521-1960, on gauge length of 100 mm shall have the minimum tensile strength specified in Tables 1 of IS : 2141/1968 according to the grade of the wire.
- 9.2.1 The tensile strength of the finalized strand shall be not less than 93% of the aggregate of the single wires.
- 9.3 Delivery test: The wire shall be subjected to the wrapping test in accordance with IS: 1755/1961. When wrapped eight times round its own diameter and on being subsequently strengthened the wire shall not break or split.
- 9.3.1 Coating test: The uniformity of Zinc coating shall be tested by the method specified in IS: 2633/1964. The wire shall withstand the number of dips as specified in IS: 4826-1968.

10.0 Marking:

- 10.1 Each coil shall be provided with a label, fixed firmly on the inner part of the coil, bearing 'the following information.
- a. Manufacturer's name or trade mark
 - b. Lot number and coil number
 - c. A brief description and quality of the materials.
 - d. Weight and
 - e. Any other particulars specified by the purchaser
 - f. Name of the project.
- 10.2 The label may also be marked with the ISI certification mark.
- 11.0 Inspection:** The test should be carried out in presence of the inspecting officer deputed by purchaser or third party nominee and the test should be in conformity with relevant IS.

TECHNICAL SPECIFICATION OF HT GUY INSULATOR

Scope

This specification covers design, manufacture, testing, transport to site, insurance, storage, erection and commissioning of the strain type porcelain Guy Insulator used in distribution overhead power lines.

1.0 Standard

This insulators shall comply with Indian Standard specification IS: 5500/1969 and as amended from time to time except where they conflict with the requirements in this specification.

Offers conforming to any other internationally accepted standard which ensure equal or higher quality than the standard mentioned will be acceptable.

2.0 General Requirements

- 3.0 This porcelain shall be sound, free from defects, thoroughly vitrified and smooth glazed.

The design of the insulator shall be such that stresses to expansion and contraction at any part of the insulator shall not lead to its deterioration.

The glaze, unless otherwise specified, shall be brown in colour. The glaze shall cover the entire porcelain surface parts except those areas that serves as supports during firing or area otherwise required to be left unglazed.

4.0 Insulator Characteristics

The Guy Strain Insulators shall have the electrical and mechanical characteristics as shown below:

H.T. Strain Type Porcelain Guy Insulator

- | | | |
|----|--|---------------------|
| 1) | Length | 140 mm |
| 2) | Diameter | 85 mm |
| 3) | Cable hole dia | 25 mm + 1.5 |
| 4) | Minimum failing load | 88 KN |
| 5) | Creepage distance | 48 mm |
| 6) | Dry one minute power frequency withstand | 27 KV (rms) voltage |
| 7) | Wet one minute power frequency withstand | 13 KV (rms) voltage |

5.0 Test

All insulators shall comply the following test as per IS : 5300

A) Routine test:

The following shall be carried out as., routine test.

a) Visual Examination

Every insulators shall be visually examined. The insulators shall be free from physical distortion of shape and defects, and thoroughly verified and smoothly glazed. They should be free from cracks or any other defects likely to be prejudicial to the satisfactory performance in service.

b) Type test:

The following shall constitute the type test and those shall be conducted in the order given below:

- | | |
|-----|----------------------------|
| i. | Visual examination |
| ii. | Verification of dimensions |

- iii. Temperature cycle test
- iv. Dry one minute power frequency voltage withstand test
- v. Wet one minute power frequency voltage withstand test
- vi. Mechanical strength test
- vii. Porosity test.

The number of samples for type test are to be agreed to between the purchaser and the supplier.

c) Acceptance Test (to be conducted in the following order)

- i. Verification of Dimensions
- ii. Temperature cycle test
- iii. Mechanical strength test
- iv. Porosity test

The number of samples for acceptance test shall be in accordance to IS: 5300.

- d) Type test certificate from National Test House/ Govt. recognized institutions/ Govt. recognized public Testing Laboratories are also to be submitted along with the offer, failing which the offer is liable for rejection.

6.0 Marking

Each insulator shall be legibly and indelibly marked to shown the following:

- a. Name of trade mark of the manufacturer
- b. Year of manufacture and name of project

Marking on porcelain shall be printed and shall be applied before firing. Insulators may also be marked with the ISI certification mark.

7.0 Inspection

All tests and inspections shall be carried out at the place of manufacturer unless otherwise agreed by the purchaser and the manufacturer at the time of purchase. The manufacturer shall afford the inspector representing the purchaser or the third party nominee, all reasonable facilities, without charge, to satisfy that materials are being furnished in accordance with the specification. The purchaser reserves the right to have the test carried out at his own cost by an independent agency whenever there is dispute regarding the quality of materials supplied.

8.0 Drawing

Drawing specifically showing all dimensions is to be submitted along with technical bid

TECHNICAL SPECIFICATION FOR COMPOSITE POLYMERIC INSULATORS FOR USE IN 11KV AND 33 KV SYSTEM

SCOPE

This section covers the specifications for design, manufacture, shop & laboratory testing, supply before dispatch & supply of Composite polymeric insulator consisting of a load bearing cylindrical insulating solid core consisting of fibres usually glass in a resin based matrix, a housing (outside the insulating core) made of polymeric material and end fittings permanently attached to the insulating core for a.c system with a nominal voltage greater than 1000 V for overhead lines.

The Composite insulator shall be pin insulator for straight line location and Long rod insulator for conductors in tension application at angle/ cut point. The composite tension / suspension insulator shall be of suitable for boll and socket type or tongue & Clevis type fittings.

1. **APPLICABLE STANDARD:** Following international standard are applicable for composite polymeric insulation with latest amendment and other relevant national & internal standard also been application with latest amendment.

The composite insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.

Sl. No.	Indian Standard	Title	International Standard
1.	IEC	Definition, test method and acceptance criteria for composite insulators for a. c. overhead lines above.	IEC:61109
2.	IS:731	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000V	IEC:60383
3.	IS:2071	Methods of High voltage testing	IEC:60060-1
4.	IS:2486	Specification for insulator fitting for overhead power lines with a nominal voltage greater than 1000V General Requirements and tests Dimensional Requirements locking devices.	IEC:60120 IEC:60372
5.		Thermal mechanical performances test on string insulator units.	IEC:60575
6.	IS:13134	Guide for the selection of insulators in respect of polluted conditions.	IEC:60815
7.		Characteristics of string insulator units of the long rod type.	IEC:60433
8.		Hydrophobicity classification	STRI GUIDE 1.92/1
9.		Radio interference characteristics of overhead power lines and high-voltage equipment	CISPR:18-2 PART2
10.	IS:8263	Methods of RI test of HV insulators	IEC:60437
11.		Standard for insulators- composite distribution dead end type	ANSI c29.13-2000
12.	IS:4759	Hot dip Zinc coatings on structural steel & other allied products.	ISO:1459 ISO:1461
13.	IS:2629	Recommendation of weight for hot, dip galvanization for iron and steel	ISO:1461(E)
14.	IS:6745	Determination of weight of Zinc coatings on zinc coated iron and steel articles	ISO:1460

15.	IS:3203	Method of testing of local thickness of electroplated coating	ISO:2178
16.	IS:2633	Testing of uniformity of coating of zinc coated articles	
17.		Standard specification for glass fiber standards	ASTM D 578-05
18.		Standard test method for compositional analysis of thermogravimetry	ASTME 1131- 03
19.	IS:4699	Specification for refined secondary Zinc	

2. SERVICECONDITION

Maximum ambient temperature :

*48⁰ C Minimum ambient temperature

: - 5⁰ C Relative humidity : 0

to 100%

The size of composite insulator, minimum creepage distance and mechanical strength along with hardware fittings shall be as follows.

3. TERMS AND DEFINITION:

- I. The polymeric insulator whose insulating body consists of organic base materials also known as non ceramic insulator and coupling device should be attached to the end of the insulating body.
- II. The composite polymeric insulator should be made two insulating part- namely a core and a housing part. The core consisting of fibres (e.g glass) which are position in a resin based matrix or a homogeneous insulating material (resin)
- III. The insulator trunk which is the central insulating part of an insulator from which the sheds project.
- IV. The housing which is the external insulating part of a composite insulator providing the necessary creepage distance and protecting core from environment.
- V. The shed of the insulator which is the insulating part projecting from the insulator trunk, intended to increase the creepage distance.
- VI. The interface which is the surface between housing and fixing device, between various parts of the housing e.g between shed or between sheath and sheds, between core and housing.
- VII. The end fitting which provide integral component or formed part of an insulator intended to connect it to a supporting structure, or to a conductor or to an item of equipment or to another insulator.

S I. N o.	Type of compo site insulat or	Nomi nal syste m volta ge KV (rms)	Highe st system voltage KV (rms)	Visible dischar ge test voltage KV (rms)	Wet power freque ncy withst and voltage KV (rms)	Impuls e withst and voltage KV (rms)	Minimum Creepage distance (mm)		Min. Failin g load KN	Pin ball shank diam eter mm
							Norma l & moder ately pollute d (20mm/ KV)	Heav ily pollu ted (25m m/ K V)		
i	Long rod insula tor	11	12	9	3 5	75	240	32 0	45	16
		33	36	2 7	7 5	170	720	90 0	45/70**	

ii	Post/ pin insulator	11	12	9	3 5	75	240	32 0	5	
		33	36	2 7	7 5	170	720	90 0	10	

Dimensional Tolerance of composite insulators

$\pm(0.04d=1.5)$ mm when $d < 300$ mm

$\pm(0.025d=6)$ mm when $d < 300$ mm

4. Interchangeability

The composite insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.

5. Corona and Rperformance

All surfaces shall be clean, smooth without cuts, abrasions or projections. No parts shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and not generate any radio interference beyond specified limit under the operating conditions.

6. Core

It shall be a glass – fiber reinforce epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or boron free E- class and shall exhibit both high electrical integrity and high resistance to acid corrosion . the matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through pultrusion process. The FRP rod shall be voidfree.

Housing (Sheath)

The FRP rod shall be covered by a seamless sheath of a silicon elastomeric compound or silicon alloy compound of a thickness of 3 mm minimum.

It should protect the FRP rod against environment influences, external pollution and humidity. It shall be excluded or directly moulded on the core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as in the sealing/ bonding area shall be free from voids.

7. Weathersheds

The composite polymer weather sheds made of silicon elastomeric compound of silicon alloy shall be firmly bounded to the sheath, vulcanized to the sheath or moulded as part of the sheath and shall be free from imperfections. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather sheds to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

8. EndFittings

End fittings transmit then mechanical load to the core. They shall be made of spheroid graphite cast iron, malleable cast iron or forged steel or aluminium alloy. They shall be connected to the rod by means of a controlled compression technique. The gap between fitting and sheath shall be sealed by a flexible silicon elastomeric compound or silicon alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection. The sealing must be moisture proof.

The dimensions of end fittings of Insulators shall be in accordance with the standard dimensions stated in IS:2486/IEC:60120

9. EquipmentMarking

- I. Each insulator unit shall be legibly and marked with the following details as per IEC-61109

- (a) Month & Year of manufacture
- (b) Min. Failing load/ guaranteed mechanical strength in kilo Newton followed by the word KN to facilitate easy identification.
- (c) Manufacture's name / trademark.

- II. One 10mm thick ring or 20mm thick spot of suitable quality of paint shall be marked on the end fitting of each composite long rod of [particular strength in case of 33 KV insulators for identification in case both type of insulators are procured by the utility. The paint shall be not have deteriorating effect on the insulator performance, following codes shall be used as identification mark:

For 45 KN Long unit : Blue

For 70 KN Long unit : Red

10. Bid Drawings

- I. The full description and illustration of the material offered.
- II. The bidder furnish along with the bid the outline drawing (3 copies) of each insulator unit including a cross sectional view of the long rod insulator unit. The drawing shall include but not be limited to the following information.
 - (a) Long rod diameter with manufacturing tolerance.
 - (b) Minimum creepage distance with positive tolerance.
 - (c) Protected creepage distance.
 - (d) Eccentricity of the long rod unit
 - (i) Axial runout
 - (ii) Radial runout
 - (e) Unit mechanical and electrical characteristics
 - (f) Size and weight of ball and socket/ tongue & cleaves
 - (g) Weight of composite long rod units
 - (h) Materials
 - (i) Identification Mark
 - (ii) Manufacturer's catalogue number

Type tests

Sl. No.	Description of type test	Test procedure / standard
1.	Dry lightning impulse withstand voltage test	As per IEC 61109 (Clause 6.1)
2.	Wet power frequency test	As per IEC 61109 (Clause 6.2)
3.	Mechanical load- time test	As per IEC 61109 (Clause 6.4)
4.	Radio Interference test	As per IEC 61109 (Clause 6.5) revised
5.	Recovery of Hydrophobicity test	Annexure-B This test may be repeated every 3 yrs by the manufacturer
6.	Chemical composition test for silicon content	Annexure-B or any other test method acceptable to the owner
7.	Brittle fracture resistance test	Annexure-B

11. Acceptance (Sample) Tests

A. For Composite Insulators

A	Verification of dimensions	Clause 7.2 IEC:61109
B	Verification of the locking system (if possible)	Clause 7.3 IEC:61109
C	Galvanizing Test	IS 2633 / IS 6745
D	Verification of the specified mechanical load	Clause 7.4 IEC:61109

B. Routine Tests

Sl. No.	Description	Standard
1.	Identification of marking	As per IEC:61109 Clause 8.1
2.	Visual Inspection	As per IEC:61109 Clause 8.2
3.	Mechanical routine test	As per IEC:61109 Clause 8.3

C. Tests During Manufacture

Following tests shall also be carried out

A	Chemical analysis of zinc used for galvanizing
B	Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings
C	Chemical analysis, hardness and magnetic particle inspection for forgings

TECHNICAL SPECIFICATION FOR HARDWARE FITTING FOR DISC INSULATOR, 90 KN (B&S)

1.0 Scope: -

This specification covers design, drawings, and manufacture, testing at manufacturers' works, supply and delivery of hardware fittings for strain insulator of ball & socket type.

The fitting shall consist of the following component:

- a) Cross arm strap conforming to IS: 2486 (Pt-II)-1989.
- b) Forged steel ball eye for attaching the socket end of the strain insulator to the cross arm strap. Forging shall be made of steel as per IS : 2004-1978.
- c) Aluminium alloy thimble socket made out of permanent mould cast , high strength aluminium alloy for attaching to the strain insulator on one end and for accommodating the loop of the helically formed dead-end fittings at the other end in its smooth internal contour. The thimble socket shall be attached to the strain insulator with the help of locking pin as per the dimension given in IS: 2486(Pt-II)-1989
- d) Helically formed dead-end grip having a pre-fabricated loop to fit into the grooved contour to the thimble on one end and for application over the conductor at the other end. The formed fitting shall conform to the requirement of IS:12048-1987.

2.0 Tests:

The helically formed fittings for strain insulators shall be subjected to tests as per IS:12048-1987. The other hardware fittings shall be tested as per IS:2486 (Part-I)

3.0 Packing:

For packing of strain clamps and related hardware, double gunny bags or wooden cases shall be used. The fittings shall be properly protected against damage.

The gross weight of the packing shall not normally exceed 50 Kg. Helically formed fittings shall be packed in card board / wooden boxes. Fittings for different sizes of conductors shall be packed in different boxes and shall be complete with their minor accessories fitted in place and colour codes on tags / fittings shall be marked to identify suitability for different sizes of conductors as per IS:12048-1987

4.0 Inspection:

All tests and inspections shall be made at the place of manufacture unless otherwise especially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this specification.

The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever there is dispute regarding the quality of supply.

TECHNICAL SPECIFICATION FOR G.I. WIRE

1.0 **Scope**

This specification covers the manufacturing, testing at works, transport to site, insurance, storage, erection and commissioning of Galvanized Iron Wire of sizes 4 mm and 5 mm diameter.

2.0 **General requirements**

It relating to the supply of mild steel wire shall be as per IS: 1387/1967 and the wire shall be drawn from the wire rods conforming to IS: 7887/1975.

The requirements for chemical composition for the wires shall conform to IS:7887/1975.

Mild steel wire for General Engineering purpose shall be of following sizes:

- I) 4mm - diameter (8 SWG)
- II) 5mm - diameter (6 SWG)

Tolerance permitted on the diameter of wire shall be as per Table -1 of IS:280/1978.

3.0 **Climatic Conditions** The cross arms should be suitable for the climatic condition mentioned In these bidding documents:

4.0 **Mechanical Properties**

4.1 **Tensile Test:** Tensile strength of wire when tested in accordance with IS:

1521-1972, shall be within the limits given in Table-2 of IS: 280/1978.

4.2 **Wrapping Test:** Wires shall be subjected wrapping test in accordance with IS: 1755-1961. The wire shall withstand without breaking or splitting. being wrapped eight times round its own diameter and subsequently straightened.

Surface finish

- a. The wire shall have galvanized finishes. The galvanized coating of steel wire shall conform to the requirements for anyone of the types of coatings given in IS: 4826-1968 as per agreement with the purchaser.
- b. The coating test for finishes other than galvanized, copper coated or tinned shall be subject to between the purchaser and the manufacturer.
- c. Unless otherwise agreed to the method of drawing representative samples of the material and the criteria for conforming shall be as prescribed in Appendix (A) of IS: 280/1978.
- d. All finished wires shall be well and cleanly drawn to the dimensions specified. The wire shall be sound, free from splits, surface flaws, rough jagged and imperfect edges and other harmful surface defects.
- e. Each coil of wire shall be suitably bound and fastened compactly and shall be protected by suitably wrapped.

5.0 **Marking** Each coil of wire shall be marked legibly with the finish size of wire, lot number and trade mark of the name of the manufacturer. The material may also be marked with the ISI certification mark and name of the project.

6.0 **INSPECTION:** Inspection may be carried out by the purchaser or third party nominee at any stage of manufacture. The supplier shall grant free access to the purchaser's representative or third party nominee at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification

TECHNICAL SPECIFICATION FOR GALVANIZED CHANNEL CROSS ARMS

1.0 Scope :

This specification covers the design, manufacture, testing at manufacturer's works, transport to site, insurance, storage, erection and commissioning of Galvanized Cross Arm and Channel used for 11 KV line complete with all accessories as specified.

2.0 Standards

The M.S Cross Arm and channel supplied under this specification shall conform to the latest issue of the relevant Indian Standards IS – 226:1975, Regulations etc. except where specified otherwise.

The rolling and cutting tolerance for steel product conforming to IS: 266 shall be those specified in the IS: 1852-1973 with latest revision.

Galvanization conforming to latest version of IS:2629 or equivalent international specifications

In the event of conforming to any standards other than the Indian Standards, the salient features of comparison shall be clearly set out separately.

3.0 General requirement :

- i. The cross arm shall be fabricated grade of mild steel of channel section as per requirement.
- ii. All steel members and other parts of fabricated material as delivered shall be free of warps, local deformation, unauthorized splices, or unauthorized bends.
- iii. Bending of flat strap shall be carried out cold. Straightening shall be carried out by pressure and not by hammering. Straightness is of particular importance if the alignment of bolt holes along a member is referred to its edges.
- iv. Holes and other provisions for field assembly shall be properly marked and cross referenced. Where required, either by notations on the drawing or by the necessity of proper identification and fittings for field assembly, the connection shall be match marked.
- v. A tolerance of not more than 1mm shall be permitted in the distance between the center lines of bolt holes. The holes may be either drilled or punched and, unless otherwise stated, shall be not more than 2mm greater in diameter than the bolts.
- vi. When assembling the components force may be used to bring the bolt holes together (provided neither members nor holes are thereby distorted) but all force must be removed before the bolt is inserted. Otherwise strain shall be deemed to be present and the structure may be rejected even though it may be, in all other respects, in conformity with the specification.
- vii. The back of the inner angle irons of lap joints shall be chamfered and the ends of the members cut where necessary and such other measures taken as will ensure that all members can be bolted together without strain or distortion. In particular, steps shall be taken to relieve stress in cold worked steel so as to prevent the onset of embrittlement during galvanizing.
- viii. Similar parts shall be interchangeable.
- ix. Shapes and plates shall be fabricated and assembled in the shop to the greatest extent practicable. Shearing flame cutting and chipping shall be done carefully, neatly and accurately. Holes shall be cut, drilled or punched at right angles to the surface and shall not be made or enlarged by burning. Holes shall be clean-cut without torn or ragged edges, and burrs resulting from drilling or reaming operations shall be removed with the proper tool.
- x. Shapes and plates shall be fabricated to the tolerance that will permit field erection within tolerance, except as otherwise specified. All fabrication shall be carried out in a neat and workmanlike manner so as to facilitate cleaning, painting, galvanizing and inspection and to avoid areas in which water and other matter can lodge.
- xi. Contact surfaces at all connections shall be free of loose scale, dirt, burrs, oil and other foreign materials that might prevent solid seating of the parts.
- xii. Welded joints not permissible.
- xiii. The rolling and cutting tolerance for steel product conforming to IS: 266 shall be those specified in the IS: 1852-1973 with latest revision.
all dimensions are subject to the following tolerances:
a) dimensions up to and including 50mm: +1mm: and
b) dimensions greater than 50mm: +2%
- xiv. The channel cross arm shall be properly brushed to make it free from rust.
- xv. **For galvanized channel :**
All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall; be hot dip galvanized conforming to latest version of IS:2629 or any other equivalent authoritative standard. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spot and

shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the galvanic bath which could have a detrimental effect on the durability of the zinc coating. Before picking, all welding, drilling, cutting, grinding and other finishing operations must be completed and all grease, paints, varnish, oil, welding slag and other foreign matter completely removed. All protuberances, which would affect the life of galvanizing shall also be removed.

The weight of zinc deposited shall be in accordance with that stated in Standard IS 2629 and shall not less than 0.61kg/m² with a minimum thickness of 86 microns for items of thickness more than 5mm, 0.46kg/m² (64 microns) for items of thickness between 2mm and 5mm and 0.33kg/m² (47 microns) for items less than 2mm thick.

- xvi. The raw materials and fabrication thereof in respect of cross arm shall be furnished along with dimension.
- xvii. The hole for fixing of insulator and pole clamp shall be provided as per requirement.
- xviii. One copy of the drawing of cross arm for each size shall be furnished along with the technical bid.

a. REQUIRED TECHNICAL SPECIFICATION FOR GI CHANNEL CROSS ARM

[100 x 50x 50x6 x 2200]

SI No.	Description	Particular
1	Type of cross arm	GI Channel cross arm
2	Size	100 x 50x 50x6 x 2200 mm
3	Material	Mild Steel channel(galvanized)
4	Length	2200 mm
5	Breath	100 mm
6	Width	50 mm
7	Thickness	6 mm
8	Hole for foxing of insulator	20 mm
9	Center to center distance for hole	1070mm
10	Weight	20.5 kg (approx)
11	Galvanization	The cross arm shall be properly brushed to make it free from rust and hot dip galvanized confirming to IS: 2629 or equivalent international specifications.

TECHNICAL SPECIFICATION FOR 11 KV T-CROSS ARM

SI No.	Description	Particular
1	Type of cross arm	11 KV T-cross arm
2	Applicable standard	IS – 226:1975 & IS 1852/1973
3	Material	Mild Steel channel
4		50 mm
5	Width	50 mm
6	Thickness	6 mm
7	Diameter of hole for Pole fixing	18 mm
8	Diameter of hole for G.I Pin	22mm
9	For Fixing of Pin insulator	A piece of 76mm length 50x50x6 mm angle or flat of 50x6mm is to be welded at the ends of cross arm for fixing of pins firmly & vertically.
10	Welding Joints	Welding should be as per IS: 832/64
11	Painting	The channel cross arm shall be properly brushed to make it free from rust and then coated with two coating of red oxide zinc chromate painted as per IS : 5660/70.
12	For galvanization	The cross arm shall be properly brushed to make it free from rust and hot dip galvanized confirming to IS: 2629.
13	Weight	11.25 kg (approx)

TECHNICAL SPECIFICATION FOR CLAMPS & CONNECTORS

CLAMPS & CONNECTORS: Clamps & connectors shall conform to IS: 5561. The clamps and connectors shall be made of materials listed below:

For connecting ACSR conductors	Aluminium alloy casting, conforming to designation A6 of IS 617 and shall be tested for all tests as per IS: 617
For connecting equipment terminals made of copper with ACSR conductor	Bimetallic connectors made from aluminium alloy casting conforming to designation A6 of IS:617 with 2mm thick Bimetallic liner and shall be tested as per IS:617
For connecting GS shield wire	Galvanised mild steel
Bolts, Nuts & plain washers	Hot dip galvanised mild steel for sizes M12 and above, and electro-galvanised for sizes below M12
Spring washers for items 'a' to 'c'	Electro-galvanised mild steel suitable for at least service condition 4 as per IS:1573

All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

No current carrying part of a clamp or connector shall be less than 10 mm thick. They shall be designed and manufactured to have minimum contact resistance.

For Bimetallic clamps or connectors, copper alloy liner of minimum 2 mm thickness shall be provided.

Flexible connectors, braids or laminated strips made up of copper/ aluminium for the terminal clamps for equipment shall be suitable for both expansion or through (fixed/ sliding) type connection of IPS Aluminium tube as required. In both the cases the clamp height (top of the mounting pad to center line of the tube) should be same.

Size of the terminal/conductor for which the clamp/connector is suitable shall be embossed/punched (i.e. indelibly marked) on each components of the clamp/ connector, except on the hardware.

Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/ connector is designed with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.

Clamps and connector shall be designed corona controlled.

1. MEDIUM VOLTAGE COVERED CONDUCTORS (MVCC)

INTRODUCTION

These Specifications lay down the Constructional, Dimensional and Performance requirements for Covered Conductors which consist of a Conductor surrounded by a covering made of Insulating Material (as described hereunder) as protection against accidental Contacts with other covered conductors and with grounded parts such as tree branches, etc. The MVCC should be suitable for use under operating condition as specified below:

1. Ambient air temperature : 45°C

- | | |
|--|---------------------|
| 2. Maximum temperature of conductor at rated current | : 90° C |
| 3. Wind condition at site | : 1 meter / sec |
| 4. Solar radiation at site | : 1200 watts / sq m |
| 5. Maximum allowable temperature under Short circuit condition | : 250°C |

Data sheet providing details of the conductor data provided above shall be submitted along with the offer.

CONSTRUCTION REQUIREMENTS

1) CONDUCTOR

- a. CONDUCTOR MATERIAL: All Aluminum Alloy (AAAC).
- b. NOMINAL CROSS SECTION: 70 sq. mm for AAAC conductors.
- c. CONDUCTOR DESIGN: The Conductor shall be stranded, round and should be Non Compacted.
- d. Non compacted Conductors shall comply with all the requirements of EN 50397-1-2006.
- e. The D.C. Resistance of the conductor shall not exceed that given in EN 50397-1-2006 by more than 5%.

2) FILLING (WATER BLOCKING)

The Stranded Conductor shall be longitudinally water tight by means of a water blocking material incorporated during the extrusion process. The use of grease /water swellable tape / water swellable powder etc. is not permitted. The water blocking material shall be stable at maximum operating conductor temperature of 90°C. **The final MVCC should result in a product with an advanced triple extrusion technology with improved water blocking, semi conductive layer, XLPE insulation and an outer covering with carbon doped XLPE.**

The water blocking compound shall be compatible with the conductor material as well as the semi conducting polymer screen layer above it and not adversely affect its electrical or mechanical properties.

3) SEMICONDUCTING SCREEN

A semi conductive polymeric screen should be applied over the filled stranded conductor to ensure a lower voltage stress on the Insulation applied over the screen.

The thickness of the semi conductive polymeric screen should be of minimum 0.2 mm.

4) INSULATION

The Insulation should be dual layered with the Inner Layer being XLPE with a nominal thickness of 1.2 mm for Voltages up to 11 KV and 1.7 mm for 33 KV and the Outer Layer being a suitable Polymer which is UV Resistant, Non Tracking and Erosion Resistant with a nominal wall thickness of 1.1 mm for Voltages up to 11 KV and 1.6 mm for 33 KV. The minimum combined Insulation Thickness of both Layers should be 2.3 mm for Voltages up to 22 KV and 3.0 mm for Voltages upto 33 KV minimum.

The conductor manufacturing and stranding process shall incorporate the longitudinal

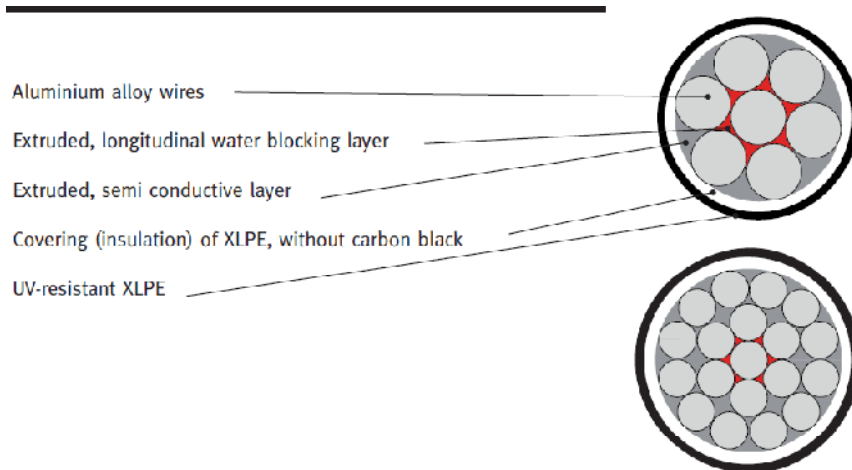
water blocking also.

The Semi Conducting Screen, Inner Insulation and Outer Insulation should be extruded in one step i.e. triple extrusion to ensure a good, permanent bond between the three layers and also with the conductor.

It shall be possible to remove the Semi Conducting Screen, Inner and Outer Insulation Layers without damage to the conductor.

Figure 1 shows the Cross Section of a Covered Conductor with AAAC Conductor and Figure 2 shows the Cross Section of a Covered Conductor with AAAC Conductor.

FIGURE 1 (AAAC)



5) TYPE TESTS:

SN	Description of Test	As per standard
1	Conductor Resistance Test	EN 50397- 1-2006
2	Thickness of Insulation & Covering	
3	Tensile strength	
4	Percentage Elongation at break of Insulation before ageing, after ageing & Completed Cable ageing	
5	Carbon black content test on outer covering	
6	Shrinkage test on outer covering	
7	Shrinkage test on Insulation	
8	Hot set test on Insulation	
9	Water Absorption test on Insulation	
10	Test for longitudinal water tightness	
11	AC High Voltage test	
12	Leakage Current Measurement	
13	Tracking Resistance test	
14	Slippage Test	

Type test report for Covered conductors is to be submitted with the bid.

ELECTRICAL TESTS

Conductor Resistance Test: To be done as a Routine as well as Type Test as per EN 50397-1-2006.

High Voltage Test as per EN 50397-1-2006: Type test

Test Voltage: Phase to Phase Voltage of the System for which the Covered Conductor is used.

No. of Specimens: One

Length of Specimen (minimum): 5 meters

Duration of Immersion in Water (minimum): 1 Hour

Temperature of Water: $(20 \pm 5)^{\circ}$ Centigrade

Test Duration:

4 Hours for Routine Test

48 Hours for Type Test

Requirement: No Breakdown

Spark Test on Covering: Routine test

Test Voltage 0.7 X Phase to Phase Voltage of System (A, C,) or Phase to Phase Voltage of System (D. C.)

Requirement: No Breakdown

Leakage Current Test - Type test

Test Voltage 0.7 X Phase to Phase Voltage of System (A. C.)

Requirement: Maximum Leakage Current 1mA

Tracking Resistance: Type test

NON – ELECTRICAL TESTS ON COVERING: Type tests

Mechanical Properties:

a) Before Ageing of Sample: As per Table 1 in accordance with EN 50397-1-2006.

b) After Ageing of Sample: As per Table 1 in accordance with EN 50397-1-2006.

c) Ageing of Complete Product Sample: As per Table 1 in accordance with EN 50397-1-2006.

d) Hot-Set-Test: As per Table 1 and in accordance with EN 50397-1-2006.

e) Pressure Test at High Temperature: As per Table 1 in accordance with EN 60811-3-1, Sub Clause 6.1.

h) Water Absorption: As per Table 1 in accordance with EN 50397-1-2006

TEST FOR LONGITUDINAL WATER TIGHTNESS

a) As Type Test with Heat Cycle and in accordance with 50397-1-2006.

No of Specimen – 1

Length of Specimen-----3 metres

Test Duration -- 24 hours

Bending Radius – 20 X Diameter of Covered Conductor

Requirement – No Leakage

b) As Routine Test without Heat Cycle and in accordance with IEC 60502 -2

No of Specimen – 1

Length of Specimen – 1 metre

Test Duration – 1 Hour

MARKING

The covered conductors shall carry the marking at regular interval as below.

- Manufacturer name
- Voltage Grade
- Covered AAAC conductor
- Conductor Size.
- Year of Manufacturing.
- Specification reference.

2. GALVANIZED CHANNEL CROSS ARMS

2.0 Scope

This specification covers the design, manufacture, testing at manufacturer's works, transport to site, insurance, storage, erection and commissioning of Galvanized Cross Arm and Channel used for 11 KV line complete with all accessories as specified.

3.0 Standards

The M.S Cross Arm and channel supplied under this specification shall conform to the latest issue of the relevant Indian Standards IS – 226:1975, Regulations etc. except where specified otherwise.

The rolling and cutting tolerance for steel product conforming to IS: 266 shall be those specified in the IS: 1852-1973 with latest revision.

Galvanization conforming to latest version of IS:2629 or equivalent international specifications

In the event of conforming to any standards other than the Indian Standards, the salient features of comparison shall be clearly set out separately.

4.0 General Requirement :

- xix. The cross arm shall be fabricated grade of mild steel of channel section as per requirement.
- xx. All steel members and other parts of fabricated material as delivered shall be free of warps, local deformation, unauthorized splices, or unauthorized bends.
- xxi. Bending of flat strap shall be carried out cold. Straightening shall be carried out by pressure and not by hammering. Straightness is of particular importance if the alignment of bolt holes along a member is referred to its edges.
- xxii. Holes and other provisions for field assembly shall be properly marked and cross referenced. Where required, either by notations on the drawing or by the necessity of proper identification and fittings for field assembly, the connection shall be match marked.
- xxiii. A tolerance of not more than 1mm shall be permitted in the distance between the center lines of bolt holes. The holes may be either drilled or punched and, unless otherwise stated, shall be not more than 2mm greater in diameter than the bolts.
- xxiv. When assembling the components force may be used to bring the bolt holes together (provided neither members nor holes are thereby distorted) but all force must be removed before the bolt is inserted. Otherwise strain shall be deemed to be present and the structure may be rejected even though it may be, in all other respects, in conformity with the specification.
- xxv. The back of the inner angle irons of lap joints shall be chamfered and the ends of the members cut where necessary and such other measures taken as will ensure that all members can be bolted together without strain or distortion. In particular, steps shall be taken to relieve stress in cold worked steel so as to prevent the onset of embrittlement during galvanizing.
- xxvi. Similar parts shall be interchangeable.
- xxvii. Shapes and plates shall be fabricated and assembled in the shop to the greatest extent practicable. Shearing flame cutting and chipping shall be done carefully, neatly and accurately. Holes shall be cut, drilled or punched at right angles to the surface and shall not be made or enlarged by burning. Holes shall be clean-cut without torn or ragged edges, and burrs resulting from drilling or reaming operations shall be removed with the proper tool.
- xxviii. Shapes and plates shall be fabricated to the tolerance that will permit field erection within tolerance, except as otherwise specified. All fabrication shall be carried out in a neat and workmanlike manner so as to facilitate cleaning, painting, galvanizing and inspection and to avoid areas in which water and other matter can lodge.

- xxix. Contact surfaces at all connections shall be free of loose scale, dirt, burrs, oil and other foreign materials that might prevent solid seating of the parts.
 - xxx. Welded joints not permissible.
 - xxxi. The rolling and cutting tolerance for steel product conforming to IS: 266 shall be those specified in the IS: 1852-1973 with latest revision.
all dimensions are subject to the following tolerances:
 - a) dimensions up to and including 50mm: +1mm: and
 - b) dimensions greater than 50mm: +2%
 - xxxii. The channel cross arm shall be properly brushed to make it free from rust.
 - xxxiii. For galvanized channel :
All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall; be hot dip galvanized conforming to latest version of IS:2629 or any other equivalent standard. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spot and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the galvanic bath which could have a detrimental effect on the durability of the zinc coating. Before packing, all welding, drilling, cutting, grinding and other finishing operations must be completed and all grease, paints, varnish, oil, welding slag and other foreign matter completely removed. All protuberances, which would affect the life of galvanizing shall also be removed.
- The weight of zinc deposited shall be in accordance with that stated in Standard IS 2629 and shall not less than 0.61kg/m² with a minimum thickness of 86 microns for items of thickness more than 5mm, 0.46kg/m² (64 microns) for items of thickness between 2mm and 5mm and 0.33kg/m² (47 microns) for items less than 2mm thick.**
- xxxiv. The raw materials and fabrication thereof in respect of cross arm shall be furnished along with dimension.
 - xxxv. The hole for fixing of insulator and pole clamp shall be provided as per requirement.
 - xxxvi. One copy of the drawing of cross arm for each size shall be furnished along with the technical bid.

REQUIRED TECHNICAL SPECIFICATION FOR GI CHANNEL CROSS ARM

(A)

Sl No.	Description	Particular
1	Type of cross arm	GI Channel cross arm
2	Size	100 x 50x 50x6 x 2200 mm
3	Material	Mild Steel channel (galvanized)
4	Length	2200 mm
5	Breath	100 mm
6	Width	50 mm
7	Thickness	6 mm
8	Hole for foxing of insulator	20 mm
9	Center to center distance for hole	1070mm
10	Weight	20.5 kg (approx)
11	Galvanization	The cross arm shall be properly brushed to make it free from rust and hot dip galvanized confirming to IS: 2629 or equivalent international specifications.

(B)

Sl No.	Description	Particular
1	Type of cross arm	GI Angle cross arm
2	Size	50x 50x6 mm
3	Material	Mild Steel channel(galvanized)
4	Length	2200 mm
5	Breath	50 mm
6	Width	50 mm
7	Thickness	6 mm
8	Hole for foxing of insulator	20 mm
9	Center to center distance for hole	1070mm
10	Weight	20.5 kg (approx)
11	Galvanization	The cross arm shall be properly brushed to make it free from rust and hot dip galvanized confirming to IS: 2629 or equivalent international specifications.

3. TECHNICAL PARICULARS OF COMPOSIT POLYMERIC DISC INSULATOR FOR 11 KV, 90 KN WITH CLAMPS, NUTS AND BOLTS

Sl. No	Description	Unit	11KV , 90 KN , T& C type
1	Type of Insulator		Composite polymeric Insulators
2	Standard according to which the Insulator manufacture and tested		IES-61109 with up to date amendments
3	Name of material used in manufacture Of the insulator with class/grade		Silicon/ Polyolefin material
(a)	Material of core (FRP rod)		ECR glass boron content free
	i) E-glass or ECR-glass		
	ii) Boron content		
(b)	Material of housing & Weather sheds []		36%
(c)	(material of end fitting)		Hot dip galvanized high strength steel
(d)	Sealing compound for end fittings		Silicon based sealants
4	Color		Grey/ Red
5	Electrical characteristics		
(a)	Normal system	KV(rms)	11 KV

	voltage		
(b)	Highest system voltage	KV(rms)	12 KV
(c)	Dry power Frequency withstand voltage	KV(rms)	35 KV
(d)	Wet power frequency withstand voltage	KV (rms)	35 KV
(e)	Dry flashover voltage	KV(rms)	>35KV
(f)	Wet flashover voltage	KV(rms)	>35KV
(g)	Dry lighting impulse withstand voltage		
	a) Positive	KV(peak)	75 KV
	b)Negative	KV(peak)	75KV
(h)	Dry lighting impulse flashover voltage	KV(peak)	
	c) positive		95KV
	d) Negative	KV(peak)	95 KV
(i)	R/V at 1MHz when energized at 10KV/30KV(rms) under dry condition	Microvolt	As per IES specification
(j)	Creepage distance (mm)	mm	320 mm
6	Mechanical characteristics		
(a)	Minimum failing load	KN	90 KN
7	Dimension of insulator		Drawing to be attached
(i)	Weight	Kg	0.90 Kg (Approx)
(ii)	Dia of FRP rod	mm	16 mm
(iii)	Length of FRP rod	mm	drawing to be attached as per type test
(iv)	Die. Of Weather sheds	mm	drawing to be attached as per type test
(v)	Thickness of housing	mm	(3mm-Min)
(vi)	Dry arc distance	mm	drawing to be attached as per type test
	Dimension drawing of insulator including weight with clearances min weight enclosed		Provided
8	Method of fixing of sheds to housing (specify single		Modular Design

	moulder Modular construction moulding)		
9	No. of Weather sheds		drawing to be attached as per type test
10	Types of sheds		drawing to be attached as per type test
(i)	Aerodynamic		Aerodynamic
(ii)	With under ribs		-----
11	Packing details		Each insulator in poly bag then packed in master carton- 7Ply
(a)	Types of packing		Corrugated Bodies
(b)	No. of insulator each pack		One master carton box containing 16Pcs
(c)	Gross weight of package		17 KG (approx.)
12	Any other particulars which the bidder may like to give		-----
13	Performance Guarantee (from date of commissioning)		18 Months

4. TECHNICAL SPECIFICATIONS FOR INSULATION PIERCING CONNECTORS SUITABLE FOR 11 KV COVERED CONDUCTORS:

1.0 Insulation Piercing Connector having 320 AMP Current Carrying capacity with maximum Outline size in mm: 97 x 63 x 54 for 50 sq mm & 393 AMP Cu Carrying capacity with maximum Outline size in mm 131 x 82 x 57 for 99 sq mm Covered Conductor.

2.0 Bodies of Insulation Piercing Connector shall made of glass fibre reinforced polymer having Insulated and Waterproof seals where Insulation material should be Weather, UV and Corrosion resistant.

3.0 Insulation Piercing Connector should have Blades made of special tinned copper with End cup Design suitable for Covered Conductor.

4.0 Insulation Piercing Connector should have Shear-head with one screw design to ensure good contact properties and avoid damaging cables.

5.0 Insulation Piercing Connector should have Lowest Torque, easy to install & no special tools necessary to operate.

6.0 Piercing of Insulation Piercing Connector should have structural design.

7.0 Insulation Piercing Connector should have a design such that there is no stripping of insulation on the covered conductor. It shall be able to get the Lowest contact resistance & Superior insulation as well as sealing performance.

8.0 Material of Insulation Piercing Connector should withstand for all routine & acceptance test as per **NFC 33 020-1998** listed below:

a. Flashover - 15 kV for 1 min in water. b. Short circuit test, c. Mechanical test d. Heat cycle test

9.0 The superior material and process technology ensure operation regularity in corrosive environment.

10.0 Insulators, hardware fittings and other accessories.

Since the covered conductor shall be suitable for stringing overhead supported by poles / tower, the insulators such as tension, suspension and pole top types shall be of capacity and polymeric type. They should also have enough mechanical strength, even though the conductor span is proposed to be made somewhat loose and having shorter span length. The insulators designed for covered conductor shall have heat & moisture resistance properties. These shall be of type & design with proven record.

The Insulator & Hardware must have Ball & Socket or Tongue & clevis coupling as per IS: 2486 (Part-II) / IEC-60120 / IEC 60471. The Hardware materials must be confirming as per IS: 2486 and must be made of forged steel / mild steel, casting will not be accepted. The Tension & Suspension Clamps must be of Bolted type and made of Aluminium alloy casting conforming to A6 of IS: 617. All the ferrous parts must be hot dip galvanized except for spring washer which must be electro galvanized. The hardware fittings to be used along with the covered conductor should have an exclusive design in such a manner that it should never destruct the outer insulation of covered conductor while it is strung.

It shall be clearly specified how each type of the above insulators and hardware can be fixed rigidly on pole / tower. The necessary drawings which depict the same should also be furnished.

Plastic insulator clamps/ties

The Clamps / ties shall be designed suitably to hold the MVCC in its position on top of the insulator. The Clamps is preferred to be made of Insulating Plastic materials or protected with Insulating Plastic material to ensure tracking resistance and to avoid any insulation damage to covered conductor due abrasion while mechanical or wind induce vibration. For attachment of Covered Conductors (35 - 240 mm²) to pin or spool type insulators. Fixing of insulator Top Use temperature: - 30° C to + 40° C.

TECHNICAL SPECIFICATION FOR 33 KV AND 11KV OUTDOOR VACUUM CIRCUIT BREAKERS

1. SCOPE

- 1.1. This specification covers design, manufacturing, assembly, testing at manufactures works, supply of 11KV and 33 KV Vacuum Circuit Breakers complete with all accessories required for their satisfactory operation for the sub-transmission system. The Breakers shall be used for Transformer protection or Feeder Control in the system. The Vacuum Circuit Breakers shall be complete with all the accessories and auxiliary equipments required for their satisfactory operation in various sub-stations of APDCL.
- 1.2. The breaker shall conform, in all respects to highest standards of engineering, design and workmanship as per recent Indian or International standards. It shall be capable of performing in continuous commercial operation up to the supplier's guaranteed life in a manner acceptable to the purchaser
- 1.3. The equipment offered shall be complete with all parts necessary for their effective and trouble-free operation. Such parts shall be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in this bid document/work order or not.
- 1.4. The Bidder/supplier shall bind himself to abide by the considerations of the technical specifications to the entire satisfaction of the purchaser and shall be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

2. SYSTEM CONDITIONS

The Vacuum Circuit Breakers shall be designed for the power system having the following parameters.

- a) Nominal system voltage: 11KV/33KV
- b) Highest system voltage: 12KV/ 36KV
- c) Number of phases: 3
- d) Frequency: 50 Hz \pm 3%.
- e) System earthing: Solidly earthed neutral
- f) Short Current Rating: 26.3kA for 3 sec for 33kV/ 25kA for 3 sec for 33kV. (Minimum)

3. SERVICE CONDITIONS:

Maximum altitude above sea level	100m
Minimum ambient air temperature	45°C
Maximum daily average ambient air temperature	40° C
Minimum ambient air temperature	2° C
Maximum temperature attainable by an object exposed to the sun	60° C
Maximum yearly weighted average ambient temperature	32° C
Maximum relative humidity	98%
Average number of thunderstorm days per annum (isokeraunic level)	45→50(MV)
Average number of rainy days per annum	120
Average annual rainfall	2200 mm
Maximum annual rainfall	3500 mm
Maximum wind pressure	260Kg/m ²
Seismic level(Horizontal acceleration)	0.24g to 0.48g
Climatic condition Moderately hot and humid tropical climate conducive to rust and fungus growth.	

4. STANDARDS

- 4.1. The design, manufacture and performance of the Vacuum circuit breaker shall comply with all currently applicable statutes, regulations and safety codes.
- 4.2. Equipment, meeting any other authoritative standard, which ensures equal or better quality than the standard mentioned above, would also be acceptable. The bidders shall clearly indicate the applicable standards to which their equipment complies-with. A copy of such standard may also be enclosed.

#	Standard	Item
1	IS 13118/ IEC 62271 -100 amended upto date	High-voltage alternating-current circuit-breakers.
2	IEC 694	Common clauses for switchgear
3	IS 2099/IEC:815 IS 5621:1980	Porcelain Bushings
4	IS 2544	Porcelain Post Insulators
5	IE C-2331	High Voltage porcelain bushings.

6	IS 325 -	Specification for 1phase induction motor
7	IS 12063/ 1987 IEC: 529	Degree of protection provided by enclosures of electrical equipment.
8	IS 5	Colour for ready mixed paints and enamels.
9	IEC - 60 -	High voltage test techniques
10	IS 5578 & IS:11353	Marking and arrangements for switchgears, busbars, main connections and auxiliary wiring.
11	IS 4794	Push button switches.
12	IEC - 71 Part-I & II -	Insulation co-ordination, Terms, definitions, principles and rules
13	IEC 270-	Partial discharge measurements.
14	IS 2629 -	Recommended practice for hot dip galvanizing of iron and steel.
15	Indian Electricity Rules 2005	

5. KEY TECHNICAL PARAMETERS

- 5.1. The circuit breakers shall be suitable for outdoor operation under the climatic conditions, as specified under 'Service Conditions' for power transformers, without any protection from sun and rain.
- 5.2. The circuit breakers shall have the following rating :

S.No.	Particulars	33 KV	11 KV
i)	Number of Poles	3 Nos.	3 Nos.
ii)	Frequency	50 Cycles	50 Cycles
iii)	Nominal System Voltage	33 KV	11 KV
iv)	Highest System Voltage	36 KV	12 KV
v)	Interrupting Capacity at nominal system voltage	1800 MVA	500 MVA
vi)	Rated Continuous Current	1250 Amps	1250 Amps
vii)	Short-time Current Rating for 3 Secs.	26.3 KA	25 KA
viii)	Basic Insulation Level	170 KV	75 KV
ix)	Power Frequency Withstand Voltage for one Minute	70 KV	28 KV
x)	Total Break-time for any Current up to the rated breaking current	3 cycles (max.)	3 cycles (max.)
xi)	Control Circuit Voltage	110 Volt D.C.	110 Volt D.C.
xii)	Operating duty for gang operation	0 – 0.3 Sec – CO – 3 Min – CO	0 – 0.3 Sec – CO – 3 Min – CO
xiii)	Mechanical Endurance	M2 class	M2 class
xiv)	Electrical Endurance	E2 class	E2 class
xv)	Capacitor Switching Duty	C2 class	C2 class
xvi)	The VCBs shall be suitable for one reclosing followed by one delayed reclosing and lock out		
xvii)	Minimum clearances		
a)	Between Phases	430 mm	280 mm
b)	Between Live Parts & Ground	4000 mm	3700 mm
c)	Creepage Distance	900 mm	300 mm

The above are minimum requirements. The manufacturers may offer their standard design, keeping in view our minimum requirements.

6. GENERAL TECHNICAL REQUIREMENTS

- 6.1. The circuit breaker shall be of porcelain clad, arc interruption in vacuum type. The breaker, complete in all respect, shall be supplied with all accessories in-place and all internal wiring installed and terminated in the mechanism housing and the equipment shall be complete in all respects.
- 6.2. The circuit breakers shall provide rapid and smooth interruption of current under all conditions, completely suppressing all undesirable phenomena, even under the most severe and persistent short-circuit conditions or when interrupting small currents or leading / lagging reactive currents. The details of any device incorporated to limit or control the rate of rise of re-striking voltage (R.R.R.V.) across the circuit breaker contacts shall be stated. The over voltage caused by the circuit breaker switching on inductive or capacitive load shall not exceed 3.2 times the normal phase to neutral voltage. The total break-time for the circuit breaker, throughout the range of breaker operating duty, shall be stated in the tender and shall be guaranteed. The breaker shall be fit for capacitor switching for 5 MVar Bank.
- 6.3. The breakers shall be provided with 'trip free' mechanism.
- 6.4. The circuit breakers shall be suitable for mounting on steel structures. The cost of necessary frames for mounting the circuit breakers shall be included in the offered prices. **Strongly supported bracket or frame, for mounting associated 3 nos. 11 KV / 33 KV CTs, shall also be provided.** All the structures shall be hot dip galvanized with 3 dips. Please note that cantilever type supports for mechanism box are not acceptable. The mechanism box shall have firm supports from bottom. This is necessary to minimize vibration of mechanism box, which in turn may disturb various settings. The agency shall indicate clearly the vibration level and dynamic load of the breaker during fault / normal ON OFF operations in all three directions.
- 6.5. The circuit breakers shall consist of three identical phase units with a common operating mechanism. While offering the circuit breaker, the following details should be confirmed and furnished with the tender:
 - a) Complete construction details of the equipment offered. It should be noted that the breakers should be suitable for out-door duty. Indoor breakers accommodated in out-door kiosks are not acceptable.
 - b) Type, make & source of vacuum interrupters with relevant details shall be indicated in the offer, clearly.
 - c) The capacity of breaker to interrupt inductive and capacitive currents shall be indicated in the offer (rating of capacitor bank should be stated and type test report shall be furnished).
 - d) Spare availability of vacuum interrupter should be confirmed by the bidder for the designed expected life of the breakers being offered.
 - e) Items inside the cabinet made of organic material shall be coated with a fungus resistant varnish.

6.6 VACUUM INTERRUPTER

- a) Interrupters shall be rated for minimum 30,000 mechanical or load operations
- b) The design of the vacuum interrupter shall be such that it gives trouble free operation under normal load and fault conditions throughout the life of the equipment. As the efficiency of the breaker depends on the degree of vacuum inside the interrupter, manufacturer shall ensure that the same is maintained consistently during service. To know the residual life of vacuum interrupter, an indicator to indicate the status of contact erosion shall be provided.
- c) The insulating ceramic body of the interrupter should have high mechanical strength and it should be capable of withstanding high temperature without any significant deterioration in its mechanical and electrical properties.
- d) The metal / alloy used for the fixed and moving contacts shall have very low resistivity and low gas content. They should be resistant to arc erosion and the contact should have no tendency to get cold-welded under the high vacuum in the interrupter. Silicone encapsulated Interrupters to avoid tracking due to condensation
- e) The interrupter design should ensure rapid de-ionization of the gap so that normal electrical strength of the gap is restored instantaneously.
- f) The metallic bellow or any other similar vacuum sealing arrangement should be provided at the moving contact and should have a long fatigue life.
- g) Manufacturer's catalogue on vacuum interrupter, indicating all the details shall essentially be submitted with the tender.

6.7 MOUNTING OF 11 KV / 33 KV CTs

The offered steel structures for breakers to be supplied by the bidders should have provision and adequate strength to accommodate 3 nos. 11 KV / 33 KV CTs on it after provision of suitable supports from ground.

6.8 TEMPERATURE RISE

The maximum temperature attained by any part of the equipment, when in service at site, under continuous full load conditions, exposed to the direct rays of the sun, shall not exceed 45° Centigrade, above maximum daily average ambient temperature. The limits of temperature rise shall be as per relevant standards. The corrections proposed shall be stated in the tender and shall be subject to approval of the owner.

6.9 INSULATION OF THE CIRCUIT BREAKER

The insulation to ground, the insulation between open contacts and the insulation between phases of the completely assembled circuit breaker shall be capable of withstanding satisfactorily dielectric test voltage corresponding to specified basic insulation level in the standard.

6.10 INSULATORS

- a) The basic insulation level of the Insulator and insulating porcelains shall be as specified and porcelain shall be homogenous and free from cavities and other flaws. They shall be designed to have ample insulation, mechanical strength and rigidity for satisfactory operation under conditions specified above. All insulators of identical ratings shall be inter-changeable. The puncture strength of the insulators shall be greater than the flash

over value. The insulators shall be type tested from independent Govt. Laboratory as per relevant standards or at any recognized and reputed international laboratory or testing institutions.

- b) The porcelain housing for the interrupter shall be of a single piece construction without any joint. It shall be made of homogeneous, vitreous porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be of uniform brown or dark brown colour with a smooth surface arranged to shed away rain water or condensed water particles (fog).

6.11 OPERATING MECHANISM

- a) The circuit breakers shall be designed for remote control from the control room and in addition there shall be provision for manual operation of circuit breakers during maintenance and for local tripping and closing by the normal means.
- b) The circuit breakers shall have operation control and mechanical "open" "close" indicator, in addition to facilities for remote electrical indication.
- c) All metal parts in the mechanism shall be of corrosion resistant material. All bearings which require greasing shall be equipped with pressure grease fittings.
- d) The design of the operating mechanism shall be such that it shall be practically maintenance free. The guaranteed number of years in maintenance free operation, the number of possible full load and full rated short circuit current breaking operations without requiring any maintenance or overhauling shall be clearly stated in the tender bid. As far as possible, the need for lubricating the operating mechanism shall be kept to the minimum and eliminated altogether, if possible.
- e) The operating mechanism shall be of the spring charging type, by electric control under normal operation. The mechanism shall be trip free and operable electrically and mechanically. The mechanism shall be capable of performing satisfactorily, the reclosing duty cycles indicated above, within the time specified. All working parts in the mechanism shall be of corrosion resistant material and all bearings, which require greasing, shall be equipped with pressured grease fittings. The mechanism shall be strong positive quick in action and shall be removable without disturbing the other parts of the circuit breaker. The mechanism and breaker shall be such that the failure of any spring will not prevent tripping and at the same time will not cause any false tripping or closing. The operating Mechanism should be motor operated spring charged type preferably without chain drive. The motor for spring charging shall be suitable to perform satisfactorily for input supply voltage of 230 Volt A.C 50 Hz/D.C with a variation of **plus / minus 20 per cent**. The A.C. Motor should have overload protection. Provision should also be made for mounting of mechanism box at an adequate height and gear ratios shall be so chosen that one man should be able to charge the spring, without any additional efforts. Provision shall be available for charging the springs manually as well, and to close CB mechanically.
- f) The time taken for charging of closing spring shall not exceed 30 seconds. The spring charging shall take place automatically preferably after a closing operation. Breaker operation shall be independent of the spring charging motor which shall only charge the closing spring. Opening spring shall get charged automatically during closing operation.

As long as power supply is available to the charging motor, a continuous sequence of closing and opening operations (CO) shall be possible.

- g) In each circuit breaker, one potential free contact of the limit switch of spring charging motor shall be provided for remote indication of spring charged. This contact shall be wired up and brought to the terminal block.
- h) Electrical anti-pumping device shall be provided for breaker.

6.12 CONTROL CUBICLE

- a) A common control cubicle shall be provided to house electrical, controls, monitoring devices and all other accessories, except those which must be located on individual poles. The cubicle shall be gasketed and shall have weather-proof construction, fabricated from sheet steel of minimum 3 mm thickness. The type test report on degree of protection test (IP-55) shall also be furnished.
- b) There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Control cubicles shall be provided with double hinged door and padlocking arrangement. The door hinges shall be of union joint type to facilitate easy removal and the distance between hinges shall not exceed 350 mm. Door shall be properly braced to prevent wobbling.
- c) It shall have backwards slanting rain hood of 2 mm thick (14 SWG) sheet for protection against rain water.
- d) The cubicle shall have front access door with lock and keys, space heater, internal illumination lamp, 3 pins 5 Amp socket with individual ON-OFF switches shall be provided in the cubicle.
- e) For local operation following shall be provided :
 - i) LOCAL / REMOTE selector switch
 - ii) TRIP / NORMAL / CLOSE control switches with pistol grip handle
- f) The control circuits shall be designed to operate on 110 Volt DC, as indicated in the schedule and it shall be possible to adopt to work on other voltages by simply changing the operating coils. The shunt tripping coils shall be designed to operate satisfactorily within 110% and 70% of the rated DC supply voltage and the shunt closing coils should operate up to 85% of the rated DC voltage. These checks shall be repeated during pre-commissioning checks at site before putting the breakers in service.
- g) AC Power supply for auxiliaries will be available at 230 Volt (+/- 10% variation) single phases 50 C/s at substation. The agency shall be required to extend this supply, using proper protection, to desired location through cable.
- h) Necessary double compression type cable glands for the cables of the operating mechanism shall be provided. The cables used for operation are all un-armoured 2.5 sq. mm copper control cables of 1100 V grade. The cable glands shall be suitable for 1 no. 8 core and 2 nos. 4 core cables and cables as per site requirements. The gland plate should be made of non-magnetic materials and suitably drilled at site to suit the cable entry.
- i) The Circuit breaker shall be provided with trip free Mechanism so that tripping instructions could over-ride the closing instructions. An additional tripping coil shall also be provided in the trip circuit. The second coil shall have separate tripping lever arrangements in the mechanism, so as to avail full advantage of second trip coil. Also the

two trip coils shall have separate fuses in the DC circuit, so that in the event of any short circuit/damage in any one of the trip coils, the supply is available to the other one.

- j) The circuit diagram of Control circuit of VCB along with operating instructions (DOS/DON'T) shall be embossed on metallic plate duly laminated and the same shall be fixed on the rear door of the control cubicle from inside.

6.13 WIRING

- a) Wiring shall be completed in all respects to ensure proper functioning of the control, protection, monitoring and interlocking schemes.
- b) All the wiring shall be carried out with 1100 V grade, PVC insulated stranded copper conductor of 2.5 sq. mm as per IS: 1554.
- c) Each wire shall be identified at both ends with permanent markers bearing wire numbers as per wiring diagram.
- d) Wire termination shall be done with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals.
- e) All spare contacts of auxiliary switches etc. shall be wired up to terminal blocks in the control cubicle.

6.14 TERMINAL BLOCKS

- a) Terminal blocks shall be of 1100 V grade, box clamp type ELMEX 10 sq. mm or approved equivalent. Not more than two wires shall be connected to any terminal. Spare terminals, equal in number to 20% of active terminals, shall be provided.
- b) Terminal block shall be such located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.

6.15 TERMINAL CONNECTORS

6 Nos. Terminal bi-metallic connector suitable for Dog conductors shall be supplied with each breaker. For ensuring quality and uniformity, the owner may decide to specify the design of terminal connector, the material of terminal connector and thickness of clamps. Further compliance of which will have to be done by the agency without any extra cost. Suitable earth connector for earthing connections shall also be supplied. The connector drawing shall be got approved from the owner.

6.16 AUXILIARY CONTACTS

- a) Eight numbers each of auxiliary contacts both of the normally open and normally closed types shall be provided in each circuit breaker for use in the remote indication and control scheme of the circuit breaker and for providing safety interlocking. Special contacts for use with trip coils, which permit for relative adjustment with respect to the travel of the circuit breaker contact, shall also be provided, wherever required. There shall be provision to add more auxiliary contacts at a later date, if required.
- b) The normally open and normally closed contacts for the control and operation of the equipment shall have continuous current rating of 10 Amp. The Breaking capacity of the

contacts shall be minimum 2 Amp with circuit time constant less than 20 milli seconds at the rated D.C. voltage.

- c) Insulation level of auxiliary contacts shall be 1100 volts, 2.5 kV for 1 min.

6.17 ACCESSORIES

The vacuum circuit breaker shall be supplied as a complete unit with internal wiring installed and terminated in mechanism box and equipped with the following accessories:

1	Motor operated spring charged mechanism (nominal motor voltage – 230 V AC)	1 No.
2	Trip coil suitable for 110 V DC	2 Nos.
3	Closing Coil suitable for 110 V DC	1 No.
4	Pistol grip C.B. Control switch having Trip/ Normal/ Close	1 No.
5	Local / Remote selector switch	1 No.
6	Spring Charged indicator	1 No.
7	Manual operating handle for maintenance	1 No.
8	Facility for manual charging of spring	1 No.
9	Operation counter	1 No.
10	Auxiliary contacts (8 N/O + 8 N/C)	1 Set
11	Anti-pumping device suitable for 110 V DC	1 No.
12	Terminal connectors suitable for connecting Dog Conductor	6 Nos.
13	Cubicle illuminating lamp with cage and switch	1 No.
14	Spare terminals connectors	20% of Total Terminals
15	Mechanical ON/OFF Indicator	1 No.
16	MCB for both AC and DC supply	1 No. each
17	Space heater and ON-OFF switch in the mechanism box	1 No.
18	Power Type 3 Pin Socket with ON-OFF switch	1 Set
19	Earthing Terminals	2 Nos.
20	LED indicating lamps	Complete set

6.18 INDICATING LAMPS

The indicating LED lamps should have in-built low voltage protection Circuit (LVGP) and surge suppressor circuit. Lamp assembly should be of fire – retardant glass epoxy PCB, industrial heat resistant, fire resistant, non- Hygroscopic DMC material , chrome – plated corrosion resistant solid brass bezel , polycarbonate lens in desired colour shades of Red , Green, Amber, Yellow etc. the intensity of light should be minimum 100 mcd at 20 mA . Indication lamp should be suitable to operate on 110 V Direct Current supply source.

6.19 SURFACE FINISH

All metal sheet surfaces exposed to atmosphere shall be given two primer coats of zinc phosphate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limits specified. The paints shall be light admiral grey shade No.627 of IS 5. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

6.20 GALVANIZING

All ferrous parts including nuts, bolts, plain and spring washers of size M 10 and above, support channels, structures, etc. shall be hot dip-galvanized to conform to latest version of IS 2629 or any other equivalent authoritative standard. All other fixing nuts, bolts, washers of size below M 10 shall be made out of stainless steel.

6.21 EARTHING

The operating mechanism housing, support structures etc. shall be provided with two separate earthing terminals for bolted connection to 50 x 8 mm MS flat to be provided by the purchaser for connection to station earth mat. The connecting point shall be marked with "earth" symbol No.86 of IEC publication 117-1 part 1

6.22 MOUNTING

- a) The design and supply of support structure, required for mounting the Circuit Breaker in Purchaser's switch yard, shall be in the bidder's scope. The bidder's scope shall also include foundation bolts, nuts, plain washers, spring washers etc necessary for the support structure. The support structure can be lattice type or tubular type and shall be made out of hot dip galvanized steel. Wheel mounted type support shall not be accepted. The support structure shall be installed on a concrete plinth of 300 mm height to be arranged by the Purchaser. The height of the support structure shall meet the following requirements.
 - i) Vertical clearance of lowest live part as specified in clause 6.
 - ii) Minimum height of 2950 mm above the top of concrete plinth (This is a Statutory Regulation).
- b) The Circuit Breaker shall be connected to adjacent equipment in the switch yard through ACSR conductor.
- c) The loading data to be considered by the bidder for design of support structure shall include the following.
 - i) Dead weight of the Circuit Breaker, Structure, Bus Bars
 - ii) Operational steady state and impact loading
 - iii) Wind load on a Circuit Breaker, Structure, Bus Bars
 - iv) Short circuit forces
- d) The support structure shall be designed on the basis of applicable Indian/International Standards and codes of practice.

7 TYPE TESTS

7.1 Type test certificates on VCB for the following tests, strictly as per IS 13118, with latest amendment thereof, from any of the independent Govt. Laboratory, or at any recognized and reputed international laboratory or testing institution, shall invariably furnished:

- a) Short Circuit Duty Tests
- b) Out of phase making and breaking tests.
- c) Short Time Current Rating Tests
- d) Mechanical Endurance Test & Electrical operation Test.

- e) Temperature Rise Test
 - f) Lightning Impulse Voltage withstand Test
 - g) Capacitor Switching Duty Test for Single Bank of 5 MVAR capacity
 - h) Power Frequency withstand Voltage Test dry & wet
 - i) Degree of protection IP-55 for control cubicle
- 7.2 The above type test certificates must accompany drawing of type tested equipment, duly signed by type testing authority.
- 7.3 The above tests must not have been conducted on the equipment earlier than 5 years from the date of opening of bids.
- 7.4 In case of any change in design/type of Breaker already type tested and the one offered against this specification, the owner reserves the right to demand repetition of type tests, without any extra cost.

7.5 **ACCEPTANCE AND ROUTINE TESTS**

All acceptance and routine tests, as stipulated in relevant standards, shall be carried out by the manufacturer, in presence of owner's representative. Immediately after finalization of the programme of testing, the manufacturers/supplier shall give, fifteen days advance intimation to the owner, to enable him depute his representative for witnessing the tests.

8 **INSPECTION**

The inspection may be carried out by the purchaser or his representative at any stage of manufacture. The successful Bidder/manufacturer shall grant free access to the purchaser's representative/s at a reasonable notice when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

9 **RATING PLATES**

The detailed rating plate shall be as per IS and in addition, shall indicate the following:

- a) Circuit Breaker and its operating device shall be provided with rating plate/s made out of corrosion proof metal, marked with the following data. The data shall be either punched or engraved on the plate/s.
- b) Manufacturer's name or trade mark by which he may be readily identified.
- c) Serial number and type designation of CB & Operating mechanism
- d) Year of manufacture
- e) Voltage
- f) Lightning impulse withstand voltage
- g) Normal current
- h) Short circuit breaking current
- i) Duration of short circuit
- j) Mass of circuit breaker with support structure.
- k) Auxiliary D.C. supply voltage of closing and opening devices
- l) Out of phase making & breaking current
- m) A.C. supply voltage of auxiliary circuits.
- n) Insulation level

- o) Frequency
- p) Purchase order reference
- q) Operating sequence.

The rating plates shall be installed in such positions that the same shall be clearly visible to a man standing on ground. i.e. at the level of eye site.

10 **EXPERIENCE**

Minimum 3 years' experience in the field of design and manufacture of the equipment offered is essential for the bidder. Details in this regards shall be clearly stipulated in the offer.

11 **PERFORMANCE GUARANTEE**

The Vacuum Circuit Breakers offered shall be guaranteed for satisfactory performance for a period of 66 months from the date of receipt of complete Vacuum Circuit Breakers at destination store/site in good condition or 60 months from the date of satisfactory commissioning of Vacuum Circuit Breakers whichever is earlier. The equipments found defective/failed within the above guarantee period shall be replaced /repaired by the supplier free of cost within one month of receipt of intimation. If the defective/failed Vacuum Circuit Breakers are not replaced /repaired as per the above guarantee clause, the purchaser shall recover an equivalent amount as deemed fit from any of the supplier's bills.

12 **DOCUMENTATION**

12.1 All drawings shall conform to international standards organization (ISO) 'A' series of drawing sheet/Indian Standards Specification IS 656. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in System International Units.

12.2 **DRAWINGS:** The bidder shall furnish four sets of relevant descriptive and illustrative published literature/pamphlets and the following drawings for preliminary study:

- i) General outline drawings showing outside dimensions, shipping dimensions, weights, quantity of insulating media air receiver capacity and such other prominent details.
- ii) Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts, with lifting dimensions for maintenance.
- iii) Schematic diagrams of the scheme for control, supervision and reclosing.
- iv) Structural drawing, design calculations and loading data for support structures.
- v) Foundation drilling plan and loading data for foundation design.
- vi) Bill of Materials.
- vii) Type test reports of circuit breakers along with a separate list showing all the tests carried out with date & place of test.
- viii) Test reports, literatures and pamphlets of bought out items and raw materials.

12.3 The successful bidder shall submit THREE sets of final versions of all the above said drawings in A-3 size, bill of material, packing list & all type test reports for purchaser's approval to the office of CGM(PP&D). The purchaser shall communicate his comments/approval on the drawings to the supplier within reasonable period.

12.4 The successful bidder shall furnish in the form of nicely bound volumes, the manuals covering erection, commissioning, operation and maintenance instructions and all relevant information and drawings pertaining to the Vacuum Circuit Breakers as well as auxiliary devices. Each manual shall also contain one set of all the approved drawings type test reports as well as acceptance test reports to corresponding consignment dispatched. The total

- quantity of the operating manuals/approved drawings sets to be supplied by the supplier shall be equal to the number of three phase breakers of rating, ordered.
- 12.5 The manufacturing of the Vacuum Circuit Breakers shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the Vacuum Circuit Breakers prior to the approval of the drawings shall be at the supplier's risk.
- 12.6 Approval of drawings/work by the purchaser shall not relieve the supplier of any of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revisions of applicable standards, rules and codes of practices.

13 **PACKING AND FORWARDING**

- 13.1 The Vacuum Circuit Breakers shall be packed in suitable crates so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable materials shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper lifting arrangement such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.
- 13.2 Each consignment shall be accompanied by a detailed packing list containing the following information:
- i) Name of the consignee.
 - ii) Details of consignment.
 - iii) Destination.
 - iv) Total weight of consignment.
 - v) Sign showing upper/lower side of the crate.
 - vi) Handling and unpacking instructions.
 - vii) Bill of materials indicating contents of each package and spare materials
- 13.3 The supplier shall ensure that the packing list and bill of materials are approved by the purchaser before dispatch.

11 KV AND 33 KV METERING UNITS FOR FEEDER METERING

1. SCOPE:

This specification covers design, engineering, manufacture, **assembly; stage testing, inspection**, testing before dispatch, supply and installation and commissioning of 11KV & 33KV CT PT Combined Metering unit Sets of class of accuracy **0.5 for 11 KV, 0.5 for 33 KV** as per the particulars given in the schedule attached.

2. STANDARD:

Except where modified by this specification the component parts of the equipment shall comply with the following ISS available (the latest versions):

Current Transformers	IS 2705/1992
Potential Transformers	IS 3156/1992
HV Porcelain Bushing	IS 5621
Insulation Oil	IS 335/1983
Galvanization	IS 2629
Structural Steel (Std. Quality)	IS 2062

Colours for ready mix paints	IS-5
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3. TYPE FOR 11 KV:

The metering transformer equipment shall be of pole mounting type for outdoor use. They are to be used in 11KV Three Phase with solidly earthed neutral and suitable for 3 Phase 4 Wire 50 cycles network. The equipment is required for operation of HT Tri-vector Meters and shall be oil cooled.

The CTPT sets shall have the following ratings:

S.N	Description	CT	PT
1	Type	Three Single phase	One three phase Star/Star
2	Accuracy Class	0.5S	0.5
3	Rated frequency	50 HZ(+)/(-) 5%	50 HZ(+)/(-) 5%
4	Rated primary current	100A / 200A	N/A
5	Rated secondary current	5 Amps	N/A
6	Rated primary voltage		11KV
7	Rated secondary voltage		110/ $\sqrt{3}$ V
8	Rated burden	5 VA at (0.8 lagging PF) per phase	30 VA (0.8 lagging PF) per phase
9	Rated voltage factor		1.5 continuous and 1.9 for 30 sec.
10	Current Density	1.5 A/sq.mm.	
11	Short circuit current withstand time	18 KA for 1 second	
12	Dynamic current Power frequency	28 KA	
13	withstand voltage on primary winding	28 KV for one minute	28 KV for one minute
14	withstand voltage on secondary winding	3 KV for one minute	3 KV for one minute
15	Lightning Impulse withstand voltage	75 KV	75 KV
16	Winding materials	Copper	Copper
17	Class insulation	A	A
18	Instrument Security Factor	Less than 2.5	
19	Maximum allowable temperature rise	50 °C	50 °C

4. TYPE FOR 33 KV:

The metering transformer equipment shall be of pole mounting type for outdoor use. They are to be used in 33 kV Three Phase with solidly earthed neutral and suitable for 3 Phase 4 Wire 50 cycles network. The equipment is required for operation of HT Tri-vector Meters and shall be oil cooled.

The CT-PT sets shall have the following ratings:

S.N	Description	CT	PT
1	Type	Three Single phase	One three phase Star/Star
2	Accuracy Class	0.5 S	0.5
3	Rated frequency	50 HZ(+)/(-) 5%	50 HZ(+)/(-) 5%
4	Rated primary current	200/400 A	N/A

5	Rated secondary current	5 Amps	N/A
6	Rated primary voltage		33 KV
7	Rated secondary voltage		$110/\sqrt{3}$ V
8	Rated burden	5 VA (0.8 lagging PF) per phase	30 VA (0.8 lagging PF) per phase
9	Rated voltage factor		1.5 continuous and 1.9 for 30 sec
10	Current Density	1.5 A/sq. mm.	
11	Short circuit current withstand time	25 KA for 1 second	
12	Dynamic current	40 KA	
13	Power frequency withstand voltage on primary winding	70 KV for one minute	70 KV for one minute
14	Power frequency withstand voltage on secondary winding	3 KV for one minute	3 KV for one minute
15	Lightning Impulse withstand voltage	170 KV	170 KV
16	Winding materials	Copper	Copper
17	Class insulation	A	A
18	Instrument Security Factor	Less than 2.5	
19x	Maximum allowable temperature rise	50° C	50° C

5. DESIGN:

- a) The equipment shall be designed to ensure satisfactory operation under all conditions of service to facilitate easy inspection, cleaning and repairs.
- b) The design shall incorporate every reasonable precaution and provisions for safety of all those concerned in the operation and maintenance of the equipment. A pressure relief valve shall be invariably provided to the CT PT set. It shall be provided at the top cover of the tank.
- c) All outdoor apparatus shall be so designed that water cannot collect at any point and enter the CT/PT set. The top cover of the tank, secondary terminal cover, inspection chamber cover plate is suitable bent at the edges **(at least 25mm bent)** so that the gaskets are not exposed to moisture.
- d) **No inspection cover at any side of the CTPT shall be provided.**
- e) All connections and terminals shall be of sufficient size for carrying the specified currents continuously without undue heating.
- f) **The CTPT sets shall be hermetically sealed type (shall not communicate with atmospheric air) in construction without any oil conservator.** The workmanship shall be of the highest standard.
- g) All bolts, nuts, washers in contact with non-ferrous parts shall be of brass.
- h) All ferrous parts including bolts & nuts liable to corrosion, forming integral part of the equipment shall be smoothly and continuously hot dip galvanized.
- i) The secondary terminal box and oil gauge shall be arranged with MU.

- j) The core shall be high grade non-ageing electrical silicon laminated steel or of better grade of low hysteric loss and high permeability to ensure high accuracy, at both normal and over current / voltage.
- k) All winding shall be of insulated high grade Electrolytic copper wire and the manufacturing of the units shall be done completely closed and air-conditioned room otherwise fibre glass insulation sleeves are to be provided for primary winding. Details of winding and core shall be furnished

6. SEALING:

Sealing arrangement for sealing on the secondary terminal box (both inner & outer door) and the top cover of the tank in the two opposite corners shall be provided. This may be made by providing a hole on tail of corner bolts of adequate size to pass the sealing wire or above 13 SWG.

7. FLUCTUATION IN VOLTAGE AND FREQUENCY:

For continuous operation, entire equipment shall be subjected to variation of voltage up to plus 20 minus 30 frequency of plus or minus 5 percent.

8. CORE:

8.1 CORE MATERIALS:

Non aging oxide film coated fresh suitable Mu-metal or Mu-metal plus CRGO toroidal cores for CT. For lamination of PT first quality laser grade CRGO shall be used as core material. All the stresses developed due to cuttings, punching etc. shall be relieved by suitable stress relieving process.

8.2 CORE CONSTRUCTION AND DESIGN:

Core is supporting steel and insulation shall be such that harmful changes in electrical and physical properties shall not occur during the life time of the CTPT unit.

Core winding shall be strongly braced so that it shall not get displaced in operation due to shrinkage on short circuit forces. Core assembly shall be rigidly clamped with M.S. Channel and mounted to the tank.

8.3 CORE OF PT:

The core of PT shall be effectively earthed by copper braided flexible wire of minimum area of 40 mm² cross-section. The core shall be rigidly branched with insulated bolts and the assembly shall be rigidly clamped with MS Channels and mounted on the tank.

8.4 CORE OF CT:

The tenderer shall provide toroidal core only. It shall be same as given in type tested unit. Core / Winding assembly of CT shall be rigidly mounted in the tank.

8.5 WINDING:

It shall be of electrolytic grade copper conductor with super enameled Insulation, conforming to relevant ISS. The winding design and contraction shall be such that it shall withstand impulse voltage. The details as per Guaranteed Technical Particulars shall be provided. The winding shall be preferable in two sections.

CT WINDING:

It shall be of electrolytic grade copper conductor with DPC/DCC and super enameled insulation conforming relevant ISS. The winding design and construction shall be such that it shall withstand impulse voltage and short circuit currents. The winding shall be provided with rigid insulating supporting hylum sheets of minimum 5 mm thickness on both the sides duly tightened by insulating fasteners only and by cotton cord etc.

- a) Each coil shall be wound of paper insulated, continuously, smooth high grade, electric copper conductor.
- b) The materials used in the insulation and assembly of the winding shall be in-soluble, non-catalytic

and chemically inactive in the transformer oil.

c) Winding assembling shall be dried in vacuum thoroughly shrunk to final alignment and vacuum impregnated with tested transformer oil.

d) Design arrangement, insulated and assembly of the winding on the core shall be so as to ensure uniform distribution of voltage amongst all coils.

9. BUSHING:

- a) Brown glazed HV bushing of approved make shall mounted as stated in 4(e) of Annexure-I on top cover of tank. The list of approved suppliers for Porcelain insulators may be obtained from this office. The hollow porcelain bushings shall be confirming to IS-5621. The metal parts of the bushings shall be tinned copper with minimum tinning with 50 micron with spring washer and plain washer (minimum 2.0 mm thick electroplated) with 3 (three) nos. nuts, one lock nut and two nuts for terminal connection
- b) Bushing clamping and accessories together with the connected bolts/studs shall be hot dip galvanized. However, nuts and washers shall be SS-304.
- c) Arcing horn shall be avoided.
- d) Suitable bird guard will be required for all HT bushings

The tests as per IS-2099/1962 shall be conducted on the transformer bushings as detailed below:

- a) Dry flash over voltage.
- b) Wet flashover voltage.
- c) Dry 1 Min. withstand volt,
- d) Impulse withstand voltage (1.2/50 Micro Seconds –ve wave).
- e) Manufacturer s test certification may be furnished for every lot of offer.

The bushings shall be of reputed manufacturers like M/s. Jayashree Insulators, M/s. WS Industries, M/s. BHEL, M/s. Allied Ceramics, M/s. India Potteries and M/s. IEC which are having complete testing facilities.

10. STEEL TANK:

The tank shall be fabricated from fresh MS Sheet of 5mm, thickness for top cover, flange and bottom of the tank and of 3.0mm thickness for side walls so as to withstand pressure built in during the expansion of oil during temperature rise or forces generated during short circuit. The expose fabricated tank with cover and other ferrous fittings shall be thoroughly cleaned, scrapped process and hot dip galvanized as per relevant IS-2629. All nuts, bolts, washers, screws, etc. exposed to the atmosphere shall be of 304 grade of stainless steel.

The curb of the tank shall be minimum 50mm wide. The top cover shall have slope of minimum 10 degree to drain off water in rainy season. The oil resistant gasket of neoprene rubber or nitril or synthetic rubberized cork of minimum 8mm thickness shall be provided. Adequate number of SS-304 grade bolts of M12 x 50mm (length) size bolts at maximum 115mm (with tolerance of mm) C/C apart with 2 mm thick washer of 304 grade SS shall be provided. Four numbers of lifting lugs of 5mm thickness shall be provided on tank sides and two nos. on top cover. The top cover shall be fabricated in such a way that nowhere the top cover gasket is exposed to air. Suitable PRV are to be placed on the top cover of the tank to prevent explosion

11. TERMINAL BOX

The terminal box shall be closed box type, water/vermin proof with tinned copper terminals of minimum 6mm dia x 35mm with electroplated spring washers and three numbers nuts. The terminal marking and polarity marking shall be done by etched aluminum square plated duly fixed in irremovable manner. The terminal box shall have cable entry hole to accommodate metallic gland (approx of 1.1/4" size) suitable to termination of 10 core, 2.5 Sq. mm PVC insulated steel armored cable. The terminal box covers shall have the provision of sealing the terminal box for which minimum Four nos. of corner bolts to be fixed on the flange of the box shall be provided with adequate hole on the bottom for sealing purpose. The terminal box with the cover closed and cable in position must have degree of protection conforming to IP-54. The minimum projection of the box shall be 70mm.

The Serial number, ratio, and date of dispatch shall have to be ENGRAVED on side (opposite to secondary terminal box), of tank with letter of suitable depth and 25mm height filled with RED color.

The fabrication of the CTPT set tank shall be such that there shall not be any oil leakage from welded positions. **The four numbers corner bolts of top cover shall have suitable hole for inserting sealing wire.**

- a) Secondary chamber shall have double door (inner & outer) with suitable arrangement for sealing of both the doors. **The inner door shall be of**

transparent Polycarbonate so that secondary terminal connections can be viewed without breaking the inner door seals.

- b) The following details of equipment shall be engraved on tank with at least 10 mm letters.

1. Make:
2. Ratio:
3. Class of accuracy:
4. Serial No:
5. Month & year of manufacturing
6. Property of employer

66(Sixty Six) months guarantee embossed plate shall be welded opposite side of name plate.

MOUNTING ARRANGEMENT:

The under base of all CTPT sets shall be provided with two nos of 150x75x6 mm GI channels and foundation dimensions shall be suitably placed with tank base uniform for all sets with only ± 2 mm tolerance, to avoid modification of structure / plinth, whenever CTPT set is replaced.

12. OIL:

The transformer oil to be supplied in the CTPT tank shall be new oil conforming to requirements as stated in Annexure-II when tested according to IS-335/1983

The current transformer shall be so constructed as to ensure that the oil does not flow or leak out even when the current transformer is used continuously at the maximum allowable temperature; similarly the potential transformer shall be so constructed as to ensure that the oil does not flow or leak out

Oil shall be filled up to the top of HT side bushing, hence necessary provision shall be made for expansion of oil due to rise in temperature.

13. GUARANTEED TECHNICAL PARTICULARS:

The Technical Particulars as specified in IS shall be guaranteed. Every tenderer shall furnish the particulars required and guarantee the values so furnished for the supplies.

14. CABLE DETAILS:

The terminal box shall have cable entry hole of size 38mm dia. with 1.1/4 inch double compression flame proof metal cable glands to avoid cutting of cable sheath. The terminal box shall have provision to seal the terminal box.

15. CLEARANCE:

The minimum air clearance for HV shall be as per IS-3347.

16. TESTING & INSPECTION:

16.1 QUALIFICATION:

The tenderer shall have to furnish to following test certificates and documents.

- i. All type tests certificates as listed under Annexure-III carried out on ONE single sample unit and tests must not be carried out more than Three years prior to the date of submission of the tender offer. The above test shall be carried out in any Govt. approved Test Lab as indicated above.
- ii. The tenderer shall also submit one type test certificate for the test of "Instrument Security Factor" as per the Cl. No. 7.1.2 of IS-2705 (Part-II). The value of ISF must be 2.5 or less than 2.5 and the test must have been conducted at any Govt. Testing Lab not prior to more than 3 years from the date of submission of the offer.
- iii. The copy / proof of bill / invoice of purchase of core material.
- iv. The copy of BH curve for the core material intended to be used in regular supply of CTPT units.

If above test certificates are not submitted the offer will not be considered as "Qualified".

NOTE: The technical offers of the suppliers submitted along with above Type Test Certificates for Three Phase combined CTPT unit (with all other technical specifications unchanged) conducted successfully on one single unit with all other rating and specification, i.e. STC, ISF etc. unchanged, will also be considered / accepted for evaluation purpose. However the successful / qualified tenderer shall have to prepare the prototype units as per tender's requirement and get tested for all tests (as per **APDCL's** discretion) at any Govt. Test Lab prescribed by the **APDCL** and in the

presence of **APDCL's** officer, within a period on ONE month from the date of LOI, failing to which the order shall be liable to be canceled without payment toward any compensation on account of cancellation of the order by the purchaser.

16.2 TYPE TEST CERTIFICATE:

On the strength of above qualification, LOI will be placed if offer passed in other requirements. However, before commencement of bulk supply, the supplier has to submit Test Certificates for all the Type Tests as prescribed under Annexure-III for CTPT sets with ration as specified.

All the tests as specified in Annexure-III shall have to be conducted only in the presence to the **APDCL's** representative on ONE single Proto / sample unit.

The FINAL purchase order OR A/T shall be placed only after successful type testing on Proto units in the presence of **APDCL** authority.

NOTE: The time limit for above test must be 30 days or whichever approved by **APDCL**. The cost of all type testing and its related expenses shall have to be borne by supplier.

16.2.1 The **APDCL** in its discretion also reserves the right to carry out all or any type tests on any CTPT set from the lot offered for inspection by the firm at CPRI / ERDA or Govt. Recognized Lab. in presence of **APDCL** officers and representative of firm at **APDCL's** cost. Any decision based on this testing shall be applied to the full ordered quantity. However, if the unit fails in test, then the test charges shall have to be borne by the supplier.

16.3 ACCEPTANCE TESTS:	
The tests shall be carried out at manufacturer's works as "Acceptance Tests" on all CT PT sets offered for inspections as per applicable is of individual units and this specification as per Annexure-IV.	
16.4 ROUTINE TESTS:	
The firm shall carry out the routine tests on each CTPT set being offered for inspection and submit the routine test certificate to the inspector deputed for inspection of CTPT sets and acceptance of the lot. Routine tests shall be carried out as per Annexure-V	
16.5 PROTO TYPE UNITS	
The successful tenderer shall have to prepare minimum 2 nos. of proto type units or ratio as specified under Cl. No: 16.2 TYPE TEST CERTIFICATE: above, separately conforming to this specification prior to manufacturing of bulk supply. The prototype units shall be subjected to (i) all Acceptance Tests as per relevant clause.	
The testing fees shall have to be borne by the supplier.	

17. GUARANTEE:

The combined CTPT set offered shall have guarantee for good design, materials and workmanship. The defective units shall have to be repaired / replaced free of cost if reported **66** months of their receipt at site or **60** months from the date of commissioning of equipments whichever is earlier.

The firm shall be responsible for proper performance of the equipment for 66 months of their receipt at site or 60 months after commissioning whichever is earlier.

Reported failed units under guarantee period as above shall be repaired / replaced as early as possible. In any case, it shall be repaired / replaced within 30 days. The failed units are to be collected by the supplier from our field offices within 15 days of reporting. If immediate arrangement for collection of failed unit is not collected and if the units are not repaired within two months time, the **APDCL** will deduct full cost of CTPT unit from the bill. All the suppliers have to give 10% Performance Bank Guarantee in advance as security deposit.

ANNEXURE – III

1. Schedule of Type Test for CT as per clause No. 16.2

TYPE TEST CERTIFICATE:

1. Verification of terminal marking and polarity.
2. High voltage power frequency tests on primary windings.

3. High voltage power frequency tests on secondary windings.
4. Over voltage inter turn test.
5. Determination of error according to the requirement of appropriate accuracy class
6. Short time current test.
7. Impulse voltage test.
8. Temperature Rise Test.
9. Instrument Security Factor Test on Both phase of the CT as per Cl. No.7.1.2 of Is-2705 (Part-II).
10. High Voltage Power-frequency Wet withstand voltage test as per Cl. No.9.9 of IS-2705 (Part-I).

2. Schedule of Type Test for P.T as per Clause No. 16.2

TYPE TEST CERTIFICATE:

- I. Verification of terminal marking and polarity.
- II. Power frequency dry withstand test on primary winding.
- III. Power frequency dry withstand test on secondary winding.
- IV. Determination of errors according to the requirement of the appropriate accuracy class.
- V. Temperature rise test.
- VI. Impulse voltage test for voltage transformer for service in electricity exposed installation.
- VII. High Voltage Power-frequency Wet withstand voltage test as per Cl. No.9.7 of IS-3156(Part-I)

ANNEXURE – IV

3. Schedule of Acceptance Test for CT as per clause No. 16.3

ACCEPTANCE TESTS:

1. Verification of terminal marking and polarity.
2. High voltage power frequency tests on primary windings.
3. High voltage power frequency tests on secondary windings.
4. Over voltage inter-turn test.
5. Determination of error according to the requirement of appropriate accuracy class.
6. Instrument Security Factor Test on Both phase of the CT as per Cl. No.7.1.2 of Is-2705 (Part-II).

4. Schedule of Acceptance Test for P.T. as per Clause No. 16.3

ACCEPTANCE TESTS:

1. Verification of terminal marking and polarity.
2. Power frequency dry withstand test on primary winding.
3. Power frequency dry withstand test on secondary winding.
4. Determination of errors according to the requirement of the appropriate accuracy class.

ANNEXURE – V

5. Schedule of Routine Test for CT as per relevant clause,

ROUTINE TESTS:

1. Verification of terminal marking and polarity.
2. High voltage power frequency tests on primary windings.

3. High voltage power frequency tests on secondary windings.
4. Over voltage inter-turn test.
5. Determination of error according to the requirement of appropriate accuracy class.
6. Instrument Security Factor Test on Both phase of the CT as per Cl. No.7.1.2 of Is-2705 8 (Part-II).

6. **Schedule of Routine Test for P.T. as per relevant Clause,**

ROUTINE TESTS:

1. Verification of terminal marking and polarity.
2. Power frequency dry withstand test on primary winding.
3. Power frequency dry withstand test on secondary winding.
4. Determination of errors according to the requirement of the appropriate accuracy class.

3. **DRAWINGS AND LEAFLETS (along with tender):**

Two sets of drawings showing clearly the general arrangements, sectional views, fitting details, electrical connections, *foundation details*, *overall dimensions* and design features of each component part shall accompany the tender. The contractor has to submit clear & detail drawing with description how he will arrange the double door system in secondary chamber with sealing. Technical leaflets giving the operating instructions shall also be furnished along with tender. Literature and drawings are to be sent along with each equipment while dispatching, after approval of Project Manager.

4. **DEVIATIONS :**

The deviations between these CTPT sets and NABL approved Standard Lab (CPRI, ERDA, etc.,) type tested CTPT set along with detailed reasons for deviations if any shall be submitted along with tender.

5. **TOLERANCES :**

Unless otherwise specified herein the test value of the transformers supplied shall be within the tolerance permitted in the IS on the guarantee values.

6. **SEALING OF CTPT SETS AFTER TESTING AND INDIVIDUAL TEST REPORTS :**

After witnessing testing on sample quantity and physical inspection of all offered CTPT sets, the purchasers representative will provide numbered plastic seal bits to two opposite corners of tank, Secondary Chamber of all offered CTPT sets, for delivery of correct inspected materials only. The manufacturer has to provide test report duly mentioning all test results, seal bit numbers and name & address of Employer representative after inspection is over. The seal bit numbers shall also be mentioned in the test reports signed by Employer representative submitted for delivery instructions.

7. **INSPECTION AND TESTING OF TRANSFORMER OIL**

To ascertain the quality of transformer oil, the manufacturer's test report shall be submitted at the time of inspection. Arrangements shall be made for testing the transformer oil, after taking out the samples from the manufactured CTPT sets and tested in the presence of Employer representative (or) if desired, in an independent laboratory manufactured CTPT sets and tested in the presence of Employer representative (or) if desired, in an independent laboratory.

8. **NAME PLATE :**

The Purchase order No. and Date of purchase order, the words **"PROPERTY OF EMPLOYER NAME"**. The name plate shall be non-detachable type & fixed with rivets, not with bolts & nuts. The name plate shall bear year & month of manufacture & other data as per IS. Space shall be provided to punch the date of installation by user group.

9. **WARRANTY :**

The manufacturer will warrant for the satisfactory functioning of the material / equipment as per specification for a minimum period of 66 months from the date of dispatch of the material / equipment in good condition indicating GP covering date upto ----- .The tenderer shall indicate the source of all materials. He shall also indicate the name of the manufacturer and make of conductor, Transformer oil Electrical Steel Laminations, Construction Steel etc.

10. FITTINGS :

The following fittings / accessories are to be provided to the CTPT units.

a)	Drain plug 19mm (3/4" size) at the bottom of the tank with pad lock.	1 No
b)	Oil level Gauge	1 No
c)	MS earthing terminals with two nos. nut & bolts and washer with earth symbol	2 Nos
d)	Rating and terminal marking plate (Etched All) riveted to tank. (The rating plate shall have all details as per IS-2705 and 3156 along with order no. of APDCL and connection diagram).	1 No
e)	Lifting lugs of minimum 8mm thick	2 Nos on top cover and 4 Nos on tank side
f)	Base mounting channel MS 150mm x 75mm x 6mm	2 Nos
g)	Oil filling hole with cap	1 No
h)	PRV	1 No
i)	HV porcelain bushings of approved make as per Annexure-I. If the supplier wants to use any other make bushing then it shall be got approved from APDCL before use and it shall be clearly indicated in Annexure-I-B. ii) LV terminals (Minimum 6 mm dia) tinned copper with spring washer Plain washer and nuts with phase and polarity marking etched plated. iii) 30 mm Double Compression-Flame Proof metallic Gland. iv) Bird guard for HT side bushings.	As required

TECHNICAL SPECIFICATION FOR ENERGY METER

1.1 GENERAL

This Chapter describes the common requirement for static energy meter required for HT feeder. The seals & sealing specifications are given in Annexure A.

1.2 STANDARDS APPLICABLE

Unless otherwise specified elsewhere in this specification, the performance & testing of the meters shall conform to the following Indian/International standards with updated and latest amendments/revisions thereof.

S. No.	Standard No.	Title
1.	IS 14697-1999	AC Static Watt-hour Meters for active energy Class 0.5s & 0.2s
2.	BIS 12063	Specification for degree of protection
3.	IS 5133/1969	Specification for boxes for enclosure of electrical accessories
4.	IEC 60687	Specific for AC static Watt hour meter class 0.5 & 0.2
6.	IS 15959/2011	Data Exchange for Electricity meters
8.	CBIP Report No.-88	Specification for AC Static Electrical Energy Meters
9.	CBIP Report NO-325	CBIP Guide on Static Energy Meter- Specifications and testing
10.	CBIP Technical Report No.111	Specification for common meter reading instrument
11.	IS:9000	Basic environment testing procedure for electric and electronic item

Note: The meters shall be DLMS compliant and conform to Indian Standard IS: 15959 and its relevant amendments.

1.3 CLIMATIC CONDITION

The meter shall be able to perform satisfactorily in moderately hot and humid climate, conducive to rust and fungus growth as specified in Section-I. The climate conditions are also prone to wide variations in the ambient conditions. The meter shall work satisfactorily even under lightning conditions and also the meter performance and life shall not be affected due to smoke present in the atmosphere.

*The specifications are applicable for meter installation up to an altitude of 2200 meter above mean sea level. For meters to be used for an altitude of above 2200 MSL, necessary corrections shall have to be carried out in BIL and one minute power frequency with stand voltage capability as per relevant standard.

1.4 SUPPLY SYSTEM

Type of Meter	Input Voltage	Input Current	Burden	Type/Phase	Starting Current	Accuracy
HT Feeder Meter	3 x 110 volt phase to phase	5A	1.5 Watts/phase or 10 VA/phase for voltage circuit and 1 VA phase for each current circuit	3 phase 4 wire	0.1 % of basic	0.5s

1.5 POWER FACTOR RANGE

The meter shall be suitable for full power factor range from Zero (lag) to Unity to Zero (lead).

1.6 POWER SUPPLY VARIATION

Energy meter along with its accessories shall withstand following extreme operating condition.

Voltage: 60% to 130 % of V ref
 Frequency : 50 ± 5% Hz

The manufacturer can also offer meters, which can withstand higher variations. Meter shall maintain its accuracy in low voltages also.

Note: The meter shall withstand phase to phase voltage between phase and neutral for 15 minutes without damage and keep registering energy.

1.7 MAXIMUM CONTINUOUS CURRENT

The maximum continuous current in meters shall be the current at which the meter purports to meet the accuracy requirement of the specification. Meter terminals shall be able to carry 150%Imax for two hours continuously.

1.8 CALIBRATION

The meter shall be only factory calibrated and no modification of calibration shall be possible at site to ensure non- tampering of meter at site.

1.9 COMMUNICATION CAPABILITY

The Meter shall be provided with a galvanically isolated optical communication port as per IEC-1107/PACT/ANSI, with removable cover and with locking arrangement so that it can be easily connected to a CMRI for data transfer. The optical communication port shall also have sealing provisions. The manufacturer shall provide the requisite meter software, protocol software or any other software and all facilities required by the owner to use the WINDOWS based hand held CMRI for reading and retrieving the data from the meter and download them in owner's base computer station. The contractor shall demonstrate the data transfer through hand held CMRI and generating the appropriate reports to owner.

The meter shall have one RS-485/232 port in the form of RJ11 near the terminal block and shall not be accessible after sealing of terminal cover. It shall be used for remote communication with the central server station/SCADA via modem connected to the port as per the relevant DLMS protocol. The data shall be transferred at a baud rate of 9600 as per DLMS protocol.

1.10 NAME-PLATE MARKING OF THE METER

The marking on every meter shall be in accordance with relevant clauses of standard.

Every meter shall have name plate beneath the meter cover such that the name plate cannot be accessed without opening the meter cover and without breaking the seals of the meter cover and the name plate shall be marked distinctly and indelibly. The basic marking on the meter nameplate shall be as follows:

Name of Project

- a) Manufacturer's name & trade mark
- b) Type Designation
- c) No. of phases & wires
- d) Serial number
- e) Month and Year of manufacture
- f) Reference Voltage
- g) Rated current
- h) Reference Standard as applicable
- i) Principal unit(s) of measurement
- j) Meter Constant
- k) Class index of meter

- l) Property of <Name of owner>
- m) Purchase Order No. & Date
- n) Guarantee period

1.11 CALIBRATION AND TEST OUTPUT

The meter shall have test output accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator must be visible from the front. Test output device shall be provided in the form of one common/separate LED for KWh and KVARh as applicable with provision of selecting the parameter being tested. The test output device shall have constant pulse rate in terms of pulse/unit energy.

The meter shall be tested, calibrated and sealed at works before dispatch. Further, no modification or calibration shall be possible at site by any means.

The resolution of the test output shall be sufficient to enable the starting current test in less than 10 minutes.

1.12 INSTALLATION AND COMMISSIONING

The Bidder shall be responsible for total installation and commissioning of the meters (along with test blocks, if supplied separately) as per Owner's advice, including unpacking and inspection on receipt at site, mounting the meters, connection of input & output cables to the meters including any required rewiring, functional testing, commissioning and handing over. The Bidder's personnel shall procure/carry the necessary tools, equipment, materials and consumables (including insulated wires, lugs, ferrules, hardware etc.).

1.13 GUARANTEE

Manufacturer shall undertake a guarantee to replace the meters up to a period of 60 months from the date of operation. The meters, which are found defective/inoperative at the time of installation, or became inoperative/defective within the guarantee period, these defective/inoperative meters, shall be replaced within one month of receipt of report for such defective/inoperative meters.

1.14 SERVICES

Manufacturer shall also extend services to repair the meters on chargeable basis, up to a period of 108 months from the date when the guarantee period is over i.e. after 60 months of successful operation of the instant meter.

2.0 3 PHASE 4 WIRE 0.5s CLASS ENERGY METER FOR FEEDER (DLMS Compliant category A meters)

2.1 GENERAL & CONSTRUCTIONAL REQUIREMENTS

2.1.1 Meters shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However, the following shall be ensured:

- a) Personal safety against electric shock.
- b) Personal safety against effects of excessive temperature.
- c) Protection against spread of fire.
- d) Protection against penetration of solid objects, dust & water.
- e) Detection against fraud.
- f) Detection against pilferage.

2.1.2 The meter shall be designed with application specific integrated circuit and shall be manufactured using SMT (Surface Mount Technology). Power supply and voltage divider circuits may be of PTH technology. The meter shall be housed in a safe, high grade engineering plastic / polycarbonate casing, which is of projection mounting type and is dust/moisture proof, conforming to IP-51 of BIS 12063 / IEC 529.

2.1.3 All insulating material used in the construction of meters shall be non-hygroscopic, non-ageing and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion during operating life by providing suitable protective coating.

2.1.4 The meter shall be supplied with a transparent extended terminal block cover (ETBC). The meter base,

meter cover, terminal block and ETBC shall be made of unbreakable high grade fire resistant non-flammable reinforced, polycarbonate (not bakelite) or equivalent high grade engineering plastic, which shall form an extension of meter cases and have terminal holes and shall be of sufficient size to accommodate insulation of the conductors, meeting the requirement of CBIP technical report CBIP.88.

- 2.1.5 The extended terminal block cover shall be separately sealable at two places and housed at the bottom of the meters and once sealed shall prevent unauthorized tampering.
- 2.1.6 The terminal block shall have sufficient insulating properties, mechanical strength and shall have tin plated solid brass terminals with two fixing screws per terminal. The terminals shall be designed to withstand high overload.
- 2.1.7 The meter shall not get damaged or substantially influenced by the electromagnetic disturbances and electrostatic discharges caused by harmonics, voltage dips and short interruptions, transients, DC and AC magnetic field.
- 2.1.8 The meter shall have an operation indication device such as a blinking LED/ LCD. The operation indicator shall be visible from the front window and capable of being monitored conveniently with suitable testing equipment.
- 2.1.9 The meter shall conform to the degree of protection IP 51 but without suction in the meter as per IS: 12063/IEC:529 for protection against ingress of dust, moisture and vermin.
- 2.1.10 The meter-base, meter cover, terminal block and ETBC shall be made of unbreakable, high grade, fire resistant, reinforced, non-flammable, polycarbonate or equivalent high grade and good quality engineering plastic.
- 2.1.11 The terminal block, the ETBC and the meter case shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermic overload of live parts in contact with them.
- 2.1.12 The meter shall have **Zn plated MS/Nickel plated Brass** terminals. The terminals shall have suitable construction with barriers and cover to provide firm and safe connection of current and voltage leads of stranded copper conductors or copper reducer type terminal ends (thimbles).
- 2.1.13 The manner of fixing the conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixing which may be loosened and tightened several times during the life of the meter shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. The internal diameter of the terminal holes shall be 5.0 mm minimum. The clearance and creepage distance shall conform to relevant clause of IS 14697:1999/CBIP technical report No. 88.
- 2.1.14 The meter shall be compact in design. The entire construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.
- 2.1.15 The meter shall have a design to operate satisfactory for 10 years under normal electrical condition and guaranteed life of 60 months from the date of commissioning against manufacturing and design defects. The meters found defective within guaranteed period shall be replaced by manufacturer free of cost within one month of intimation.

- 2.1.16 The meter shall be provided with accurate quartz crystal based real time clock and calendar with the accuracy limit as per relevant standards. Meter shall have provision to synchronize the meter time with standard time through CMRI with proper security system.
- 2.1.17 The integration period shall be set as 30 minutes and subsequently can be changed on real-time basis.
- 2.1.18 Vendor will give one copy of all the software's (meter reading software for CMRI, software for uploading data from CMRI to computer).
- 2.1.19 It shall be possible to check the healthiness of phase voltages by displaying all the voltages on the meter display.
- 2.1.20 The Meter shall have battery backup to be read in absence of Power Supply.
- 2.1.21 The meter shall work accurately irrespective of phase sequence of the mains supply.
- 2.1.22 The meter shall remain powered up and functional even when either any two phases are available to the meter.
- 2.1.23 The meter shall record active energy, even if one or more CT"s are reversed. The current vector direction shall always be considered as positive (import) for computation of energy and shall be added in main active energy register.
- 2.1.24 Data Security: The Meter shall have multilevel password for data protection and security. The meter data retrieval shall be possible through authenticated CMRI. The meter shall support the event of change of TOD register timings / no. of TOD registers, demand integration period and /or setting the meter time through authenticated transaction and shall be logged as an event. The transaction events shall be available for viewing at BCS end.
- 2.1.25 The meter data shall be retrievable through CMRI and will be downloaded in the Base computer software for viewing, analyzing and printing. The meter data downloaded at BCS end shall be in user-friendly formats. The manufacturer shall supply the required software for base computer system. The base computer software shall have the facility to convert the required data (For billing, Energy Audit, tamper analysis purpose) in to ASCII format. This data shall be possible to be used as input data for any other software to generate desired reports as per the utility requirement.
- 2.1.26 The meter shall have radio interference suppression such that it shall not generate noise, which could interfere with the other equipment.
- 2.1.27 The meter shall have three fixing holes, one at the top and two at the bottom. The top hole shall be provided with a special clip at the back of the meter so that holding screw is not accessible to the consumer after fixing the meters. The lower fixing screws shall be provided under the sealed terminal cover. The requisite fixing screws shall be supplied with each meter.

2.2 SEALING OF METER

Reliable sealing arrangement shall be provided to make the meter tamper proof and avoid fiddling or tampering by unauthorized persons. For this, at least two no. of seals on meter body, two no. of seals on meter terminal cover and one no. of seal on each communication port shall be provided. All the seals shall be provided in front side only. Please refer Annexure A for specification for sealing system. **The meter cover and base shall be ultrasonically/chemically welded on at least three sides of the meter so that if the meter cover is opened there is clear evidence of tampering and the meter shall be completely broken.**

2.3 CONNECTION DIAGRAM & TERMINAL MARKINGS

The terminals shall be marked properly on terminal block for giving external connections. A diagram of connections shall be provided inside the cover of terminal block. The terminal cover shall be extended

such that when it is placed in position it is not possible to approach the connections or connecting wires. The terminals and the screws shall be suitable to carry upto 150% of I_{max} safely. The terminals shall have suitable construction with barriers and covers to provide secure and safe connections.

2.4 REMOTE READOUT FACILITY, COMMUNICATION CAPABILITY

The meter also shall have a separate individually sealable RS-485 communication port to communicate with Remote Terminal Unit (RTU) over Modbus protocol in multi-drop mode so that selected analog data can be communicated to central location for SCADA / DMS application. The implementation detail of MODBUS protocol shall be furnished by the bidder.

2.5 SOFTWARE

Licensed copies of the software (meter reading software for CMRI, software for downloading/uploading data from CMRI to computer) shall be made available and shall be installed on each common meter reading instrument (CMRI) and Base computer by the manufacturer.

Common Meter Reading Instrument (CMRI) would be loaded with user-friendly software (MS-DOS 5.0 or higher version compatible) for reading, downloading meter data and Time of Day (TOD) programming in the meter.

Windows based *user interactive* Software for receiving data from CMRI and downloading instructions from base computer to CMRI. This software shall have, amongst other requirements, features and facilities as described later in this specification, the facility to convert meter reading data into a user definable DBF (Access) or spreadsheet or ASCII format or any other format for integrating with the Employer's billing system as desired/required by the utility. Here again an "Export wizard" or similar utility shall be available whereby user can select file format, the variable data to export, the field width selection of each variable so that it may be possible for the user to integrate the same with the user's billing data and process the selected data in desired manner.

The software shall have the flexibility to generate the following sets of reports:

- Load survey reports.
- Tamper reports.

Necessary software for loading application program into meter via CMRI serial port shall also be provided. The BCS shall incorporate the following points:-

- 1) Line graph shall be provided in load survey of the BCS
- 2) There shall be provision for daily; weekly and monthly viewing of meter DATA.
- 3) There shall be provision for meter serial number/date wise viewing of meter DATA.
- 4) The load survey shall be consisting of voltage, energy, maximum demand and power factor. These parameters shall be on selectable basis.
- 5) In the bar graph of the load survey in BCS, the thirty minutes maximum demand integration period shall have accurate values up to the last three decimal point.
- 6) All temper shall be logged properly with date and time.
- 7) Maximum demand values and other parameters in the load survey of the BCS shall be logged and visible properly with date and time on pointing of the cursor on the graph.
- 8) BCS shall be operable through single window and user friendly

2.5.1 Tamper reports to include for a pre-determined duration or month wise, tamper count, tamper duration and tamper history for each of the meters.

2.5.2 There shall be provision to synchronize RTC (Real Time Clock) of the meter through CMRI/BCS and it shall be password protected.

2.5.3 Vendor will provide soft copy of all the software in CD form along with the meters supplied.

2.5.4 Vendor to install & demonstrate working of software programmes of other meter

manufacturers on the CMRI's to be supplied with this package.

The specification of CMRI is presented as Annexure B.

2.6 DISPLAY

A real time quartz clock shall be used in the meter for maintaining time and calendar date. The maximum drift shall not exceed 5 minutes per year. The uncertainty of setting initial time shall not exceed ± 30 Seconds with respect to Indian standard time (Ref NPL New Delhi).

Facility for adjustment of real time shall be provided through CMRI with proper security.

The meter shall have a minimum 7 digits, 7segment display of liquid crystal display (LCD) or light emission diode display (LED) with another digit for legend. The minimum character height shall be 10 mm. Provision shall be made to read consumption in either whole units or decimal multiples or sub-multiples of one possible to display content of relevant parameters with another digit displaying legend for identification. The display shall remain on the screen till operator presses button for subsequent display or 10 sec whichever is earlier. The meter shall have non-volatile memory, so that the registered parameters will not be affected by loss of power. A provision shall be made to read the meter parameters such as MD and consumption, etc., through the meter cover without actually opening the meter box cover. The non-volatile memory shall have a minimum retention time of 10 years under unpowered condition.

2.7 DISPLAY SEQUENCE

The meter shall display the required parameters in two different modes as follows:

A. Auto Display Mode:

- Display test (LCD/LED Segment check)
- Real time & date
- Active energy forwarded
- Reactive energy lag
- Reactive energy lead
- Apparent energy forwarded
- Last bill Active and Apparent Energy
- Last bill Maximum Demand
- Average Bill Power Factor
- Maximum demand forwarded
- MD occurrence date and time
- Rising demand with elapsed time MD reset count
- Cumulative MD forwarded
- Instantaneous average 3 PF
- Instantaneous frequency
- Phase voltages R,Y,B
- Phase currents R,Y,B
- Cumulative power on hours of current month.

B. Push Button Mode/Capacitive mode button :

All above & the following :

- Tamper and fraud .
- details Present CT status.
- Last occurrence tamper ID.
- Date and time of last tamper .
- occurrence Last restoration tamper ID.
- Date and time of last tamper restoration.
- Cumulative tamper count.
- TOD Register [Active forwarded energy (8 Nos)].
- TOD Register [Apparent forwarded energy (8 Nos)].

- TOD Register [Apparent forward MD (8 Nos)].
- Cumulative power on hours.

C. Read Out Parameters with CMRI :

- Energy registers.
- Billing registers.
- TOD Registers.
- Load survey data
- Tamper and fraud (all event details with date and time).
- Self diagnostic details.
- Real time calendar clock fail.
- Battery bad flag.
- History of monthly Energy Flow, Maximum Demand, Average power factor for the last 12 months.

2.8 MAXIMUM DEMAND REGISTER

The maximum demand is to be monitored during each demand interval set with 30 minutes integration and the maximum of these in a month shall be stored. Whenever MD is reset the maximum demand value so registered shall be stored along with date and time. Under the current integration period, the rising demand shall be displayed continuously along with the elapsed time. The registered demand and the number of times the MD is reset shall also be displayed and the information stored.

2.9 MAXIMUM DEMAND RESET

Facility for auto reset of MD at 00.00 hrs of first of every month shall be provided for which minimum 30 years calendar shall be programmed by the manufacturer.

The meter shall display the maximum demand reset count.

2.10 LOAD SURVEY CAPABILITY

Load survey shall be available for at least 45 days with 30 minutes load survey integration period for following parameters. Vendor shall provide necessary facility to transfer data through CMRI/Public Switch Telephone Network-PSTN/Low Power Radio (LPR)/GSM.

- a) kWh forwarded
- b) kVAh forwarded
- c) Voltage Phase wise
- d) Current Phase wise
- e) Daily maximum demand active & Apparent.

The load survey data, abnormality event information and instantaneous parameters data shall all be retrievable through the meter's communication port from a common meter reading instrument (CMRI)/ Hand Held Unit and shall be transferred (downloaded) to a PC with user friendly Windows based software to get complete details in numerical and/or graphic form. The necessary feature shall be available in the software used for uploading data from CMRI to computer and shall be provided by the manufacturer with complete details.

The meter shall have sufficient non-volatile memory for recording history of energy parameters for last twelve billing cycles (Bill date shall be 00 hrs of the 1st date of the calendar month by default – programmable) and information shall be made available at the BCS end.

2.11 TIME-OF-DAY (TOD) TARIFF/DEMAND

The meter shall have provision of registering the time-of-day energy and maximum demand. It shall be possible to define TOD register for active forwarded, apparent forwarded energy type.

The meter shall have in-built capacity to define up to eight (8) time zones through operation of CMRI. The change of the TOD time-period(s) or changing number of TOD zones shall be possible through CMRI with special authenticated command from the software used for uploading data from CMRI to computer so that only authorized person(s) can make such changes. The main control of this system along with proper security password/code shall be available on one or more computers located at the authorized location(s) as per the directions to be given by the Employer.

2.12 SELF DIAGNOSTIC FEATURE

2.12.1 The meter shall be capable of performing complete self diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location at all times. The meter shall have indications for unsatisfactory/nonfunctioning/malfunctioning of the following :

- a) Real Time and Date
- b) All display segments as per the requirement
- c) Nonvolatile memory (NVM) failure indication at BCS
- d) Low battery indication at BCS

2.12.2 While installing the meter, it shall be possible to check the correctness of Current and Voltage Transformer connections to the meter and their polarity from the functioning of the meter for different voltage injections with the help of vector/phasor diagrams. For this purpose a suitable software for field diagnosis of meter connections with the help of Meter Reading Instrument shall be supplied.

2.13 TAMPER & FRAUD PROTECTION

The meter shall function properly under following common abnormal conditions:

1. **Phase sequence reversal** **The meter shall keep working irrespective of the phase sequence of the supply.**
2. **Current reversal/ CT polarity reversal** The meter shall log energy in forward direction even if the current is flowing in reverse direction in one or more phases.
The metering system shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet) as per the values specified in CBIP Technical Report No. 88 (with latest amendments) applied on the metering system shall not affect the proper functioning and recording of energy as per error limits prescribed by CBIP.
3. **External magnetic influence**
4. **35 KV spark discharge** The meter shall be immune to application of 35KV spark discharge for 10 minutes.
5. **Jammer** The meter shall be immune to application of high frequency jammer.

Beside this the meter shall have features to detect the occurrence and restoration of, at least, the following common abnormal events:

- i. **Missing Potential & Potential imbalance:** The meter shall be capable of detecting and recording occurrence and restoration with date and time the cases of Potential failure which could happen due to disconnection of potential leads (one or two), failure of phase line fuse from the Potential Transformer primary side. Meter shall also detect and log cases of voltage unbalance (from 5% for more than 5 minutes or more (programmable)) of voltages.
- ii. **Voltage High / Voltage Low:** In case the average 3 phase voltage remains less (below 0.75Vref by default) than or above (above 1.15Vref by default) for a predefined period (30 minutes by default), the meter shall

log such incidences with date & time. The voltage thresholds & persistence time shall be programmable using the CMRI & BCS. This abnormal condition shall be logged only when all the three-phase voltage is available.

- iii. Current imbalance: The meter shall be capable of detecting and recording occurrence and restoration with date and time of Current unbalance (30% or more for more than 15 minutes, or as programmable).
- iv. Current Circuit Short: The meter shall be capable of detecting and recording occurrences and restoration of shorting of any one or two phases of current circuit to identify events like CT saturation, CT lead shorting, CT inter turns short etc.
- v. Current Circuit Open: The meter shall be capable of detecting and recording occurrences and restoration of opening of any one or two phases of current circuit which can happen due to intentional / accidental disconnection of current circuits. The meter shall be able to log abnormality conditions in current open event like CT leads burns, loose connection, CT winding open etc in the meter memory. No load condition shall not be recorded in meter memory as a Current circuit open event.
- vi. Power on/off: The meter shall be capable to record power on /off events in the meter memory. All potential failure shall be recorded as power off event.

Cover Open: The meter shall be able to detect cover open occurrence event if cover is opened in mains on or off condition. Separate legend for cover open event shall be made available on LCD.

This legend shall remain in on state till meter reading so that it will come in to notice of meter reader. This tamper shall be logged as **non-rollover event**.

The meter restorations shall record the total duration of the above abnormalities, time and date of their occurrences & with a snapshot of electrical conditions viz. Voltage, current, PF etc.

Logic for calculation of voltage and current imbalance shall be furnished by the tenderer.

The meter shall keep records for the minimum last 250 events (occurrence + restoration) for above of abnormal conditions. It shall be possible to retrieve the abnormal event data along-with all related snapshots' data through the meter's optical port with the help of a hand held unit (HHU) and download the same to the BCS where it shall be available for viewing. All this information shall be made available in simple and easily understandable format.

2.14 TAMPER LOGIC

Properly designed meter event logic shall be provided. There shall be separate compartments for logging of potential related event, current related event and power on/off event. The bidder shall explain the events details in each compartment under their offer.

The logging of various events in each compartment shall be as under :

Once one or more compartments have become full, the last event pertaining to the same compartment will be entered and the earliest (first one)-event shall disappear. Thus, in this manner each succeeding event will replace the earliest recorded event, compartment wise. Events of one compartment/category shall overwrite the events of their own compartment/category only.

A properly defined meter tamper logic shall be provided. The tamper logic shall be capable of discriminating the system abnormalities from source side and load side and it shall not log/record

tamper due to source side abnormalities.

There shall be three separate compartments for logging of different types of tampers as follows:

Compartment No. 1:

50 % of the tamper memory space shall be allocated for the following current related tampers

- a. CT open circuit
- b. CT short (bypass)

Compartment No. 2:

25 % of the tamper memory space shall be allocated for missing potential tampers.

Compartment No. 3:

25 % of the tamper memory space shall be allocated for current unbalance tampers

2.15 TESTS

Unless specifically waived off all test shall be witnessed by the Employer.

2.15.1 Type Test

Energy Meters offered shall be fully type tested as per IS 14697 / CBIP Technical Report No. 88 at any of the NABL accredited test laboratories.

In case meters are not type tested in NABL accredited test laboratories the bidder shall arrange to carry out type tests in any of the NABL accredited test laboratories at his own cost.

2.15.2 Acceptance Test

Acceptance test shall be carried out as specified in table 18 of CBIP Technical Report No. 88

2.15.3 Routine Test

All routine tests as specified in table 18 of CBIP Technical Report No. 88 shall be carried out on each individual meter.

2.16 OTHER SALIENT FEATURES

2.16.1 It shall be possible to check the healthiness of phase voltages by displaying all the voltages on the meter display.

2.16.2 The meter shall have provision of reading through communication port in the absence of power through a backup internal battery.

2.16.3 The meter shall work accurately irrespective of phase sequence of the mains supply.

2.16.4 The meter shall remain powered up and functional even when either of the two phases or one phase along with neutral is available to meter.

Annexure-A

SPECIFICATION OF POLY CARBONATE SEALS FOR SEALING OF METERS

- 1.01 Seal shall be made of polycarbonate with ultra violet additive & shall not be affected by boiling water & acid.
- 1.02 The seal shall withstand temperature up to 147 deg C.
- 1.03 Seal shall be available in Clear / Red / Blue / Yellow / Amber / Green / Grey colour and shall be transparent.
- 1.04 Every seal shall have 6" long, 20 gauge, twisted strand stainless steel wire.
- 1.05 Seal shall have facility to print mono gram / name of company.
- 1.06 Every Seals shall have a unique seven-digit number. Numbers shall be printed on seal including the anchor cap-
using laser marking which shall not be erased using any tool or by any chemical reaction. Both the seven digit seal
numbers shall be visible separately after closing the seal.
- 1.07 Seals shall have tamper proof, internal " anchor " locking mechanism that permanently secures the wire upon
closing. The mechanism shall be designed in such a way that its original position can't be restored after any effort of tamper or breaking of seals.
- 1.08 Sealing mechanism shall be designed in such a way that it can be sealed without using any pliers or tools.
- 1.09 Seal shall be constructed of two parts, first the main body (female type) & second the anchor (male type) having locking mechanism. Both the part shall be designed in such a way that once the seal is

closed the two parts can't be separated.

1.010 Seal shall be patented. Copy of patent shall be submitted along with offer.

1.011 Packaging: Seals shall be supplied in packet of 100 seals. Each packet shall be labelled for following information:
 Client Name
 Purchase order number & date
 Serial number range in the form of bar coding.

1.12 Seals shall be provided with tracking & recording software. The software shall have following features:

Software shall have facility of defining the system controller
 Facility to enter serial number of seals with the help of bar code scanner.
 Receiving of seal in the system and with authentication like signature.
 Facility to identify the concern who is responsible for receiving of seals and nominated by system supervisor.
 Provision to define different type of seals for various uses.
 Software shall have facility of report generation for inventory & issue records.
 Facility to track for relevant data for individual seal entered in the system.

TECHNICAL SPECIFICATION FOR 11 & 33 KV OUTDOOR TYPE CURRENT TRANSFORMER

1. INTRODUCTION

This section covers the specification of 33 kV and 11kV Current Transformer suitable for outdoor service. Any other parts not specifically mentioned in this specification but otherwise required for proper functioning of the equipment should be included by the tender in the offer. The CTs should normally be installed above VCB. The VCB & CT should be installed on common mounting structure. In places, where VCB are not provided in the substation, separate CT mounting structure shall be provided with CTs.

2. APPLICABLE STANDARDS

Unless otherwise modified in this specification, the Current Transformer shall comply with the latest version of relevant standards (IS 2165, IS 2705(I-IV), IS 2099, IS 5621, IS 2071, IS 335, IS 13947(part I), IEC 185, IEC 270, IEC 44(4), IEC 171, IEC 60, IEC 8263, IEC 815, Indian electricity Rules 2003) or better international standards. This list of standards is for guidance only. The contractor shall be solely responsible to design & manufacture the CT suitable for 33kV & /11 kV systems.

3. SERVICE CONDITIONS

The CT supplied against these specifications shall be suitable for satisfactory continuous operation under the tropical conditions, as mentioned for power transformers.

Maximum altitude above sea level	100m
Minimum ambient air temperature	45°C
Maximum daily average ambient air temperature	40° C

Minimum ambient air temperature	2° C
Maximum temperature attainable by an object exposed to the sun	60° C
Maximum yearly weighted average ambient temperature	32° C
Maximum relative humidity	98%
Average number of thunderstorm days per annum (isokeraunic level)	45→50(MV)
Average number of rainy days per annum	120
Average annual rainfall	2200 mm
Maximum annual rainfall	3500 mm
Maximum wind pressure	260Kg/m ²
Seismic level(Horizontal acceleration)	0.24g to 0.48g
Climatic condition Moderately hot and humid tropical climate conducive to rust and fungus growth.	

4. SYSTEM PARTICULARS

- a) Nominal System Voltage 33kV & 11kV
- b) Highest system Voltage 36kV & 12kV
- c) Rated Frequency 50Hz & 50Hz
- d) No of phases Three & Three
- e) System neutral earthing -Solidly Earthed-
- f) One minute Power Freq. 70kV & 28kV withstand voltage (rms)
- g) Lighting Impulse withstand Voltage 170kVp & 75kVp
- i) System fault level -25kA for 3sec-

5. TECHNICAL PARAMETERS OF CT

- a) Type Single phase, dead tank, outdoor, oil filled& hermetically sealed
- b) Type of mounting Pedestal type
- c) Rated primary current As per BPS
- d) Rated Continuous thermal current 120 % of rated Primary current
- e) Rated short time withstand As per IS 2705 Pt. I
Requirement for sec. Winding
- f) Rated short time withstand 25kA(RMS)
Current
- i) Duration (for primary current 3Secof 150amps and above)
- ii) Duration (for primary current 1Secbelow 150amps)
- g) Rated dynamic withstand 62.5Current (KA rms)
- h) Max temp rise As per IEC-185/ IS 2705

- i) Minimum creepage distance 25 mm /KV
of porcelain housing(mm)
- j) One minute power frequency 3 kV
Withstand voltage between
Secondary terminal & earth
- k) Detail of Secondary Cores Metering Protn.
Current ratio (As per BPS)
Accuracy class 0.5 5P10
Burden (VA) 15 15
Instrument security Factor ≤ 5 -
Accuracy Limit Factor - ≥ 10

Note: The ratings indicated for instrument transformer are tentative only and may be changed to meet the requirements.

6. INSULATION

The insulation of the CT shall be so designed that the internal insulation shall have higher electrical withstand capability than the external insulation. The designed dielectrics withstand values of external and internal insulations shall be clearly brought out in the GTP. The dielectric withstand values specified in this specification are meant for fully assembled CT. The temperature rise on any part of equipment shall not exceed the maximum temperature rise limits specified in the relevant standard.

7. PORCELAIN HOUSING

It shall be single piece of homogeneous, vitreous porcelain of high mechanical & dielectric strength. It will be glazed with uniform Brown or Dark brown colour with smooth surface finish. The Creepage distance for the porcelain housing shall be at least 25 mm per kV.

8. TANK & SURFACE FINISH

The metal tanks shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage. The tank shall be fabricated of MS steel sheet of min. 3.15 mm for sides & 5 mm for top & bottom. The bottom of the tank shall be adequately accessible for periodical maintenance of open surface.

The metal tanks shall be coated with at least two coats of zinc rich epoxy painting. The inner surface shall be painted with oil resistance white enamel paint. All the ferrous hardware, exposed to atmosphere, shall be hot dip galvanized. All other fixing nuts, bolts, washers in the electrical current path shall be made out of stainless steel.

9. GENERAL CONSTRUCTIONAL REQUIREMENTS

- 9.1 The CT shall be of dead tank design and shall be so constructed that it can be easily transported to site within the allowable transport limitation, even in horizontal position, if the transport limitation so demands. The C.T. shall be hermetically sealed and method of such sealing shall be detailed in the offer.
- 9.2 CT secondary terminals shall be brought out in a weatherproof terminal box. The terminal box shall be provided with removable gland plate and glands. The cable glands shall be suitable for 1100 volts grade PVC insulated, PVC sheathed multi core stranded 6 sq.mm copper conductor cable. This terminal box

shall be dust and vermin proof. The dimensions of the terminal box and its opening shall be adequate to enable easy access and working space with the use of normal tools.

- 9.3 Polarity shall be invariably marked in each primary and secondary terminal. Facility shall be provided for short circuiting and grounding of the CT secondary terminals inside the terminal box.
- 9.4 The CT shall be provided with a rating plate with dimensions and marking as per IS-16227. The markings shall be punched and not painted. The serial number and code of the supplier shall also be punched on the tank to identify the unit in case of loss or damage to the rating plate.
- 9.5 The CT shall be vacuum filled with oil after processing and thereafter hermetically sealed to eliminate breathing and to prevent air and moisture entering into the tank. Oil filling and / or oil sampling cocks, if provided to facilitate factory processing should be permanently sealed before dispatching the CT. The method adopted for hermetic sealing shall be described in the offer.

10. WINDING

10.1. PRIMARY WINDING

It shall be made of high conductivity rigid copper wire. The primary winding current density shall not exceed the limit of 1.6 Amp per sq. mm for normal rating. The design current density for short circuit current as well as conductivity of metal used for primary winding shall be as per IS 2705. The calculation for the selection of winding cross section shall be furnished by contractor. The primary terminal shall be of standard size of 30 mm dia x 80 mm length of heavily tinned (min. thickness 15 micron) electrolytic copper of 99.9 % conductivity.

10.2 SECONDARY WINDING

Shall be made of insulated copper wire of electrolytic grade. Type of insulation used shall be described in the offer. For multi ratio design, the multi ratio will be achieved by reconnection of the primary winding or secondary winding. The excitation current of the CT shall be as low as possible. The contractor shall furnish the magnetization curves for all the cores.

The terminal box shall be dust free & vermin proof. The size of the terminal box shall be big enough to enable easy access and working space with the use of normal tools.

The secondary terminals studs shall be provided with at least 3 nuts and two plain washers, these shall be made of brass duly nickel plated. The min. stud outer dia shall be 6 mm & length 15 mm. The min spacing between the centres of the adjacent studs shall be 1.5 time the outer dia of the stud.

10.3 POLARITY

The polarity shall be marked on each CT at the primary and secondary terminals.

11. INSULATION OIL

The first filling of oil in CT shall be in contractor's scope. The oil shall be as per IS 335:2018.

To ensure prevention of oil leakage, the manufacturer will give following details supported by drawings:

- i) Location of emergence of Primary & Secondary terminals
- ii) Interface between porcelain & metal tanks
- iii) Cover of the secondary terminal box

Any nut & bolt and screw used for fixation of the interfacing porcelain bushing for taking out the terminals shall be provided on flanges cemented to the bushings & not on the porcelain.

If gasket joints are used, Nitrite Butyl Rubber gasket shall be used. The grooves shall be machined with adequate space for accommodating gasket under pressure.

The CT shall be vacuum filled with oil after processing. It will be properly sealed to eliminate breathing & to prevent air & moisture from entering the tank. The sealing methods/arrangement shall be described by the contractor & be approved by the owner.

12. OIL LEVEL INDICATOR

The CT shall be fitted with prismatic type oil sight window at suitable location so that the oil level is clearly visible with naked eye to an observer standing at ground level.

To compensate oil volume variation due to temperature variation, Nitrogen cushion or the stainless steel bellows shall be used. Rubber diaphragms are not permitted for this purpose.

13. EARTHING

Two earthing terminals shall be provided on the metallic tank of size 16 mm dia & 30 mm length each with one plain washer & one nut for connection to the station earth mat.

14. JUNCTION BOX

The junction box shall be of MS sheet having thickness of 2mm, synthetic enamel painted as per procedure mentioned in General Technical Requirement (Min. thickness 55 micron). The shade of junction box shall be 697 of IS: 5. Disconnecting type terminal blocks for CT secondary lead shall be provided. The junction boxes shall be weather proof type with gaskets, as per section-I (Introduction and general technical requirements) conforming to IP-55 as per IS-13947 (Part-I).

15. LIFTING & MOUNTING ARRANGEMENT

The CT shall be provided with two lifting eyes to lift the CT. This shall be so positioned so as to avoid any damage to the CT during lifting for installation or transportation purpose. This shall be detailed in General Arrangement drawing.

The CT shall be of pedestal mounting type suitable for outdoor installation on steel/cement concrete structures. All the clamps, bolts, nut and washers etc. required for mounting the CT on the structure shall be supplied along with the CT and shall be galvanized. The contractor shall supply all the terminal connectors etc. required for connection to the CT.

16. TESTING

Type Test:

The Current Transformer design offered in the Bid should have been successfully type tested at NABL laboratories for the tests indicated as follow in line with the relevant standard and technical specification. These Type Tests should have been carried out within five years prior to the date of opening of tender. The bidder shall be required to submit complete set of the type test reports along with the offer.

In case these type tests are conducted earlier than five years, all the type tests as per the relevant standard shall be carried out by the successful bidder at NABL in presence of purchaser's representative free of cost before commencement of supply. The undertaking to this effect should be furnished along with the offer without which the offer shall be liable for rejection.

If there is any change in the design/ type of old type tested current transformers to be offered against this specification, then the offer is considered for placement of order. However, successful bidders have to carry out the said type tests on offered type equipment before commencement of supply at their own expense.

Sl.No.	Type test Description
A	<u>Schedule of Type Test for CT</u>
1	Verification of terminal marking and polarity.
2	High voltage power frequency tests on primary windings.
3	High voltage power frequency tests on secondary windings.
4	Over voltage inter turn test.
5	Determination of error according to the requirement of appropriate accuracy class
6	Short time current test.
7	Impulse voltage test.
8	Temperature Rise Test.
9	Instrument Security Factor Test on Both phase of the CT as per Cl. No.7.1.2 of IS-2705 (Part-II).
10	High Voltage Power-frequency Wet withstand voltage test as per Cl. No.9.9 of IS-2705 (Part-I).

Acceptance & Routine Tests:-

All acceptance and routine tests as stipulated in the respective applicable standards amended up-to-date for current transformer shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser before dispatch.

17. INSPECTION

- 17.1. The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representative at any reasonable time when the work is in progress. All facilities must be made available by supplier/ manufacturer for unrestricted inspection of the works, raw material & manufacture of all the accessories & for conducting necessary tests as declared therein.
- 17.2. No current transformer shall be dispatched from its point of manufacture unless the current transformer has been satisfactorily inspected and tested.
- 17.3. Inspection and acceptance of any current transformer under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing current transformer in accordance with the specification and shall not prevent subsequent rejection, if the current transformer is found to be defective.

18. PERFORMANCE GUARANTEE

The equipment offered shall be guaranteed for satisfactory performance for a period of 66 months from the date of receipt of complete equipment at site in good condition or 60 months from the date of satisfactory commissioning, whichever is earlier. In case of failure within this period, the supplier shall make necessary repairs / replacement of the faulty current transformer at no extra cost to the purchaser.

19. DOCUMENTATION

- 19.1. List of Drawings & Documents :-
The bidder shall furnish two sets of the following drawings along with offer.
 - a) General outline and assembly drawings of the equipment

b) Sectional views showing :-

- i) General Constructional features of Current Transformer, dimensions of conductor, depth of insulation, clearance between paper insulation & the inside of porcelain, grading stages used for primary insulation, whether & how a semi conducting tape is used to cover metal foils etc.
- ii) The Sectional view shall show the materials / gaskets / sealing used for perfect hermetic sealing and arrangement for compensation of oil volume variation.
- iii) The insulation, the winding arrangements, method of connection of the primary / secondary winding to the primary / secondary terminals etc.
- iv) Porcelain housing used and its dimensions along with the mechanical and electrical characteristics, as well as volume of oil.
- c) Arrangement of secondary Terminal box & details of connection studs provided.
- d) Name Plate
- e) Schematic drawing
- f) Type Test reports in case the equipment has already been type tested.
- g) Test reports, literature, pamphlets of the bought out items, and raw material
- h) Bill of material and packing list.
- i) Pressure release device
- j) Oil level indicator
- k) Drain plug
- l) Bushing drawing

- 18.2 The successful bidders shall submit three sets of final versions of all the above said drawings in line with Technical Specifications.
- 18.3 Adequate copies of acceptance and routine Test Certificates, duly approved by APDCL shall accompany the dispatched consignment.
- 18.4 The manufacturing of the current transformers shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the APDCL. All manufacturing and fabrication work in connection with the current transformers prior to the approval of the drawing shall be at the supplier's risk.
- 18.5 One set of nicely printed and bound volume of operation, maintenance and erection manuals in English language per Current Transformer of each voltage rating shall be submitted by the supplier to respective consignees along with the dispatch documents of each unit. The manual shall contain all the drawings and information required for erection, operation and maintenance of the Current Transformer. The manual shall also contain a set of all the approved drawings, Type Test reports etc.
- 18.6 Approval of drawings by APDCL shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirement of the Technical Specification, latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and APDCL shall have the power to reject any work or materials which, in his judgment, is not in full accordance therewith.

19. PACKING & FORWARDING

- 19.1 The current transformers shall be packed in wooden crates of good quality and shall be suitable for vertical / horizontal transportation as the case may be, and suitable to withstand handling during transport and outdoor storage in stores before erecting. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily

damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

- 19.2 Each consignment shall be accompanied by a detailed packing list containing the following information:
- Name of the consignee.
 - Details of consignment.
 - Destination.
 - Total weight of consignment.
 - Sign showing upper / lower side of the crate.
 - Handling and unpacking instructions.
 - Bill of material indicating contents of each package
- 19.3 The supplier shall ensure that the packing list and bill of material are approved by the APDCL before dispatch.

TECHNICAL SPECIFICATION FOR 33 & 11 KV OUTDOOR TYPE POTENTIAL TRANSFORMER

1. INTRODUCTION

This chapter covers specification of 33kV and 11kV Potential Transformer suitable for outdoor service. Any other parts not specifically mentioned in this specification but otherwise required for proper functioning of the equipment should be included by the tender in the offer.

2. APPLICABLE STANDARDS

Unless otherwise modified in this specification, the Potential Transformer shall comply with the latest version of relevant standards (IS 3156, IS 2099, IS 5621, IS 335, IS 13947(Part I), IEC 186, Indian electricity Rules 2003, IEC 815) or better international standards. This list of standards is for guidance only. The contractor shall be solely responsible to design & manufacture the PT suitable for 33 kV/11kV systems.

3. SERVICE CONDITIONS

The PT supplied against this specification shall be suitable for satisfactory continuous operation under the tropical conditions as detailed for power transformers.

Maximum altitude above sea level	100m
Minimum ambient air temperature	45°C
Maximum daily average ambient air temperature	40° C
Minimum ambient air temperature	2° C
Maximum temperature attainable by an object exposed to the sun	60° C
Maximum yearly weighted average ambient temperature	32° C
Maximum relative humidity	98%
Average number of thunderstorm days per annum (isokeraunic level)	45→50(MV)
Average number of rainy days per annum	120

Average annual rainfall	2200 mm
Maximum annual rainfall	3500 mm
Maximum wind pressure	260Kg/m ²
Seismic level(Horizontal acceleration)	0.24g to 0.48g
Climatic condition Moderately hot and humid tropical climate conducive to rust and fungus growth.	

4. SYSTEM PARTICULARS

a)	Nominal System Voltage	33kV	11kV
b)	Highest system Voltage	36kV	12kV
c)	Rated Frequency	50Hz	50Hz
d)	No of phases	Three	Three
e)	System neutral earthing	---Solidly Earthed---	
f)	One minute Power Freq. Withstand voltage (rms)	70kV	28kV
g)	Lighting Impulse withstand Voltage	170kVp	75kVp
h)	System fault level	---25 kA for 3sec---	

5. TECHNICAL PARAMETERS OF PT

a)	Rated primary Voltage	36 KV	12 KV
b)	Type	Single phase potential transformer	
c)	Voltage/ Ratio(kV)	33/0.11	11/0.11
d)	Rated voltage factor	1.2continuous	1.5–30seconds
e)	One minute power freq. Withstand voltage for		
	Primary Terminals	70 kV(rms)	28 kV
	Secondary winding	36 kV	12 KV
f)	Min. Creepage Distance	25 mm/kV of Highest System Voltage	
g)	Detail of secondaries	Core I	Application Metering
	Accuracy	0.5	0.5
	Burden (VA)	100	100

Note: The ratings indicated for instrument transformer are tentative only and may be changed to meet the requirements.

6. INSULATION

The insulation of the potential transformers shall be so designed that the internal insulation shall have higher electrical withstand capability than the external insulation. The designed dielectrics withstand values of external and internal insulations shall be clearly brought out in the GTP (Guaranteed Technical particulars). The dielectric withstand values specified in this specification are meant for fully assembled instrument transformer. The temperature rise on any part of

equipment shall not exceed the maximum temperature rise limits specified in annexure IV under the conditions specified there in.

7. PORCELAIN HOUSING

- 7.1. It shall be single piece of homogeneous, vitreous porcelain of high mechanical & dielectric strength. It will be glazed with uniform Brown or Dark brown colour with smooth surface finish. The creepage distance for the porcelain housing shall be at least 25mm per kV.
- 7.2. The contractor shall clearly detail in his bid the details of attaching the metallic flange to porcelain, pressure release valve and also how primary & secondary terminals shall be brought out.

8. TANK & SURFACE FINISH

- 8.1. The metal tanks shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage. It shall be fabricated of MS steel sheet of min. 3.15 mm for sides & 5 mm for top & bottom. The tank will be finished with min. 2 coats of zinc rich epoxy paint externally. The inner surface shall be painted with oil resistance white enamel paint.
- 8.2. All ferrous hardwares, exposed to atmosphere shall be hot dipped galvanized.

9. GENERAL CONSTRUCTIONAL REQUIREMENTS

- 9.1. The PT shall be vacuum filled with oil after processing and hermetically sealed to eliminate breathing and to prevent air and moisture entering the tanks. Method adopted for hermetic sealing shall be described in the offer and shall be subject to approval of the purchaser.
- 9.2. The PT shall be so constructed that it can be easily transported to site within the allowable transport limitations, even in horizontal position, if the transport limitations so demand.

10. WINDING

PRIMARY WINDING

It shall be made of insulated electrolytic copper wire. The neutral end of the winding shall be brought outside for earthing. The primary terminal shall be of standard size of 30 mm dia x 80 mm length of heavily tinned (min. thickness 15 micron) electrolytic copper of 99.9 % conductivity.

SECONDARY WINDING

It shall be made of insulated copper wire of electrolytic grade. The terminal box shall be dust free & vermin proof. The size of the terminal box shall be big enough to enable easy access and working space with the use of normal tools.

The secondary terminals studs shall be provided with at least 3 nuts and two plain washers. These shall be made of brass duly nickel plated. The min. stud outer dia shall be 10 mm & length 15 mm. The min spacing between the centres of the adjacent studs shall be 1.5 time the outer dia of the stud.

POLARITY

The polarity shall be marked on each PT at the primary and secondary terminals.

11. INSULATION OIL

The first filling of oil in PT shall be in contractor's scope. The oil shall be as per IS 335. To ensure prevention of oil leakage, the manufacturer will give following details supported by drawings :

- i) Location of emergence of Primary & Secondary terminals
- ii) Interface between porcelain & metal tanks
- iii) Cover of the secondary terminal box

Any nut & bolt and screw used for fixation of the interfacing porcelain bushing for taking out the terminals shall be provided on flanges cemented to the bushings & not on the porcelain.

If gasket joints are used, Nitrite Butyl Rubber gasket shall be used. The grooves shall be in machined with adequate space for accommodating gasket under pressure.

The PT shall be vacuum filled with oil after processing. It will be properly sealed to eliminate breathing & to prevent air & moisture from entering the tank. The sealing methods/arrangement shall be described by the contractor & be approved by the owner.

12. OIL LEVEL INDICATOR

The PT shall be fitted with prismatic type oil sight window at suitable location so that the oil level is clearly visible with naked eye to an observer standing at ground level.

To compensate oil volume variation due to temperature variation, Nitrogen cushion or the stainless steel bellows shall be used. Rubber diaphragms are not permitted for this purpose.

13. EARTHING

Two earthing terminals shall be provided on the metallic tank of size 16 mm dia & 30 mm length each with one plain washer & one nut for connection to the station earth mat.

14. Junction Box

The junction box shall be of MS sheet having thickness of 2mm, synthetic enamel painted as per procedure mentioned in General technical Requirement (Min. thickness 55 micron). The shade of junction box shall be 697 of IS: 5. Disconnecting type terminal blocks for PT secondary lead shall be provided. The junction boxes shall be weather proof type with gaskets as per section-I (Introduction and general technical requirements) conforming to IP-55 as per IS-13947 (Part-I).

One junction box shall be provided for 3 numbers of single phase CT's and PT's.

15. LIFTING & MOUNTING ARRANGEMENT

The PT shall be provided with two lifting eyes to lift the PT. This shall be so positioned so as to avoid any damage to the PT during lifting for installation or transportation purpose. This shall be detailed in General Arrangement drawing.

The PT shall be of pedestal mounting type suitable for outdoor installation on steel/cement concrete structures. All the clamps, bolts, nut and washers etc. required for mounting the PT on the structure shall be supplied along with the PT and shall be galvanized. The contractor shall supply all the terminal connectors etc. required for

connection to the PT.

16. TESTING

16.1. Type Tests:

The Potential Transformer offered in the Bid should have been successfully type tested at NABL laboratories for the tests indicated as follow in line with the relevant standard and technical specification. These Type Tests should have been carried out within five years prior to the date of opening of tender. The bidder shall be required to submit complete set of the type test reports along with the offer. In case these type tests are conducted earlier than five years, all the type tests as per the relevant standard shall be carried out by the successful bidder at NABL in presence of purchaser's representative free of cost before commencement of supply. The undertaking to this effect should be furnished along with the offer without which the offer shall be liable for rejection. If there is any change in the design/ type of old type tested Potential transformers to be offered against this specification, then the offer is considered for placement of order. However, successful bidders have to carry out the said type tests on offered type Potential transformers before commencement of supply at their own expense.

Sl.No.	Type test Description
A	<u>Schedule of Type Test for PT</u>
1	Verification of terminal marking and polarity.
2	Power frequency dry withstand test on primary winding.
3	Power frequency dry withstand test on secondary winding.
4	Determination of errors according to the requirement of the appropriate accuracy class.
5	Temperature rise test.
6	Impulse voltage test for voltage transformer for service in electricity exposed installation.
7	High Voltage Power-frequency Wet withstand voltage test as per Cl. No.9.7 of IS-3156(Part-I)

Acceptance & Routine Tests:-

All acceptance and routine tests as stipulated in the respective applicable standards amended up-to-date for potential transformer shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser before dispatch.

17. INSPECTION

- 17.1. The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representative at any reasonable time when the work is in progress. All facilities must be made available by supplier/ manufacturer for unrestricted inspection of the works, raw material & manufacture of all the accessories & for conducting necessary tests as declared therein.
- 17.2. No potential transformer shall be dispatched from its point of manufacture unless the potential transformer has been satisfactorily inspected and tested.
- 17.3. Inspection and acceptance of any potential transformer under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing potential transformer in

accordance with the specification and shall not prevent subsequent rejection, if the potential transformer is found to be defective.

18. PERFORMANCE GUARANTEE

The equipment offered shall be guaranteed for satisfactory performance for a period of 66 months from the date of receipt of complete equipment at site in good condition or 60 months from the date of satisfactory commissioning, whichever is earlier. In case of failure within this period, the supplier shall make necessary repairs / replacement of the faulty potential transformer at no extra cost to the purchaser.

19. DOCUMENTATION

19.1. List of Drawings & Documents :-

The bidder shall furnish two sets of the following drawings along with offer.

- a) General outline and assembly drawings of the equipment
- b) Sectional views showing :-
 - i) General Constructional features of Potential transformer, dimensions of conductor, depth of insulation, clearance between paper insulation & the inside of porcelain, grading stages used for primary insulation, whether & how a semi conducting tape is used to cover metal foils etc.
 - ii) The Sectional view shall show the materials / gaskets / sealing used for perfect hermetic sealing and arrangement for compensation of oil volume variation.
 - iii) The insulation, the winding arrangements, method of connection of the primary / secondary winding to the primary / secondary terminals etc.
 - iv) Porcelain housing used and its dimensions along with the mechanical and electrical characteristics, as well as volume of oil.
- c) Arrangement of secondary Terminal box & details of connection studs provided.
- d) Name Plate
- e) Schematic drawing
- f) Type Test reports in case the equipment has already been type tested.
- g) Test reports, literature, pamphlets of the bought out items, and raw material
- h) Bill of material and packing list.
- i) Pressure release device
- j) Oil level indicator
- k) Drain plug
- l) Bushing drawing

- 19.1 The successful bidders shall submit three sets of final versions of all the above said drawings in line with Technical Specifications.
- 19.2 Adequate copies of acceptance and routine Test Certificates, duly approved by APDCL shall accompany the dispatched consignment.
- 19.3 The manufacturing of the potential transformers shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the APDCL. All manufacturing and fabrication work in connection with the potential transformers prior to the approval of the drawing shall be at the supplier's risk.

- 19.4 One set of nicely printed and bound volume of operation, maintenance and erection manuals in English language per Potential transformer of each voltage rating shall be submitted by the supplier to respective consignees along with the dispatch documents of each unit. The manual shall contain all the drawings and information required for erection, operation and maintenance of the Potential transformer. The manual shall also contain a set of all the approved drawings, Type Test reports etc.
- 19.5 Approval of drawings by APDCL shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirement of the Technical Specification, latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and APDCL shall have the power to reject any work or materials which, in his judgment, is not in full accordance therewith.

20 PACKING & FORWARDING

- 20.1 The potential transformers shall be packed in wooden crates of good quality and shall be suitable for vertical / horizontal transportation as the case may be, and suitable to withstand handling during transport and outdoor storage in stores before erecting. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.
- 20.2 Each consignment shall be accompanied by a detailed packing list containing the following information:
- Name of the consignee.
 - Details of consignment.
 - Destination.
 - Total weight of consignment.
 - Sign showing upper / lower side of the crate.
 - Handling and unpacking instructions.
 - Bill of material indicating contents of each package
- 20.3 The supplier shall ensure that the packing list and bill of material are approved by the APDCL before dispatch.

TECHNICAL SPECIFICATION OF BATTERY BANK AND CHARGER

1.0 SCOPE :

This Section of the Specification covers the design, manufacture, and testing at manufacturer's work, of stationary type sealed, Valve Regulated Lead Acid Battery Bank, Battery Charger, DC Distribution Boards and LTAC Panels complete with all required accessories for various Sub-stations.

2.0 BATTERY BANK :

2.1 TECHNICAL PARTICULARS OF BATTERY BANK :

Capacity Rating	150 Ah to 1.75 ECV at C10 at 27 ^o C
Type of battery	Maintenance free valve regulated lead acid (MF-VRLA)

		battery
	Specification	It conforms to IS 15549:2005 It conforms to International Standards (I) IEEE 1188 and 1189 (II) BS6290 Part 4/ IEC 896
	Manufacturers cell designation	P
	Cells	(for 110V) + 2 nos. spare cells with connectors
	Life of Battery @ 27° C	cycles for 50 % depth of discharge or 1200 cycles for 80 % depth of discharge
	Efficiency	90%
	Self-discharge	80 %
	Self-discharge/ Week	of rated capacity
	Allowable ambient temp at which cell can safely operate	continuously and 70° C short time
	Overall dimension of each cell	198.5 x 198.5 x 477)mm approx.
	Overall weight of each cell	approx.
	Recommended Max period of storage	12 mths from the date of manufacturing and the batteries shall be stored in covered area at 27° C
	Material of container	Polyethylene co-polymer
	Material of separator	absorbent micro porous spun glass matrix (AGM)
	Material of +ve & -ve plates	Lead
	Material of rack	Steel coated with acid resistance paint
	Method of connection between cells	
	Recommended float charge	Batteries shall be charged in constant potential mode with current limit Voltage: 2.23-2.25 Volts per cell Current: Recommended- charging current is 45 amps
	Recommended boost charge	Voltage: 2.3 Volts per cell Current: Recommended- charging current is 45 to 90 amps
	Time required for boost charge from fully discharged condition at 27° C	for 90 % state of charge (or) for 100 % state of charge
	AC ripple allowable	of the RMS value
	Material of connectors	Plated heavy duty copper strips

2.1.1 PLATES :

Positive plates shall be made of flat pasted type using lead-cadmium antimony alloy for durability, high corrosion resistant, maintenance free, long life both in cyclic as well as in float applications.

Negative plates shall be heavy duty, durable flat plate using lead calcium alloy pasted box grid. Negative plates shall be designed to match the life of positive plates and combination of negative and positive plates shall ensure long life, durability and trouble free operation of battery.

PLC operated equipment should be deployed for preparation of paste to ensure consistency in paste quality.

Conventional / manual type of paste preparation is not allowed.

2.1.2 CONTAINER AND LID :

The containers and lids shall be made of a special grade polypropylene copolymer plastic material. They shall be sufficiently robust and not liable to deformation under internal operating pressures and within the temperature range naturally encountered, leak proof, non-absorbent and resistant to the acid with low water vapour permeability.

2.1.3 VENT PLUGS :

Each cell shall be equipped with one-way safety valve with opening pressure of 5 ± 1 psi and closing pressure 4 ± 1 psi. The vent plug shall be made with suitable grade of fire retardant plastic material. Each valve opening shall be covered with flame barrier capable in preventing the ingress of flame into the cell interior when the valve opens and hydrogen / oxygen gas mixture is released.

2.1.4 SEPARATORS :

Separator shall be made of spun glass, micro porous matrix and shall be resistant to Sulphuric Acid. It shall be capable of keeping the entire electrolyte and shall be electrically insulated. Sufficient separator overlap and PVC shield protection to top and bottom edges of the plates is to be provided to prevent short circuit formation between the edges of adjacent plates.

2.1.5 CONNECTORS :

The connectors shall be lead coated copper of suitable size to join the cells. The connectors shall be suitably designed and coated to withstand corrosion due to sulphuric acid. The coating should be adequate and tenacious. All the copper inter cell connectors shall be provided with heat shrinkable sleeves except at the connecting points.

2.1.6 ELECTROLYTE :

The electrolyte shall be prepared from the battery grade Sulphuric Acid conforming to ISS: 266. The batteries shall be supplied in factory filled and charged condition.

2.1.7 WATER :

Water required for preparation of electrolyte shall conform to IS: 1069.

2.1.8 PLATE CONNECTION :

Lugs of plates of like polarity shall be connected by lead burning to a horizontal strap having an upstanding terminal post adopted for connection to external circuit. Strap and post shall be cast with lead alloy. The positive and negative terminal posts shall be clearly marked for unmistakable identification.

2.1.9 BOLTS AND NUTS :

Nuts and Bolts for connecting the cells shall be of superior grade passivated Stainless steel.

2.1.10 TERMINALS :

Terminals shall be of integral lead terminal with solid copper core with M6 threading for fastening. The

junction between terminal posts and cover and between the cover and container shall be hermetically sealed.

2.1.11 BATTERY RACKS:

Batteries shall be installed on MS racks to be supplied by the Contractor to fit in the battery room. Racks/Trays shall be powder coated with anti corrosive paint. Rack shall accommodate 55 cells plus 2 spares. Racks/Tray shall be suitably treated before painting for protection against fungus growth and other harmful effects due to tropical environment.

The color of the supporting racks shall conform to RAL 7032 shade.

2.2 BATTERY CHARGING EQUIPMENT :

2.2.1 GENERAL DESCRIPTION :

Battery charger of 33/11kV substation shall have two complete different independent trickle (float) and boost charger i.e. Dual Trickle cum Boost charger (FCBC) and shall be SCADA compatible. Dual charger means one charger shall always be in stand by mood. Dual charger shall be fed through either common source or separate 3-phase AC source and thus separate control supply & circuit should be available for two Float cum-Boost and Float-cum-Boost charger.

Dual chargers shall be designed to supply both Load and Battery Charging current. During normal operation FCBC-1 is in ON condition and FCBC-2 is made off. Provision to select Auto (auto changeover from float to boost and vice versa), manual Float or Boost mode of operation shall have available for each charger. In case of manual connection of one FCBC to load and another to battery, the FCBC connected to load should not go to boost mode. Dual float cum boost charger should be designed in such a way that if FCBC-1 fails, FCBC-2 comes in line automatically and takes care of both load as well as battery charging currents.

The battery charging equipment shall be capable of giving two rate of charging currents namely Boost Charge and Trickle Charge. The charging equipments capable of giving two rate of charging currents shall consist of two separate sections: Boost Charger Section & Trickle Charger Section.

The Trickle Charger Section along with all necessary equipments is required for the purpose of float charging one battery bank of 55 cells of capacity 150 Ah at 10 hours discharge rate at the rate of 2.0 volts to 2.3 volts per cell and for meeting a constant D.C. load of 10 Amperes at 110 Volts D.C. simultaneously.

The Boost Charger Section along with all necessary equipments is required to charge a battery bank of 55 cells of capacity 150 Ah at 10 hours discharge rate at the rate of 1.85 volts to 2.55 volts per cell and for meeting a constant D.C. load of 10 Amperes simultaneously.

2.2.2 TYPE AND RATING :

i) TYPE

The charger shall be static type, using Thyristors. The rectifiers shall be arranged in three phase bridge circuit for full wave rectification. The charger unit shall be suitable for operation on 415 volts three phase, 4 wire, 50 Hz A.C. Supply.

The Boost and Trickle Charger section shall have an arrangement for automatic and manual D.C. voltage regulating system with an Auto / Manual change over switch.

ii) RATING

The entire Dual charger circuitry shall have two separate sections eg. Boost charger and Trickle charger sections and shall of following ratings :

2.2.2.1 Float Charger :

- (a) D.C. Output Voltage: (i) The D.C. output voltage of the Float charger shall be 24 volts or 110 volts (nominal). (ii) The D.C. output voltage of the Float charger shall be adjustable between 24 volts to 27.6 volts (for 24 volts) / 110 volts to 126.5 volts (for 110 volts).
- (b) D.C. Output Current: (i) The Trickle charger shall be capable of supplying a continuous D.C. load of 10 amperes and float a battery bank of 150 Ah at 10 hours discharge rate simultaneously at normal voltage.

2.2.2.1 Boost charger :

- (a) The d.c. output voltage of the Boost charger section shall be adjustable between 22 volts to 30.5 volts (for 24 volts battery) / 101 volts to 140 volts (for 110 volts battery).
- (b) D.C. Output Current: The Quick charger shall be capable of charging a battery bank of 150 Ah capacity at 10 hours discharge rate and to meet a continuous D.C. load of 5 amperes simultaneously. Output current of the Boost charger shall not be less than about 20 Amperes.

2.2.3 OPERATION AND CONTROL REQUIREMENTS :

1. Each battery bank is connected with two Float-Cum-Boost Chargers (FCBC). First float cum boost charger will be normally ON in float mode, supplying the D.C. load and the other FCBC trickle charging the battery and shall
 - (a) Provide occasional equalizing charge
 - (b) Boost charge the battery up to 2.55 Volts per cell as required. Each FCBC can take over all the functions of the other FCBC in case of the failure of the later. The float-cum-boost charger will also have provision for float, equalizing, and boost charging the battery through manual selection.
2. The float charger shall withstand momentary supply failure due to changeover on AC supply feeding bus and continue to operate on float mode satisfactorily on restoration of AC supply to charger.
3. The DC system shall be ungrounded and shall float with respect to the ground potential when healthy. An earth fault relay of approved type and make shall be provided for detection and annunciation of earth fault.
- 4 After the batteries are boost charged and operation is changed to float mode, the voltage impressed on the loads shall not exceed float charge voltage.
5. The charger shall be designed to operate at an ambient air temperature of 50°C. It will be located indoor but in a hot, humid and tropical atmosphere.
6. The voltage at load terminal will not exceed the limits of +10% and -10% of nominal system voltage for DC system.
7. In case of failure of AC, battery will meet the DC load requirement. After restoration of power, one

FCBC will continue to supply the loads and the second FCBC will trickle charge the battery. Under discharge condition, one battery will be put to boost charge at a time.

8. Provision of Cell Tap assures that there is no need to isolate battery from loads while it is in boost mode.

The incoming A.C. supply for Quick and Trickle charger shall be controlled by rotary switches. In addition to the rotary switches supplies to the both chargers shall be controlled by two push button operated contractors having overload protection. 'RED' & 'GREEN' indicating lamps shall be provided to indicate 'ON' & 'OFF' conditions respectively of the Quick and Float charges in addition to the A.C. 'ON' indication.

During normal operation of the Trickle charger shall supply the normal direct current requirements of the substation and the station battery shall be floating on D.C. system. In the event of failure of A.C. supply or failure of the charger itself the battery shall come automatically across the load without any interruption.

It is intended to supply the D.C. load of the equipment normally by the float charger during boost charging of the bank. Thus, when the Boost charger is switched 'ON' the Boost charger and the battery bank shall be isolated from the float charger and the load automatically. If during boost charging operation, the A.C. supply fails, the battery shall come automatically across the load without any interruption. During the infinitely small time required for initiation of the contractor a reduced number of cells shall be available across the load, through the blocking diode.

Provision shall also be made so that in the event of failure of Float Charger, the Boost charger shall supply the load as well as charging a battery bank. Arrangement shall be made to limit the voltages across the load to around 110 volts, even if the boost charger is operating at maximum charging voltage. This aspect shall be clearly brought out in the tender by the bidder. In this operation also, the battery bank should come across the load automatically and without any interruption in the event of A.C. mains failure.

2.2.4 VOLTAGE REGULATING SYSTEM :

The Float and Boost Charger sections shall have suitable arrangement for regulation of D.C. output voltage by the following methods.

- (a) Automatic Voltage Regulation.
- (b) Manual Voltage Regulation.

(a) Automatic Voltage Regulation :

The Automatic Voltage Regulation shall hold the voltage flat from zero to full load within $\pm 1\%$ of pre-set value of the charger with a fluctuation of $\pm 10\%$ in voltage and $\pm 5\%$ in frequency in the A.C. input voltage. The setting device of the automatic voltage regulator shall be so designed that the D.C. output voltage can be set anywhere between (i) 100 volts to 126.5 volts for Float Charger and (ii) 100 volts to 140 volts for Boost Charger. The automatic voltage regulator shall be static type and its characteristics shall be supplied with the tender.

(b) Manual Voltage Regulator :

The Manual Voltage Regulator for Trickle charger shall have suitable equipments and means to

control the D.C. output voltage with the ranges mentioned earlier. The voltage control shall be smooth and continuous. The charger shall have a change over switch for selecting 'Auto' or 'Manual' mode of regulation to regulate the D.C. voltage. The tenderer shall furnish all the details of the manual voltage regulator in the tender.

Both the trickle and boost chargers shall be provided with alarm and indication for the following :

- Mains on
- Charger failed.
- Rectifier element fuse blown.
- Charger output fuse blown.
- AC input failed

In addition to the above arrangement for controlling, regulating and operation of the charger, the bidder may suggest and quote suitable alternative arrangement for the same. The right of acceptance of such an arrangement shall however, lie with the Employer.

2.2.5 INSTRUMENTS, EQUIPMENT ETC. :

i) Rectifier Transformer :

The rectifier transformers shall be designed to operate at a frequency of 50 Hz and at the r.m.s. voltage between the lines on the line side of transformers of 415+10% volts. The rating of the rectifier transformer shall correspond to the rating of the associated rectifier assembly. The transformer should preferably be air cooled dry / synthetic oil filled type and shall conform to the latest issues of IS: 2026 and IS: 4540.

ii) Rectifier Elements :

Rectifier elements shall be Thyristor and shall be arranged in three bridge circuit. The rectifier elements shall be protected by HRC fuse with fuse blow out indication. The rectifier stacks shall be supplied with their own heat dissipating arrangement for natural air cooling.

iii) Measuring Instruments :

The instruments shall be flush type and shall have dust proof and moisture resistant enclosed cases, finished in black and suitable for tropical use. Elements shall be shock resistant and shielded from external magnetic fields. The instruments and meters shall have easy accessible means for calibration testing and adjustment and shall conform to relevant I.S.S.

iv) Air Break Switches and Fuses :

The series combination air break rotary switches and HRC fuses shall conform to provisions of the latest issue of IS-4064, IS-4047 and IS-2208. the air break switches and fuses housed in the charger panel shall be so arranged that when they are opened, the terminals are readily accessible. Switches shall be of rotary operated type preferably with silver to silver contacts of adequate making, carrying and breaking current ratings and shall open and close with snap action to minimise arcing. The 'ON' and 'OFF' positions of the switches shall be definite and shall be clearly indicated.

All fuses shall be of HRC type conforming to the latest issue of I.S. 2208.

- v) The charger units shall be provided with but not limited to the following instruments and equipment :
- a) 3-pole a.c. mains ON-OFF switches and HRC fuses of suitable capacity.

- b) 2 pole air break switches with HRC fuses of suitable capacity output side of chargers.
- c) Air break magnetic contactors of suitable ratings complete with push button and thermal overload devices and red and green indicating lamps for A.C. input ON/OFF to the chargers.
- d) Fuse blown out indication for D.C. output fuses.
- e) HRC fuses for protection of rectifier elements with fuse blow out indication.
- f) 0-500 volts range, A.C. voltmeters to measure A.C. input voltage to the chargers. Accuracy class 1.0 as per I.S. 1248.
- g) Moving coil, flush mounting type voltmeters of suitable ranges to measure trickle, boost and battery voltages. Accuracy class: 1.0 as per I.S.-1248.
- h) Moving coil, flush mounting type ammeters of suitable scales to read the output currents of boost and trickle chargers and load current. Accuracy class : 1.0 as per I.S.-1248.
- i) Single pole D.C. contactors of suitable ratings.
- j) Blocking diode of adequate capacity.
- k) Cubicle illuminating lamps with door operated switches suitable for 240 volts ac.
- l) All other equipments and accessories for indication and alarm annunciation as mentioned earlier.
- m) All other equipments not specifically mentioned but required for proper and satisfactory operation of the charger shall be provided.
- n) The charger assembly shall be complete with input / output terminals, cable glands, internal wiring, earthing terminals, rating plates, etc.

2.2.6 CONSTRUCTIONAL FEATURES :

The whole battery charging equipment shall be housed in an indoor, floor mounting type; sheet metal clad, cubicle type enclosures which shall also be served as charger panels. The assembly shall be complete in all respect and shall contain all the components described in different clauses and which are essential for the proper operation and control of the equipment. The enclosures shall be totally enclosed dust tight and vermin proof.

All doors and covers shall be filled with rubber gaskets. The panels shall have double leaf hinged doors at the back and shall be provided with locks and duplicated keys. The equipment in the panels shall be so located as not to cause congestion and accessibility to the equipment located herein shall be easy and convenient.

All incoming and outgoing cables shall enter from bottom and suitable cable terminal boards with cable lugs shall be provided in side of each panel for incoming and outgoing cables. Each terminal of the terminal boards shall be serially numbered to facilitate connections. At least 20% extra terminals shall be provided in each terminal board. Suitable compression type cable glands with base plates shall also be provided. The terminal boards shall be easily accessible for inspection and checking. The panels shall have cable supports and metallic clips for supporting power and control cables for internal wiring of the panels.

2.2.7 TESTS :

The battery charger and all the components of the charger shall be routine tested accordingly to their relevant standard. This shall include the following :

- a) Operational check for boost and float charger.

- b) Input / Output test of the chargers.
- c) Performance test of the charger.
- d) Temperature rise test of the rectifier transformer.
- e) Power frequency H.V. test / Insulation tests.

2.3 DC DISTRIBUTION BOARD :

2.3.1 General Features :

The D.C. distribution boards shall be indoor, floor mounting of self supporting, sheet metal clad, and cubicle type. The panels should be totally enclosed, dust tight and vermin proof and shall be made of 2.0mm cold rolled sheet steel. The boards shall be provided with double leaf hinged doors at the back. All doors and covers shall be fitted with rubber gaskets. The doors shall be provided with locks and duplicated covers.

2.3.2 Busbars :

The busbars shall be of electrolytic copper of ample cross-section. The busbars shall be insulated from the structure by means of durable, non-hydroscopic, non-combustible and non tracking materials.

2.3.3 Requirement in detail :

The 110 Volts D.C. distribution boards shall be provided with the following:

- A. One mains failure alarm relay.
- B. One earth fault alarm relay (both for +ve and –ve earth fault).
- C. One 24 Volts / 110 Volts D.C. bell to be operated by the mains failure alarm relay.
- D. One 24 Volts / 110 Volts D.C. buzzer to be operated by the earth failure alarm relay.
- E. One double pole air-break circuit breaker of 200 amp capacity with thermal overload tripping arrangement to act as incoming breaker of the load bus.
- F. One 0-40 volts / 0-150 volts D.C. moving coil voltmeter to measure the bus-bar voltage. The display is to be in digital.
- G. One pilot lamp to indicate D.C. on conditions.
- H. 250 volts, double pole double throw make before break switch with H.R.C. fuses of following ratings for outgoing feeders.
 - a. 16 Amp, 4 Nos.
 - b. 32 Amp, 3 Nos.
 - c. 63 Amp, 1 Nos
- I. One terminal Board/block for all feeder outlets including cable glands.

2.4 L.T. AC PANEL :

2.4.1 General Arrangement :

The 415 volts L.T.A.C. panels shall be indoor floor mountings sheet metal clad type comprising of combination switch fuse units and busbar chambers and equipped with circuits and equipments as specified. The different circuits shall be mounted above and below the busbar chamber to form a suitable arrangement, except that the incomings will be located at the front and mounted below the

bus bar chamber. All equipments shall be suitable for the reception of the cables rising from the ground level. The switchboards shall be so designed as to be readily extensible.

2.4.2 Busbars :

The phase and neutral busbars shall be of high conductivity Aluminium of adequate uniform cross section. The busbars shall be insulated from the structure by means of durable non-hygroscopic, non-combustible and non-tracking materials. Busbar joints shall be of bolted type.

2.4.3 Requirement in detail :

The 415 Volts, L.T. AC switchgears shall have following circuits and equipment :

a) INCOMING : One number fitted with following :

- i. One 200 Amp, four pole MCCB and cable glands suitable for 4 core P.V.C. cable labeled as 'INCOMING'.
- ii. One Voltmeter, 0-500 Volts.
- iii. One Ammeter, 0-500 Amps.
- iv. One K.W.H. Digital Energy meter with connected C.T.R 200/5A.

b) OUTGOING : 1 no. comprising of :

One 32 Amps T.P.N. Switch fuse unit fitted with 32 Amps H.R.C. fuses and complete with direct connected round projecting pattern ammeter, scaled 0-50 Amps and cable glands suitable for 4 core P.V.C. cable and labeled as 'Transformer Heater' and 'Circuit Breaker Heater'.

c) OUTGOING : 2 No., each comprising of :

One 100 Amps, T.P.N. switch fuse unit, fitted with 100 Amp H.R.C. fuses and cable glands suitable for 4 core, P.V.C. cables and labeled as 'FILTRATION SET'.

d) OUTGOING : 3 No., each comprising of :

One 30 Amps D.P. switch fuse unit fitted with 15 Amp H.R.C. and cable glands suitable for 2 core P.V.C. cable labeled as :

No. 6: 'Indoor lights and Indicating Lamps'

No. 7: 'Emergency Lights'

No. 8: 'Spare'.

e) OUTGOING : 3 No., each comprising of :

One 60 Amps T.P.N. switch fuse units fitted with 30 Amp H.R.C. fuses and cable glands suitable for 4 core P.V.C. cables and labeled as :

No. 9: 'Outdoor Light'

No. 10: 'Battery Charger'

No. 11: Spare

No. 12: 'Spare'

FORMS FOR GUARANTEED TECHNICAL PARTICULARS (GTP)

GUARANTEED TECHNICAL AND OTHER PARTICULARS FOR STEEL TUBULAR POLE

(TO BE FILLED IN BY THE BIDDER)

:-SL. NO.	DESCRIPTION	UNIT	SP-76	SP-66
	Name of the bidder			
1	Name of Manufacturer			
2	Place of manufacture			
3	Country in origin			
4	IS Standards Application			
5	Type of Pole			
6	Total length	M		
7	Out side diameter and thickness of section			
A	Bottom	Mm		
B	Middle	Mm		
C	Top	Mm		
8	Minimum Guaranteed weight of pole (without base plate)			
9	Effective length of Section			
A	Bottom			
B	Middle			
C	Top			
9	Minimum Guaranteed weight of Base plate			
10	Breaking load			
11	Crippling load			
12	Galvanization—gm/sqm			
	PERFORMANCE GAURANTEE			

GUARANTEED TECHNICAL AND OTHER PARTICULARS FOR ACSR RACCOON CONDUCTOR

CONDUCTOR		
1. Conductor:		
2. IS applicable:		
3. Wire Diameter		
Aluminum (mm)		
Steel(mm)		
4. Number of strands:		
Steel centre		
1st steel layer		
1st Aluminium layer		
2nd Aluminium layer		
5. Sectional Area of Aluminium (sq. mm.)		
6. Total Sectional Area(sq.mm.)		
7. Overall diameter(mm)		
8. Approximate weight(Kg./Km.)		
9. Calculated D.C resistance at 20 degrees C., maximum. (Ohms/Km)		
10. Ultimate tensile strength (KN)		
11. Final modulus of elasticity (GN/sq.m)		
12. Coefficient of linear expansion x 10-6 per°C		
13. Lay ratio		
Steel core 6 wire layer		
Aluminium 1st layer		
2 nd layer		
14. Technical Particulars		
a. Diameter-mm		
Standard(mm)		
Maximum (mm)		
Minimum (mm)		
b. Cross-sectional area of nominal diameter wire (mm ²)		
c. Weight (Kg./Km)		
d. Min. breaking load (KN)		
Before stranding		
After Stranding		
e. D.C resistance at 20°C min. (Ohm/Km)		

GUARANTEED TECHNICAL PARTICULARS FOR 33/11 KV SURGE ARRESTORS

(To be filled in by the bidder)

Sl. No.	Description	Particulars
1	Name & Address of Supplier & Manufacturer	
	Surge Arrestor	
	Line Disconnector	
	Metal Oxide Block	
	Terminal Clamp	
2	Name & address of collaborator, if an	
3	Standard to which surge arrestors conforms	
4.0	Surge Arrestor	
4.1	Voltage rating (KV rms)	
4.2	Continuous Operating Voltage (KV rms)	
	a) Continuous Operating Voltage (KV rms)	
	b) Leakage current at continuous operation voltage	
	c) Permitted leakage current of arrestor beyond which arrestor is faulty.	
5	Frequency (Hz.)	
6	Nominal discharge current (wave shape – 8/20 micro second) (KA)	
7	Pressure relief rated current (KA rms)	
8.	Steep current protection level at 10 KA	
	a) Lightning impulse protection level with 40 X 80 micro-sec. Wave at 500/1000 A	
9	Long duration current impulse withstand capacity and virtual duration	
10	Line discharge class	
11	Thermal runaway limit arrestor	
12	Energy capability (kj/KV)	
13	Pressure relief rating	
14	Dry arcing distance	
15	Reference current and reference voltage	
16	Arrestor Housing	
16.1	Power frequency one minute wet withstand voltage (kV rms)	
16.2	Lightning impulse dry withstand voltage (kVP)	
16.3	Creepage distance	
	a) Protected	
	b) Total	
16.4	Short Circuit withstand capacity	
16.5	Bending moment (mm)	
17	Dis-connector	
	a) Constructional Details	
	b) Other information as applicable to surge arrestor	
18	Surge Monitor	
	a) Constructional Details	
	b) Degree of protection	
19	Suitable for hot line washing	
20	Dimension and Weight	
21	G.A Drawing indicating height of complete unit from base to line, minimum recommended center to center spacing, clearance from ground equipment at various height of Arrestor, earthing arrestor, earthing arrangement on earthed side of arrestor etc.	
22	Details of Packing	
23	License number and date for using ISI certification mark if any	
24	Ammeter for discharge current	
	a) Type & Make	
	b) Accuracy	
	c) Range (mA)	

25	Residual voltage	
26	Follow Current	
27	PERFORMANCE GUARANTEE	

GUARANTED TECHNICAL PARTICULARS OF 11 KV COMPOSITE POLYMER PIN INSULATORS

S.N	Description	11 KV, 5 KN
1	Name of Manufacturer	
2	Address:	
(a)	Registered Office	
(b)	Factory	
3	Type of Insulators	
4	Standard specification to which the insulators manufactured and tested	
5	Name of Material used in manufacture of the Insulator (With class/ Grade)	
(a)	Material of core rod	
(b)	Material of Housing & Weather sheds (silicon content by weight)	
(c)	Material of end fittings : tongue/ clevis	
(d)	Sealing compound for end fitting	
6	Colour Glaze of Insulator	
7	Electrical Characteristics:	
(a)	Nominal System Voltage (kV RMS)	
(b)	Highest System voltage (kV RMS)	
(c)	Dry power frequency withstand (kV RMS)	
(d)	Wet power frequency withstand (kV RMS)	
(e)	Dry flash over voltage (kV RMS)	
(f)	Wet flash over voltage (kV RMS)	
(g)	Dry lightning impulse withstand voltage	
	(a) Positive (kV Peak)	
	(b) Negative (kV Peak)	
(h)	Dry lightning impulse flashover voltage	
	(a) Positive (kV Peak)	
	(b) Negative (kV Peak)	
(i)	RIV at 1MHz when energized at 10kV/30kV(rms) under dry condition(microvolt)	
(j)	Creepage distance (min) mm	
8	Mechanical Characteristics:	
	Minimum failing load(KN)	
9	dimensions of insulator:	
(i)	Weight(kg)	
(ii)	dia of FRP rod(mm)	
(iii)	Length of ERP rod(MM)	
(iv)	dia of weather sheds (mm)	
(v)	Thickness of housing (mm)	
(vi)	Dry arc distance(mm)	
	Dimensioned drawings of Insulator(including weight with tolerances in weight) enclosed	
10		
11	Method of fixing of sheds to housing specify):- Single mould or modular construction (injection moulding/ compression moulding)	
12	No. of weather sheds	
13	Type of sheds	
(i)	Aerodynamic	
(ii)	With under ribs	
14	Packing details	

(a)	Type of packing	
(b)	No. of Insulators in each pack	
(c)	Gross weight of package	

**GUARANTEED TECHNICAL PARTICULARS OF COMPOSITE POLYMERIC INSULATOR (STRING/ DISC) FOR
11 KV , 45 KN (T & C) TYPE**

(To be filled in by the bidder)

Sl. No	Description	Unit	11KV , 45 KN , T& C type
1.	Type of Insulator		
2.	Standard according to which the Insulator manufacture and tested		
3.	Name of material used in manufacture Of the insulator with class/grade		
(a)	Material of core (FRP rod) i) E-glass or ECR- glass ii) Boron content		
(b)	Material of housing & Weather sheds Silicon content by weight		
(c)	(material of end fitting)		
(d)	Sealing compound for end fittings		
4.	Color		
5.	Electrical characteristics		
(a)	Normal system voltage	KV(rms)	
(b)	Highest system voltage	KV(rms)	
(c)	Dry power Frequency withstand voltage	KV(rms)	
(d)	Wet power frequency withstand voltage	KV (rms)	
(e)	Dry flashover voltage	KV(rms)	
(f)	Wet flashover voltage	KV(rms)	
(g)	Dry lighting impulse withstand voltage a) Positive b) Negative	KV(peak) KV(peak)	
(h)	Dry lighting impulse flashover voltage c) positive d) Negative	KV(peak) KV(peak)	
(i)	R/V at 1MHz when energized at 10KV/30KV(rms) under dry condition	Microvolt	
(j)	Creepage distance (mm)	Mm	
6.	Mechanical characteristics		
(a)	Minimum failing load	KN	
7.	Dimension of insulator		
(i)	Weight	Kg	
(ii)	Dia of FRP rod	Mm	
(iii)	Length of FRP rod	Mm	
(iv)	Die. Of Weather sheds	Mm	
(v)	Thickness of housing	Mm	

(vi)	Dry arc distance	Mm	
	Dimension drawing of insulator including weight with clearances min weight enclosed		
8.	Method of fixing of sheds to housing (specify single moulder Modular construction moulding)		
9.	No. of Weather sheds		
10.	Types of sheds		
(i)	Aerodynamic		
(ii)	With under ribs		
11.	Packing details		
(a)	Types of packing		
(b)	No. of insulator each pack		
(c)	Gross weight of package		
12.	Any other particulars which the bidder may like to give		

GUARANTEED TECHNICAL PARTICULARS OF H.T. GUY INSULATOR
(To be filled in by the bidder)

Sl.NO.	PARAMETER	GUARANTEED VALUE
1	Manufacturer's Name & Address	
2	Type of insulator	
3	Standards to which insulator will conform	
4	Dimensions	
5	Hole diameter (mm)	
6	Color of glaze	
7	Dry Power Frequency withstand Voltage (kV)	
8	Wet Power Frequency withstand Voltage (kV)	
9	Minimum failing load (Newton)	
10	Minimum Creepage distance (mm)	
11	Weight per piece (Kg)	
12	Temperature cycle test (as per ISS)	
13	Porosity test (as per ISS)	
14	Tolerance, if any (as per ISS)	
15	Performance guarantee	

GUARANTEED TECHNICAL PARTICULARS FOR G.I. WIRE

(To be filled in by the bidder)

A.	G.I. Wire (4 mm dia)	:	
1.	Size of Wire	:	
2.	Tolerance in size of wire	:	
3.	Tensile strength	:	
4.	Wrapping list	:	
5.	Galvanising conforming to IS : 4826 – 1968	:	
6.	Guarantee	:	
B.	G.I. Wire (5 mm dia)	:	
1.	Size of Wire	:	
2.	Tolerance in size of wire	:	
3.	Tensile strength	:	
4.	Wrapping list	:	
5.	Galvanising conforming to IS : 4826 – 1968	:	
6.	Performance guarantee	:	

GUARANTEED TECHNICAL PARTICULARS FOR C.I. PIPE (EARTH)

(To be filled in by the bidder)

Sl.No.	G.I.Wire (4 mm dia)	:	
1.	Length of Pipe	:	
2.	Diameter of Pipe	:	
3.	External Dia of Pipe	:	
4.	Thickness of Pipe	:	
5.	Internal Dia of Socket	:	
6.	Thickness of Socket	:	
7.	Internal Depth of Socket	:	
8.	Internal Radius of Socket	:	

9.	Width of Grooves of Socket	:	
10.	External Dia of Grooves Socket		
11.	Weight of Pipe	:	
12.	Hydraulic Test	:	
13.	Guarantee	:	

GUARANTEED TECHNICAL PARTICULARS FOR TENSION HARDWARE FITTINGS

(To be filled in by the bidder)

A.	TENSION HARDWARE FITTINGS		
	Size of conductor for which the fitting is designed		
1.	Electrical resistance of dead end assembly	Ohms	
2.	Slip strength of dead end assembly	kN	
3.	Total weight of assembly		
a)	Single Tension	Kg	
b)	Double Tension	Kg	
4.	UTS of Tension string hardware		
a)	Single Tension	kN	
b)	Double Tension	kN	
5.	Purity of zinc used for galvanizing	%	
6.	Min. No. of dips in standard Preece test the ferrous parts can withstand	No.	
B.	MID SPAN COMPRESSION JOINT FOR CONDUCTOR		
	Size of conductor for which the fitting is designed		
1.	Suitable for conductor size	Mm	
2.	Material of Aluminum sleeve		
a)	Aluminum		
b)	Purity of Aluminum sleeve		
3.	Outside diameter of sleeve before compression		
a)	Aluminum	Mm	
b)	Steel	Mm	

4.	Inside diameter of sleeve before compression		
a)	Aluminum	Mm	
b)	Steel	Mm	
5.	Length of sleeve before compression		
a)	Aluminum	Mm	
b)	Steel	Mm	
6.	Dimensions of sleeve after compression		
a)	Aluminum		
i)	Corner to Corner	Mm	
ii)	Face to Face	Mm	
b)	Steel		
7.	Length of sleeve after compression		
a)	Aluminum	Mm	
b)	Steel	Mm	
8.	Weight of sleeve		
a)	Aluminum	Kg	
b)	Steel	Kg	
c)	Total	Kg	
9.	Slipping strength	kN	
10.	Conductivity of the compressed unit expressed, as percentage of the conductivity of equivalent length of bare conductor	%	
C.	REPAIR SLEEVE FOR CONDUCTOR		
	Size of conductor for which the fitting is designed		
1.	Suitable for conductor size	Mm	
2.	Material of Sleeve		
a)	Aluminum/Aluminum Alloy		
b)	Purity of Aluminum	%	
3.	Inside diameter of sleeve before compression	Mm	
4.	Outside dimensions of sleeve		
a)	Dia before compression	Mm	
b)	After compression	Mm	
i)	Corner to Corner		
ii)	Face to Face		
5.	Length of sleeve		
a)	Before compression	Mm	
b)	After compression	Mm	
6.	Weight of sleeve	Kg	

D.	PARTICULARS OF VIBRATION DAMPER FOR CONDUCTOR			
	Size of conductor for which the fitting is designed			
1.	Suitable for conductor size	Mm		
2.	Total weight of one damper	Kg		
3.	Diameter of each damper mass	Mm	Right	Left
4.	Length of each damper mass	Mm		
5.	Weight of each damper masses	Kg		
6.	Material of damper masses			
7.	Material of the stranded messenger cable			
8.	Material for clamp			
9.	Number of strands in stranded messenger cable			
10.	Lay ratio of stranded messenger cable			
11.	Minimum ultimate tensile strength of stranded messenger cable	Kg/mm		
12.	Slipping strength of stranded messenger cable (mass pull off)	kN		
a)	First frequency	Hz		
b)	Second frequency	Hz		
14.	Designed clamping torque	Kg-m		
15.	Slipping strength of damper clamp			
a)	Before fatigue test	kN		
b)	After fatigue test	kN		
16.	Magnetic power loss per vibration damper at a conductor Current of 350 Ampere, 50 hz AC-	Watts		
17.	Percentage Variation in reactance after fatigue test in comparison with that before fatigue	%		
18.	Percentage Variation in power dissipation after fatigue test in comparison with that before fatigue	%		
E.	SPAN OF COMPRESSION JOINT FOR GALVANISED STEEL EARTHWIRE			
	Size of Earthwire for which the fitting is designed			
1.	Material of joint			
a)	Type of Material with Chemical composition			
b)	Hardness of steel sleeve (Brinell Hardness)			
2.	Inside diameter of sleeve before compression			
a)	Steel Sleeve	Mm		

b)	Aluminum Sleeve	Mm	
c)	Aluminum Filter Sleeve	Mm	
3.	Outside diameter of sleeve		
a)	Steel Sleeve	Mm	
b)	Aluminum Sleeve	Mm	
c)	Aluminum Filter Sleeve	Mm	
4.	Outside dimensions of sleeve after compression		
a)	Steel Sleeve	Mm	
b)	Corner to Corner	Mm	
c)	Surface to Surface	Mm	
5.	Length of Steel Sleeve		
a)	Before compression	Mm	
b)	After compression	Mm	
6.	Length of Aluminum Sleeve		
a)	Before compression	Mm	
b)	After compression	Mm	
7.	Weight of Sleeve		
a)	Steel	Mm	
b)	Aluminum	Mm	
c)	Filler Aluminum Sleeve	Mm	
8.	Slipping Strength		
9.	Conductivity of the compressed unit expressed as a percentage of the conductivity of equivalent length of bare earthwire	%	
F.	VIBRATION DAMPER FOR GALVANISED STEEL EARTHWIRE (7/3.15mm)		
	Size of Earthwire for which the fitting is designed		
1.	Suitable for earthwire size	Mm	
2.	Total weight of one damper	Kh	
3.	Diameter of each damper mass	Mm	
4.	Length of each damper mass	Mm	
5.	Weight of each damper mass	Kg	
6.	Material of damper mass	Kg	
7.	Material of Clamp		
8.	Material of Stranded messenger cable		
9.	Number of Strands in stranded messenger cable		
10.	Lay ratio stranded messenger cable		
11.	Minimum ultimate tensile strength of	Kg/Sq.mm	

	stranded messenger cable		
12.	Slipping strength of stranded messenger cable (mass pull off)	kN	
13.	Resonance frequencies		
a)	First frequency	Hz	
b)	Second frequency	Hz	
G.	FLEXIBLE COPPER BOND		
1.	Stranding		
2.	Cross Sectional Area	Sq.mm	
3.	Minimum Copper equivalent area	Sq.mm	
4.	Length of Copper Cable	Mm	
5.	Material of lugs		
6.	Bolt Size		
a)	Diameter	Mm	
b)	Length	Mm	
7.	Resistance	Ohm	
8.	Total Weight of Flexible Cu bond	Kg	
H.	TENSION CLAMP FOR GALVANIZED STEEL EARTHWIRE		
	Size of earthwire for which the fitting is designed		
1.	Material		
i)	Shackle		
ii)	a) Compression clamp		
	b) Hardness of the material (BHN)	BHN	
2.	Inside diameter of the clamp before compression	Mm	
3.	Outside dimensions of sleeve before compression		
4.	Outside dimensions of sleeve		
a)	Corner to Corner	Mm	
b)	Surface to Surface	Mm	
5.	Length of Clamp		
a)	Before Compression	Mm	
b)	After Compression	Mm	
6.	Weight	Kg	
7.	Slip strength (minimum)	kN	
8.	Compression Pressure	T	
9.	Minimum Breaking Strength of assembly (excluding clamp)	kN	

10.	Performance guarantee
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GUARANTEED TECHNICAL PARTICULARS FOR GI CHANNEL CROSS ARM
[100 x 50x 50x6 x 2200]
 (To be filled in by the bidder)

Sl No.	Description	Particular
1	Type of cross arm	
2	Size	
3	Material	
4	Length	
5	Breath	
6	Width	
7	Thickness	
8	Hole for foxing of insulator	
9	Center to center distance for hole	
10	Weight	
11	Galvanization	

GUARANTEED TECHNICAL PARTICULARS FOR 11 KV T-CROSS ARM
 (To be filled in by the bidder)

Sl No.	Description	Particular
1	Type of cross arm	
2	Applicable standard	
3	Material	
4		
5	Width	
6	Thickness	
7	Diameter of hole for Pole fixing	
8	Diameter of hole for G.I Pin	
9	For Fixing of Pin insulator	
10	Welding Joints	
11	Painting	
12	For galvanization	
13	Weight	

GUARANTEED TECHNICAL AND OTHER PARTICULARS FOR 70 SQ. MM COVERED CONDUCTOR.

SN.	Parameters	Bidder's offer
1	Conductor type	
2	Lay up of Conductors (mm)	
3	Conductor Dia (mm)	
4	Inner Semiconducting Layer thickness (mm)	
5	Inner XLPE Layer thickness (mm)	
6	Outer UV Resistance - XLPE Thickness (mm)	
7	Over all diameter (Min-Max) (mm)	
8	Weight (Kg/Km)	
9	Rated Operated Voltage (KV)	
10	DC-resistance at 20 Degree C, Maximum (Ohm/KM)	
11	Resistance Temperature coefficient (/°C)	
12	Lightening Impulse withstand strength of XLPE Layer (KV)	
13	Maximum Continuous Operating temperature (°C)	
14	Max load (IEC 61597), cond.temp 80 °C, air temp. 40 °C, wind speed 0.5 m/s, Solar radiation 1045W/m ² , Approximate value (A)	
15	Max short circuit current, 1 sec (KA)	
16	Tensile Strength of Conductors (kN)	
17	Aluminium Alloy	

Marking

The Conductor Drum shall be marked with the following:

- 1) Manufacturer's name,
- 2) APDCL "SOPD 2018-19"
- 3) Size and type of conductor,
- 4) Net weight of conductor in Kg,
- 5) Gross weight of conductor in Kg,
- 6) Length of conductor in meter,
- 7) BIS Standard Mark.

Sl.No.	Particular of GTP Parameter	Bidders Confirmation	
		33kV CT	11kV CT
1	Manufacturer's Name & address		
2	Type of equipment		
3	Type of Mounting		
4	Equipment Conforming to Standards		
5	Rated Voltage / Highest System Voltage in KV		
6	Rated Primary Current (Amp)		
7	Rated Secondary Current (Amp)		
8	Frequency (HZ)		
9	Ratio of Current Transformer		
10	Details of Cores		

i)	Number of Cores		
ii)	Purpose		
iii)	Burden (VA)		
iv)	Class of Accuracy		
11	Rated Short Time Withstand Current for 1 Sec. duration		
12	Rated Dynamic Withstand Current (KAp)		
13	Method of Earthing system to be connected to		
14	One minute Dry Power Frequency Withstand Voltage (KV rms) of Primary Winding		
15	One minute Wet Power Frequency Withstand Voltage (KV rms) of Primary Winding		
16	1.2/50 micro-second Impulse Withstand Voltage (KVP)		
17	The die-electric Withstand values (KVp) of external & internal insulation		
18	One minute Power Frequency Withstand Voltage (KV rms) of Secondary Winding		
19	Minimum Creepage Distance (mm)		
20	Weight of oil (kg/Ltrs.)		
21	Total Weight (kg)		
22	Mounting details		
23	Overall dimension		
24	Type of Winding		
25	Material of Winding		
26	Size & Cross Section of Primary Winding		
27	Size & Cross Section of Secondary Winding		
28	No. of Primary Turns		
29	No. of Secondary Turns		
30	Current Density of Primary & Secondary Winding (max. – 1.6A/sq.mm)		
31	Primary Terminal		
32	Type of Insulation		
33	Whether Current Transformer confirms to Temperature Rise limits		
34	Type of oil compensation		
35	Type of pressure release device provided		
36	Partial Discharge level		
37	Rated continuous Thermal Current (120% of the rated Primary Current)		
38	Instrument Security Factor (ISF ≤ 5)		
39	Class of Insulation		
40	Actual clearance between live part & ground (mm)		

Sl.No.	Particular of GTP Parameter	Bidders Confirmation	
		33kV PT	11kV PT
1	Manufacturers name & Type of PT		
2	Manufacturer's type Designation.		
3	Whether Conforming to standards		
4	Rated Primary Voltage in kV		
5	Number of secondary windings		

6	Rated secondary voltage (Volts)		
7	Rated burden (VA)		
8	Accuracy class		
9	Highest system voltage (kV)		
10	Quantity of oil (Liters)		
i)	Type of insulation & Temperature rise limits		
ii)	Whether Potential transformer conforms to the Temperature rise limits		
iii)	Rated voltage factor & time		
iv)	One minute power frequency withstand voltage test (dry) (kV rms)		
11	One minute power frequency withstand voltage test (wet) (kV rms)		
12	1.2/50 microsecond impulse wave withstand test voltage (kVP)		
13	One minute power frequency withstand voltage on secondary (kV rms)		
14	Minimum Creepage distance (mm)		
15	Weight of oil (kg)		
16	Total weight (kg)		
17	Overall dimensions		
18	Mounting details		
19	Primary terminals		
20	Whether Type test reports (within 5 years) are submitted along with the offer?		
21	Type of oil compensation		
22	Whether experience sheet n is submitted along with the offer?		
23	Whether 5 year continuous servicing performance certificate is submitted along with the offer?		
24	Whether Drawings are submitted along with the offer?		
25	Whether Pressure release device of technical specification is provided?		
26	Type of insulation material used for PT		

UARANTEED TECHNICAL PARTICULARS			
FOR 33kV, 1250A, 26.3 kA for 3 sec/ 11KV, 1250A, 25kA VACUUM CIRCUIT BREAKERS			
Sl.No.	Description	Bidder's Confirmation	
		For 33KV	For 11KV
1	Name of Manufacturer		
2	Type of Outdoor switchgear		
3	Designation of outdoor circuit breaker		
4	VCB conforms to IEC 62271- 100 amended upto date / IS: 13118:1991 : Yes/No		
5	Whether offered outdoor circuit breaker is porcelain clad type (yes/no)		
6	Shall outdoor circuit breaker provided 3 number of poles (yes/no)		
7	Rated voltage of outdoor circuit breaker in kV.		

8	Is offered out door circuit breaker suitable for 50 Hz rated frequency.(Yes/No)		
9	Type of operation - Mechanically coupled gang operated : Yes/No		
10	Operating mechanism, A. C. Control & Protective devices, lighting fixtures, space heaters and motor operating on supply single phase, 250 Volts \pm 10% A.C., 50 Hz , two pole with one pole grounded : Yes/No		
11	Maximum continuous voltage of outdoor circuit breaker in kV		
12	Rated continuous current of outdoor circuit breaker in amps.		
13	Offered VCB shall be suitable for solid neutral earthing : Yes/No		
14	Rated symmetrical short circuit breaking current (for 3 seconds) of outdoor circuit breaker in ka (rms) 25 kA		
15	Rated operating sequence of outdoor circuit breaker shall be o- 0.3 sec-co-3 min - co		
16	Amplitude factor of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity shall be 1.4		
17	First pole to clear factor of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity shall be 1.5		
18	Rate of rise of restriking voltage of outdoor circuit breaker on restriking voltage at 100% rated breaking capacity in kv/microsecs) 50/70		
19	Dry-1 minute power frequency withstand voltage of outdoor circuit breaker between line terminal and earth in kvrms shall be 50/70kV		
20	Dry-1 minute power frequency withstand test voltage for outdoor circuit breaker between terminal with breaker contacts open in kvrms		
21	1.2 / 50 micro second impulse with-stand voltage for outdoor circuit breaker between line terminal and earth in kvp		
22	1.2 / 50 micro second impulse with-stand voltage for outdoor circuit breaker between terminals with breaker contacts open in kvp		
23	Material of main contacts of outdoor circuit breaker		
24	Material of terminal pad of outdoor circuit breaker (copper/Aluminium)		
25	If Terminal Pads are made of metal other than aluminum, thickness of silver plating on terminal pads shall be at least 25 microns.		
26	The current density for copper terminal pad shall not be more than 1.6 A/sq. mm.		
27	The current density for other than copper terminal pad shall not be more than 1 A/sq. mm.		
28	Net cross section of terminal pad of outdoor circuit breaker in sq mm		

29	Material of make –break contacts in Vacuum Interrupter		
30	Material of tips of Main contacts of circuit breaker		
31	Whether electrical anti pumping device provided for outdoor circuit breaker (yes/no)		
32	Size of auxiliary contacts of outdoor circuit breaker in sq. Mm.		
33	Material of auxiliary contacts of outdoor circuit breaker		
34	Continuous current capacity of auxiliary contacts of outdoor circuit breaker in amps.		
35	Breaking current capacity of auxiliary contacts of outdoor circuit breaker in amps.		
36	Insulation level of auxiliary contacts of outdoor circuit breaker in volts.		
37	1 minute p. F. Withstand voltage of auxiliary contacts of outdoor circuit breaker in kvrms.		
38	Whether any contact multiplier are used for outdoor circuit breaker (yes/no) (if *yes* then fill 39 to 42)		
39	Make of contact multiplier used for circuit breaker		
40	Making and breaking capacity of contact multiplier used for outdoor circuit breaker in ka		
41	Voltage rating of contact multiplier used for outdoor circuit breaker in kv		
42	Capacity of coil of contact multiplier used for outdoor circuit breaker in watts		
43	No. Of normally open auxiliary contacts provided for outdoor circuit breaker available for use in remote C&R panels		
44	No. Of normally close auxiliary contacts provided for outdoor circuit breaker available for use in remote C&R panels		
45	Whether potential free contact available for remote indication of spring charged" of outdoor circuit breaker (yes/no)		
46	Voltage rating of bushing used for outdoor circuit breaker in kv.		
47	Dry-1 minute power frequency withstand voltage of bushing used for outdoor circuit breaker in kvrms		
48	Dry flashover voltage of bushing used for outdoor circuit breaker in kvrms		
49	Wet flashover voltage of bushing used for outdoor circuit breaker in kvrms		
50	1.2/50 micro second impulse withstand voltage of bushing used for outdoor circuit breaker shall be 125/170 kvp		
51	Total creepage distance of bushing used for outdoor circuit breaker shall be 300 mm.		
52	Center to center minimum clearances in air between phases of outdoor circuit breaker in mm		

53	Minimum Clearances provided in air between two Phases : in mm		
54	Minimum clearances in air between live part to live part of phases of outdoor circuit breaker shall be 430 mm.		
55	Minimum clearances in air between live part to earth of outdoor circuit breaker shall be 450mm		
56	Minimum clearances in air between live part of outdoor circuit breaker to ground level shall be 3700 mm		
57	Height of the lowest part of the support insulator from ground level		
58	Class of Insulating Material		
59	Max. closing time in ms (Max.150 ms)		
60	Max. total break time at 100 % rated interrupting breaking capacity : 100 ms		
61	Type of closing mechanism of outdoor circuit breaker shall be motor assisted spring charged mechanism.		
62	Type of tripping mechanism of outdoor circuit breaker shall be motor assisted spring charged mechanism with shunt trip coil.		
63	Burden of trip coil of outdoor circuit breaker at 110 V (DC) in watts		
64	Burden of closing coil of outdoor circuit breaker at 110 V (DC) in watts		
65	Whether mechanical on/off and "spring charged" indications for outdoor circuit breaker provided (yes/no)		
66	Whether manual trip/close of outdoor circuit breaker possible (yes/no)		
67	Whether mechanical spring charging for outdoor circuit breaker possible (yes/no)		
68	Voltage rating of spring charging motor of outdoor circuit breaker in volts		
69	Burden of spring charging motor of outdoor circuit breaker in VAmp		
70	Control circuit voltage of outdoor circuit breaker shall be 30 volts d. C. (yes/no)		
71	The surface finish paints of non galvanized metallic part of VCB shall be battleship gray shade No.632 of IS 5.		
72	Process of painting of parts of outdoor circuit breaker		
73	Type of primer used for painting of parts of outdoor circuit breaker		
74	Type of finish paint used for painting of parts of outdoor circuit breaker		
75	Degree of protection of Operating Mechanism enclosure is IP 55 as per IEC529/ IS 2147		
76	Mounting of CB On hot dip galvanized steel support structure or on the operating mechanism box, as the case may be, to be supplied by the tenderer		

77	Whether all type tests are carried out on outdoor circuit breaker at nabl laboratories within five years from date of opening of tender (yes/No)		
78	Whether type tested on offered design of outdoor circuit breaker (yes / no).		
79	A list of recommended spares with unit rates for each circuit breaker that may be necessary for satisfactory operation and maintenance of the circuit breaker for a period of 5 years shall be submitted.		
80	A list and unit rates of all the special tools, equipments and instruments required for erection, testing, commissioning and maintenance of the breaker shall be submitted		
81	The list of necessary tools/equipments which will be supplied free of cost with each CB furnished separately.		
82	Are following Type test reports submitted with offer for offered equipment		
	a. Lightening impulse withstand voltage test. :Yes/No		
	b. Power Frequency Voltage withstand test (dry & wet). :Yes/No		
	c. Temperature rise test. :Yes/No		
	d. Measurement of resistance of Circuit: Yes/No		
	e. Short time and peak withstand current tests. :Yes/No		
	f. Mechanical operation test. :Yes/No		
	g. Degree of protection (IP55) for all cabinets. :Yes/No		
	h. Out of phase making and breaking tests. :Yes/No		
	i. Short Circuit Making and Breaking current Tests a) No load operation before and after test b) Basic test duties no. 1 to 5 c) Single Phase Short circuit test d) Condition of breaker after short circuit tes		
83	Are the following drawing submitted		
	a. General outline drawings showing outside dimensions, shipping dimensions, weights, quantity of insulating media air receiver capacity and such other prominent details. :Yes/No		
	b. Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts, with lifting dimensions for maintenance. :Yes/No		
	c. Schematic diagrams of the scheme for control, supervision and reclosing :Yes/No		
	d. Structural drawing, design calculations and loading data for support structures. :Yes/No		
	e. Foundation drilling plan and loading data for foundation design. :Yes/No		
	f. Type test reports of circuit breakers along with a separate list showing all the tests carried out with date & place of test. :Yes/No		

	g. Test reports, literatures and pamphlets of bought out items and raw materials. :Yes/No		
84	Whether bidder adequate in-house testing facilities for conducting acceptance tests in accordance with relevant IS.		
85	Type of operation shall be suitable for 3 phase reclosing : Yes/No.		

GAURANTEED TECHNICAL PARTICULARS OF BATTERY BANK

(To be Filled in by the bidder)

1.	Battery Rating	
2.	Type of battery	
3.	Battery specification	
4.	Manufacturers cell designation	
5.	No of Cells	
6.	Cycle life of Battery @ 27 ⁰ C	
7.	All efficiency	
8.	WH Efficiency	
9.	Self discharge / week	
10.	Max. allowable ambient temp at which cell can safely operate	
11.	Overall dimension of each cell	
12.	Overall weight of each cell	
13.	Recommended Max period of storage	
14.	Material of container	
15.	Type of separator	
16.	Type of +ve & -ve plates	
17.	Material of rack	
18.	Method of connection between cells	
19.	Recommended float charge	
20.	Recommended boost charge	
21.	Time required for boost charge from fully discharged condition at 27 ⁰ C	
22.	Voltage ripple allowable	
23.	Type of connectors	

Guaranteed technical particulars of battery charger

1.	Battery Rating	110 V - 150 Ah to 1.75 ECV at C10 at 27 ⁰ C
2.	Type of battery	Maintenance free valve regulated lead acid (MF-VRLA) battery
3.	Battery specification	Batteries conforms to IS 15549:2005 Also conforms to International Standards (I) IEEE 1188 and 1189 II) BS6290 Part 4/ IEC 896

4.	Manufacturers cell designation	F 100 P
5.	No of Cells	55 No. (for 110 volts)
6.	Cycle life of Battery @ 27° C	cycles for 50 % depth of discharge or 1200 cycles for 80 % depth of discharge
7.	All efficiency	Above 90%
8.	WH Efficiency	Above 80 %
9.	Self discharge / Week	< 1% of rated capacity
10.	allowable ambient temp at which cell can safely operate	55° C continuously and 70° C short time
11.	Overall dimension of each cell	(107.8 x 198.5 x 477)mm approx.
12.	Overall weight of each cell	27 kg approx.
13.	Recommended Max period of storage	months from the date of manufacturing and the batteries shall be stored in covered area at 27° C
14.	Material of container	Polypropylene co-polymer
15.	Type of separator	Highly absorbent micro porous spun glass matrix (AGM)
16.	Type of +ve& -ve plates	Flat pasted
17.	Material of rack	Mild steel coated with acid resistance paint
18.	Method of connection between cells	Bolted
19.	Recommended float charge	Batteries shall be charged in constant potential mode with current limit Voltage: 2.23-2.25 Volts per cell Current: Recommended- charging current is 45 amps
20.	Recommended boost charge	Voltage: 2.3 Volts per cell Current: Recommended- charging current is 45 to 90 amps
21.	Time required for boost charge from fully discharged condition at 27° C	9 Hrs for 90 % state of charge (or) 24 hrs for 100 % state of charge
22.	Voltage ripple allowable	< 2% of the RMS value
23.	Type of connectors	Lead coated heavy duty copper strips

Bidders Seal and Signature

SECTION -VII FORMS OF BID

Annexure 1. Format for sending query to APDCL[Query may be sent via email to **cgmppdapdcl@yahoo.com**]

From:

[Reference No.]

[Address of the Bidder] [Telephone No., Fax No., Email] [Date]

To:

The Chief General Manager (PP&D)
 Assam Power Distribution Company Limited
 6thFloor, Bijulee Bhawan, Paltanbazar
 Guwahati, Assam

Sub: Query.

Ref: Your Tender No. **NIT No. CGM(PP&D)/APDCL/UDAY 17-18/FDR-Separation/
 GEC-II/PKG 4/ Dtd:18.11.2020**

Dear Sir,

Please find below our query with respect to the BID DOCUMENT subject to the terms
 and conditions therein:

SL.	Reference Clause No.	Page No.	Concise Query
1.			
2.			
3.			

Thanking you,

Sincerely yours,

[Insert Signature here] [Insert Name here] [Insert Designation here]

Annexure 2: Format of Covering Letter by single Bidder/Lead Joint Venturepartner for submission of Bid

[Covering Letter shall be on the official letterhead of the Single Bidder/Lead partner of the Joint Venture]

Reference No.]

[From
: [Address of the Lead Partner
Member] [Telephone No., Fax No., Email]
[Date]

To:
The Chief General Manager (PP&D)
Assam Power Distribution Company Limited
6thFloor, Bijulee Bhawan, Paltanbazar
Guwahati, Assam

Sub:Submission of Bid against **NIT No. CGM(PP&D)/APDCL/UDAY 17-18/FDR-Separation/REC-MEC/PKG 4/ Dtd: 18.11.2020**

Dear Sir,

We, the undersigned [Insert name of the Lead Partner of the Joint Venture] having read, examined and understood in detail the BID DOCUMENT for the work mentioned in the Bid Document and hereby submit our Bid comprising of Technical and Financial Bids.

1. We give our unconditional acceptance to the BID DOCUMENT including but not limited to all its instructions, terms and conditions, and formats attached thereto, issued by APDCL, as amended. In token of our acceptance to the BID DOCUMENT, the same have been initialed by us and enclosed to the Bid. We shall ensure that our Consortium shall execute such requirements as per the provisions of the BID DOCUMENT and provisions of such BID DOCUMENT shall be binding onus.

2. Fulfillment of BID DOCUMENT Eligibility

We undertake that we fulfill the Eligibility Criteria stipulated in the BID DOCUMENT and have been in operation for at least 3 (three) years and must have 3 (three) years of experience as Turnkey Contractor for Electrical Installations, and fulfill all the eligibility requirements as the Lead Partner as outlined in the BIDDOCUMENT.

3. No Deviation

We have submitted our Financial Bid strictly as per terms and formats of the BID DOCUMENT, without any deviations, conditions and without mentioning any assumptions or notes for the Financial Bid in the said format.

4. Acceptance

We hereby unconditionally and irrevocably agree and accept that the decision made by APDCL in respect of any matter regarding or arising out of the BID DOCUMENT shall be binding on us. We hereby expressly waive any and all claims in respect of Bid process.

We confirm that there are no litigations or disputes against us, which materially affect our ability to fulfill our obligations with regard to fulfilling our obligations as per the BIDDOCUMENT.

5. Familiarity with Relevant Indian Laws and Regulations

We confirm that we have studied the provisions of the relevant Indian laws and regulations as required to enable us to submit this Bid and execute the BID DOCUMENT Documents, in the event of our selection as Selected Bidder. We further undertake and agree that all such factors as mentioned in the BID DOCUMENT have been fully examined and considered while submitting the Bid.

6. Contact Person

Details of the contact person representing our Bidding Consortium supported by the Power of

Attorney prescribed in the BID DOCUMENT are furnished as under:

Name :.....
Designation :.....
Company :.....
Address :
.....
..... Mobile :
..... Phone :
..... Fax :
.....
Email :

7. We are submitting herewith the Technical Bid containing duly signed formats (duly attested) as desired by you in the BID DOCUMENT for your consideration.

8. We are also submitting herewith the Financial Bid in electronic form, as per the terms and conditions in the BIDDOCUMENT.

9. It is confirmed that our Bid is consistent with all the requirements of submission as stated in the BID DOCUMENT and subsequent communications from APDCL.

10. The information submitted in our Bid is complete, strictly as per the requirements stipulated in the BID DOCUMENT and is correct to the best of our knowledge and understanding. We would be solely responsible for any errors or omissions in our Bid.

11. We confirm that all the terms and conditions of our Bid are valid for acceptance for a period of 6 (six) months from the Bid Submission Deadline.

12. We confirm that we have not taken any deviation so as to be deemed non- responsive with respect to the provisions stipulated in the BIDDOCUMENT.

13. We confirm that no order/ ruling has been passed by any Competent Court or Appropriate Commission against us or any of the partners of our Joint Venture in the preceding one (1) year from the Bid Submission Deadline for breach of any contract

and that the Bid Security submitted by the us or any of our Joint Venture Partners has not been forfeited, either partly or wholly, in any bid process in the preceding one (1) year from the Bid Submission Deadline.

Dated the [Insert date of the month] day of [Insert month, year] at

[Insert place].

Thanking you,

Sincerely yours,

[Insert Signature here]

[Insert Name here]

[Insert Designation here]

**Annexure 3: Format for Joint Venture Agreement to be entered amongst all
partners of the Joint Venture**

FORM OF JOINT VENTURE AGREEMENT

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE TO BE PURCHASED
IN THE NAME OF JOINT VENTURE)

PROFORMA OF JOINT VENTURE AGREEMENT BETWEEN _____
AND _____
FOR BID SPECIFICATION No. _____ OF ASSAM POWER
DISTRIBUTION COMPANY LTD.

THIS Joint Venture agreement executed on this _____ day of _____ Two thousand Twenty
and between M/S _____ a Company
incorporated under the laws of _____ and having its registered
office at _____ (herein after
called the "Lead Partner" which expression shall include its successors, executors and permitted
assigns) and M/S _____ a Company incorporated
under
the laws of _____ and having its registered office at
_____ (herein after called
the "Partner" which expression shall include its successors, executors and permitted assigns) for
purpose of making a bid and entering into a contract* (in case of award) for Construction
of
_____ (name of the package) against the specifications
No. _____ of **APDCL BIJULEE BHAWAN, PALTAN BAZAR, GUWAHATI
- 781001**, an Electricity Distribution Company registered under Indian Electricity Act, 2003
having its registered office at Bijulee Bhawan, Paltan Bazar, Guwahati - 781001 (herein after
called the "Owner")

WHEREAS the Owner invited bids as per the above mentioned Specification for the design
manufacture, supply and erection, testing and commissioning of Equipment/Materials stipulated
in the bidding documents under subject Package*

For _____ (Package Name) (Specification No.: _____)

AND WHEREAS Annexure – A (Qualification Requirement of the Bidder). Section-4, forming part
of the bidding documents, stipulates that a Joint Venture of two or more qualified firms as
partners, meeting the requirement of Annexure-A, Section 4 as applicable may bid, provided the
Joint Venture fulfills all other requirements of Annexure-A, Section 4 and in such a case, the BID
shall be signed by all the partners so as to legally bind all the Partners of the Joint Venture, who
will be jointly and severally liable to perform the Contract and all obligations hereunder.

* Strike which is not applicable.

The above clause further states that the Joint Venture agreement shall be attached to the bid and
the contract performance guarantee will be as per the format enclosed with the bidding document
without any restriction or liability for either party.

AND 'WHEREAS the bid has been submitted to the Owner vide proposal
No. _____ dated _____ by Lead Partner based on the Joint

Venture agreement between all the Partners under these presents and the bid in accordance with the requirements of Annexure-A (Qualification Requirements of the Bidders), Section -4 has been signed by all the partners.

NOW THIS INDENTURE WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the Partners to this, Joint Venture do hereby now agree as follows:

1. In consideration of the award of the Contract by the Owner to the Joint Venture partners, we, the Partners to the Joint Venture agreement do hereby agree that M/S_____ shall act as Lead Partner and further declare and confirm that we shall jointly and severally be bound unto the Owner for the successful performance of the Contract and shall be fully responsible for the design, manufacture, supply, and successful performance of the equipment in accordance with the Contract.
2. In case of any breach of the said Contract by the Lead Partner or other Partner(s) of the Joint Venture agreement, the Partner(s) do hereby agree to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.
3. Further, if the Owner suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performance guaranteed as per the specification in terms of the Contract, the Partner(s) of these presents undertake to promptly make good such loss or damages caused to the Owner, on its demand without any demur. It shall not be necessary or obligatory for the Owner to proceed against Lead Partner to these presents before proceeding against or dealing with the other Partner(s).
4. The financial liability of the Partners of this Joint Venture agreement to the Owner, with respect to any of the claims arising out of the performance or non-performance of the obligations set forth in the said Joint Venture agreement, read in conjunction with the relevant conditions of the Contract shall, however, not be limited in any way so as to restrict or limit the liabilities of any of the Partners of the Joint Venture agreement.
5. It is expressly understood and agreed between the Partners to this Joint Venture agreement that the responsibilities and obligations of each of the Partners shall be as delineated in Appendix-I (*To be incorporated suitably by the Partners) to this agreement. It is further agreed by the Partners that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Partners under this Contract.
6. This Joint Venture agreement shall be construed and interpreted in accordance with the laws of India and the courts of Assam shall have the exclusive jurisdiction in all matters arising thereunder.
7. In case of an award of a Contract, We the Partners to the Joint Venture agreement do hereby agree that we shall be jointly and severally responsible for furnishing a contract performance security from a bank in favour of the Owner in the forms acceptable to purchaser for value of 10% of the Contract Price in the currency/currencies of the Contract.
8. It is further agreed that the Joint Venture agreement shall be irrevocable and shall form an integral part of the Contract, and shall continue to be enforceable till the Owner discharges the same. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Partners to the Joint Venture agreement have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

IN WITNESS WHEREOF, the Partners to the Joint Venture agreement have through their

authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of _____
has been affixed in my/our
presence

For Lead Partner

pursuant to the Board of Director's
resolution dated _____
Name
Signature
Designation

(Signature of authorized
representative)

Name
Designation

Common Seal of the Company

Common Seal of _____
has been affixed in my/our
presence

For Other Partner

pursuant to the Board of Director's
resolution dated _____

(Signature of authorized

Name
Signature
Designation

Name
Designation

Common Seal of the Company

WITNESSES

1. Name .
(Official address)

(Signature)

2. Name .
(Official address)

(Signature)

Annexure 4: Format for Power of Attorney for Joint Venture**FORM OF POWER OF ATTORNEY FOR JOINT VENTURE**

(On Non-judicial Stamp Paper of Appropriate value to
be purchased in the Name of Joint Venture)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Partners whose details are given hereunder..... have formed a Joint Venture under the laws of.....and having our Registered Office(s)/Head Office(s)at

.....(herein after called the 'Joint Venture' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) acting thorough M/S.....

..... being the Partner in- charge do hereby' constitute, nominate and appoint M/S.....

.....a Company incorporated under the laws of arid having its Registered/Head Office at. As our duly 'constituted lawful Attorney (hereinafter called "Attorney" or" Authorized Representative" or "Partner In-charge") to exercise all or any of the powers for and on behalf of, the Joint Venture in regard*to ----- (Name of the Package)(Specification No -----)of Assam Power Distribution Company Ltd. Bijulee Bhawan, Paltan Bazar, GUWAHATI (hereinafter called the "Owner"). and the bids for which' have been invited by the Owner, to undertake the following acts:

- i) To submit proposal and participate in the aforesaid Bid Specification of the Owner on behalf of the "Joint Venture".
- ii) To negotiate with the Owner 'the terms and' conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Owner for and on behalf of the "Joint Venture".
- iii) To do any other act or submit any document related to the above.
- iv) To receive, accept and execute the Contract for and on behalf of the "Joint Venture".

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

It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

The Joint Venture hereby agrees and undertakes to ratify and confirm all the above whatsoever the said Attorney/ Authorized Representative/Partner In-charge quotes in

the bid,

negotiates and signs the Contract with the Owner and/or proposes to act on behalf of the joint Venture by virtue of this Power of Attorney and the same shall bind the Joint Venture as if done by itself.

* Strike which is not applicable.

IN WITNESS THEREOF the Partners Constituting the Joint Venture as
aforesaid have executed these presents on this day of
.....unde
r
the Common Seal(s) of their Companies.

for and on behalf
of the Partners of
Joint Ventures

The Common Seal of the above Partners of the Joint Venture:
The Common Seal has been affixed there unto in the presence
of:

WITNESS

1. Signature _____
Name _____
Designation _____
Occupation _____

2. Signature _____
Name _____
Designation _____
Occupation _____

Annexure 5: Proforma of Bank Guarantee for Contract Performance

(To be stamped in accordance with Stamp Act)

Ref.....

Bank Guarantee No.....

Date.....

To

The Chief General Manager (PP&D)
Assam Power Distribution Company
Ltd. Bijulee Bhawan, Paltanbazar
Guwahati-1

Dear Sirs/ Madam,

In consideration of Assam Power Distribution Company Ltd., (herein after referred to as the 'Owner' which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s.....

.....with registered/ Head office at (hereinafter referred to as " Contractor" which expression shall unless repugnant to the context or meaning thereof include its successors, administrators, executors and assigns), a Contract by issue of Owner's Letter of Intent No.....dated.....and the same having been acknowledged by the contractor, resulting in a contract and contractor having agreed to provide a Contract Performance Guarantee for the faithful performance of the entire Contract equivalent to 10(%) of the said value Contract to the Owner.

We (Name& Address) having its Head Office at..... (hereinafter referred to as the " Bank" ,which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the owner, on demand any or all monies payable by the contractor to be extent of ₹..... at anytime up to ** (day/month/year) without any demur, reservation , contest , recourse or protest and / or without any reference to this contractor. Any such demand made by the owner on the bank shall be conclusive and binding notwithstanding any difference between the Owner the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The bank undertakes not to revoke this guarantee during its currency without previous consent of the owner and further agrees that the guarantee herein contained shall continue to be enforceable till the owner discharges this guarantee.

The Owner shall have the fullest liberty without affecting in any way the liability of the Bank under the guarantee, from time to time to extend the time for performance or the contract by the contractor. The owner shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any power vested in them or of any right which they might have against the contractor, and to exercise the same at any time in any matter, and either to enforce or to for bear to enforce any covenants, contained or implied, in the contract between the owner and the contractor or any other course or remedy or security available to the owner. The Bank shall not be released to its obligations under these presents by any exercise by the owner of its liberty with reference to the matters aforesaid or any of them or by reason of any other act of omission or commission on the part of the owner or any other indulgences shown by the owner or by any other

matter or thing whatsoever which under law would, but for this provision have the effect of relieving the Bank.

The bank also agrees that the owner at its option shall be entitled to enforce this guarantee against the Bank as a principal debtor, in the first instance without proceeding against the contractor and not withstanding any security or other guarantee the owner may have in relation to the Contractor's liabilities.

Notwithstanding anything contained herein above our liability under this guarantee is restricted to And it shall remain in force up to an including and shall be extended from time to time for such period(not exceeding 1 year) as may be desired by M/s.....on whose behalf this guarantee has been given.

Dated this..... Day of 20..... at.....

WITNESS

.....
(Signature)

.....
(Signature)

.....
(Name)

.....
(Name)

.....
(Official address)

.....
(Official address)

Attorney as per power
Of Attorney No.....
Date.....

NB: The stamp paper of appropriate value shall be purchased in the name of issuing bank.

Annexure 6: Proforma of Extension of Bank Guarantee

Ref.....

Date.....

To

The Chief General Manager (PP&D)
Assam Power Distribution Company
Ltd. Bijulee Bhawan, Paltanbazar
Guwahati-1

Dear Sirs/ Madam,

Sub: Extension of Bank Guarantee No..... for Rs.....Favouring
yourselves , expiring on On account of M/S.....in
respect of contract no..... dated (hereinafter called original Bank
Guarantee).

At the request of M/s we bank, branch office at
..... and having its Head Office at Do hereby extend our liability
under the above mentioned Bank Guarantee No.....
dated.....for a further period of (Years / Months) from.....
to expire on.....expect as provided above, all other terms
and
conditions of the original Bank Guarantee No.....dated..... Shall
remain unaltered and binding.

Please treat this as an integral part of the original Bank Guarantee to which it would be attached.

Yours faithfully

For.....
Manager/ Agent/Accountant
Power of attorney No.....
Dated.....
SEAL OF BANK

Note: The non-judicial stamp paper of appropriate value shall be purchased in the name of the
Bank who has issued the Bank Guarantee.

Annexure 7: Proforma of Contract Agreement

(To be executed on non-Judicial stamp paper)

This Agreement made this day oftwo thousand.....Between Assam Power Distribution Company Ltd. having its head office at Bijulee Bhawan, Paltanbazar, Guwahati-1 (hereinafter referred to as 'Owner' or 'APDCL', which expression shall include its administrators, successors and assign on one part and (hereinafter referred to as the 'Contractors 'X' (Name of the contracting Co.) which expression shall include its administrators, successors, executors and permitted assigns) on the other part.

WHEREAS APDCL desirous of..... inCircle associated with APDCL at(District) invited Bids for..... (Briefly describe scope of works) for the first state of the project as per its Bid Specification No.....

AND WHEREAS....."X" Had participated in the above referred Bidding vide their proposal No..... dated..... And awarded the Contract to....." X"..... on terms and conditions documents referred to therein which have been acknowledged by....."X"resulting into a "Contract"

NOW THEREFORE THIS DEED WITNESS AS UNDER:-

1.0 Article

1.1 Award of Contract

APDCL awarded the contract to....."X".....for the work ofon the terms and conditions contained in its letter of Award No..... Dated..... and the documents referred to therein. The award has taken effect from aforesaid letter of award. The terms and expression used in this agreement shall have the same meaning as are assigned to them in the 'Contract Documents' referred to in this succeeding Article.

2.0 Documentation

2.1 The contract shall be performed strictly as per the terms and condition stipulated herein and in the following documents attached herewith(hereinafter referred to as "Contract Documents".)

i) Section 1-11 of the Bidding Document.

ii) Proposal Sheets, Data Sheets, Drawing work schedule submitted by "X".

APDCL's Letter of Award No.....dated..... duly acknowledged by "X".

Quality Plans for manufacturing and field activities entitled as Quality Plan.

All the aforesaid Contract Documents shall form an integral part of this agreement , in so far as the same or any part conform to the bidding documents and what has been specifically agreed to by the Owner in its letter of Award. Any matter inconsistent therewith, contrary or repugnant thereto or any deviations taken by the Contractor in its 'Proposal' but not agreed to specially by the Owner in its Letter of Award shall be deemed to have been withdrawn by the Contractor. For the sake of brevity, this agreement along with its aforesaid Contract Documents shall be referred to as the 'Agreement'.

3.0 Conditions & Covenants

3.1 The scope of Contract, Consideration, Terms of Payment, Price Adjustments, Taxes wherever applicable, Insurance, Liquidated Damage, Performance Guarantees and all other terms and conditions are contained in APDCL's Letter of Award No.....dated.....read in conjunction with other aforesaid contract documents. The contract shall be duly performed by the contract Documents, but which are needed for successful, efficient, safe and reliable operation

of the equipment unless otherwise specifically excluded in the specification under 'exclusion' or Letter of Award.

3.2 The scope of work shall also include supply and installation of all such items which are not specifically mentioned in the contract Documents, but which are needed for successful, efficient, safe and reliable operation of the equipment unless otherwise specifically excluded in the specifications under 'exclusions' or 'Letter of Award'.

3.3 Time Schedule

3.3.1 Time is the essence of the Contract and schedules shall be strictly adhered to "X" shall perform the work in accordance with the agreed schedules.

3.4 Quality Plans

3.4.1 The Contractor is responsible for the proper execution of the Quality Plans mentioned in Section 4.8 of GTC. The work beyond the customer's hold points will progress only with the owners consent. The Owner will also undertake quality surveillance and quality audit of the Contractor's /Sub- contractor's works, systems and procedures and quality control activities. The Contractor further agrees that any change in the Quality Plan will be made only with the Owner's approval. The contractor shall also perform all quality control activities, inspection and tests agreed with the Owner to demonstrate full compliance with the contract requirements.

3.4.2 The contractor also agrees to provide the Owner with the necessary facilities for carrying out inspection, quality audit and quality surveillance of contractors and its Subcontractor's Quality Assurance Systems and Manufacturing Activities.

These shall include but not limited to the following:

- Relevant plant standards, drawing and procedures;
- Detailed Quality Assurance System manuals for manufacturing activities.
- Storage procedures and instructions weld, NDT, heat treatment prior to commencement of manufacture;
- Complete set of log sheets (blank) mentioned in the Quality Plans.

It is expressly agreed to by the contractor that the quality test and inspection by the owner shall not in any way relieve the contractor of its responsibilities for quality standards and performance guarantee and their other obligations under the Agreement. 3.4.4 "X" agrees to submit quality Assurance Documents to APDCL for review and record after completion and within 3 weeks of dispatch of material.

The package will include the following :

- Factory test result, inspection report for testing required by this contract or applicable codes and standards.
- Two copies of inspection reports duly signed by Quality Assurance personnel of both APDCL and "X" for the agreed customer hold points.
- Report of the rectification works where and if applicable.

3.5 It is expressly agreed to by the Contractor that notwithstanding the fact that the Contract is termed as Supply-cum-Erection Contract or indicates the break-up of the Contract consideration, for convenience of operation and for payment of tax on supply portion, it is in fact one composite Contract on single source responsibility basis and the Contractor is bound to perform the total Contract in its entirety and non-performance of any part or portion of the Contract shall be deemed to be breach of the entire Contract.

3.6 The Contractor guarantees that the equipment package under the Contract shall meet the ratings and performance parameters as stipulated in the technical specifications (Section 10) and in the event of any deficiencies found in the requisite performance figures, the Owner may at its option reject the equipment package or alternatively accept it on the terms and conditions and subject to levy of the liquidated damages in terms of Contract documents. The amount of liquidated damages so leviable shall be in accordance with the contract document and without any limitation.

3.7 It is further agreed by the contractor that the contract performance guarantee shall in no way be constructed to limit or restrict the owner's equipment right to recover the damages/compensation due to shortfall in the equipment performance figures as stated in Para 3.6 above or under any other clause

of the agreement. The amount of damages/compensation shall be recoverable either by way of deduction from the contract price, contract performance guarantee and or otherwise. The contract performance guarantee furnished by the contractor is irrevocable and unconditional and the owner shall have the power to invoke it notwithstanding any dispute or difference between the owner and the contractor pending before any court tribunal, arbitrator or any other authority.

3.8 This Agreement constitutes full and complete understanding between the parties and terms of the payment. It shall supersede all prior correspondence terms and conditions contained in the Agreement. Any modification of the agreement shall be affected only by a written instrument signed by the authorized representative of both the parties.

4.0 SETTLEMENT OF DISPUTES

4.1 It is specifically agreed between parties that all the differences or disputes arising out of the agreement or touching the subject matter of the agreement shall be decided by process of settlement and Arbitration as specified in clause 41 of the General Condition of the Contract and provision of the Indian Arbitration Act, 1996 shall apply. Guwahati Courts alone shall have exclusive jurisdiction over the same.

4.2 NOTICE OF DEFAULT

Notice of default given by either party to the other under agreement shall be in writing and shall be deemed to have been duly and properly served upon the parties hereto if delivered against acknowledgement or by telex or by registered mail with acknowledgements due addressed to the signatories at the addresses mentioned at Guwahati.

IN WITNESS WHEREOF, the parties through their duly authorized representatives have executed these presents (execution where of has been approved by the competent authorities of both the parties) on the day, month and year first above mentioned at Guwahati.

WITNESS:

- | | |
|---------|--|
| 1. | (Owner's signature) (Printed Name) |
| 2. | (Designation)(Company's Stamp) |
| 3. | (Contractor's Signature)(Company's Name) |
| 4. | (Designation)(Company's Stamp) |

- ☐ Applicable in case of single award is placed on one party on Supply-cum- Erection basis. In two separate awards are placed on single party/two different parties this clause is to be modified suitably while signing the contract agreement to be signed separately for two awards to incorporate cross fall breach clause.

Annexure 8: Format for List of Ongoing and Completed Projects in 1) APDCL & other successor Companies of ASEB and 2) Outside the State of Assam

(To be submitted by all the Partners of the Joint Venture)

SL No.	Name of Company	Name of Work	Contract Value (inRs.)	Date of Letter of Award/ Work Order	Expected Date of Completion of Work (as per work order)	Actual Date of Completion of Work (attach completion certificate from Client)	Physical Progress (%)
1.							
2.							
3.							
4.							
5.							

Annexure 9: Format for Summary of Audited Financial Statements distinctly indicating the revenue heads and Annual Turnover for the last 3(three) consecutive FYs for each member of the Joint Venture

FORM FIN-1

Financial Data for Previous 3 Years [Rs in lakhs]		
Year 1: 2016-17	Year 2: 2017-18	Year 3: 2018-19

Information from Balance Sheet

Total Assets			
Total Liabilities			
Net Worth			
Current Assets			
Current Liabilities			

Form FIN - 2: Average Annual Turnover

Each Bidder or member of a JV must fill in this form.

Annual Turnover Data for the last 3 Years	
Year	Amount (Rs. In lakhs)
2016-17	
2017-18	
2018-19	
Average Annual Turnover	

The information supplied shall be the Annual Turnover of the Bidder or each member of a JV in terms of the amounts billed to clients for each year for contracts in progress or completed in ₹ (Rupees).

Form FIN – 3: Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total

construction cash flow demands of the subject contract or contracts as indicated in Section 3 (Evaluation and Qualification Criteria)

Financial Resources		
No.	Source of financing	Amount (Rs. In lakhs)
1		
2		
3		

- ☐ All the information furnished above shall be CA (Chartered Accountant) certified and duly supplemented by Audited Balanced sheet for the respective financial years.

Annexure 10: Information regarding Bid Capacity**A. Format for assessing the Bid Capacity of the Bidders to calculate the value of "A"****AFFIDAVIT****(To be executed on non-Judicial stamp paper)**

I/We aged Years son of..... do hereby solemnly affirm
 And declare for and on behalf of the Firm that following are the list
 of Electrical Construction Projects (Turnkey projects/Item rate contract/Construction
 works) with respect to APDCL/other Utility undertaken by the Bidder during the last 5
 years.

SL No.	Financial Year	Total value of Electrical works done during the year (excluding advance such as mobilisation advance etc.) ** Rs. in Lakhs	Factor for updating to current price level (Rs. in Lakhs)	Updated Value of the Work (Rs.in Lakhs)
		<i>A</i>	<i>B</i>	<i>C=AxB</i>
1	2018- 19		1.00	
2	2017- 18		1.10	
3	2016- 17		1.21	
4	2015- 16		1.331	
5	2014- 15		1.464	
Maximum Value of work in one FY during last 5 FYs (Rs. in Lakhs)				

** Figures to be mentioned in the Column A shall be supported by relevant copies of the Work Order/LOA as well as the corresponding Completion Certificates issued by the officer not below the rank of **CEO/DGM/Superintending Engineer** of the Public Utilities.

Maximum value of projects that have been undertaken during the F.Y. out of the last 5 years and the value of the projects updated to the current price level (i.e. FY 2018-19) thereof is Rs Lakhs (Rupees in words).

.....

.....

Signature, name, and designation of Authorized Signatory

For and on behalf of

.....(Name of the Bidder)

Date:

Place

B. Format for assessing the Bid Capacity of the Bidders to calculate the value of "B"**AFFIDAVIT****(To be executed on non-Judicial stamp paper)**

I/We aged Years son of..... do hereby solemnly affirm and declare for and on behalf of the Firm..... that following is the list of all the existing commitments and ongoing works (Turnkey projects/Item rate contract/Construction works) with respect to APDCL/other Utility that are to be completed during the next 3(three)years.

SL No	Name of Project / Work	Percent age of participation of Bidder in the project	Date of commencement of Project	Stipulated date of Completion	Value of the contract as per Contract Agreement /LOA	Value of work completed **	Balance value of work to be completed	Balance value of work at current price level (FY2018-19)
					Rs. in Lakhs	Rs. in Lakhs	Rs. in Lakhs	Rs. in Lakhs
1	2	3	4	5	6	7	8= (6-7)	9 (3x 8 x #)

** All relevant Certificates will required to be duly signed by the officer not below the rank of **CEO/DGM/Superintending Engineer** of Public utilities.

Updating Factor as given below:

F.Y.	Updating Factor
2018-19	1.00
2017-18	1.10
2016-17	1.21
2015-16	1.331
2014-	1.464

15	
----	--

The Statement showing the value of all existing commitments and ongoing works as well as the value of work completed for each of the works mentioned above is verified from the certificate issued by the Engineer not below the rank of CEO/DGM in respect of APDCL Projects **or** Superintending Engineer in respect of Projects in other Public Utilities. No awarded/ ongoing works has been left in the aforesaid statement which has been awarded to M/s.....individually/as partner, in case of Joint Venture, as on due date of submission for this tender.

.....
.....
Signature, name, and designation of Authorized Signatory

For and on behalf of
.....(Name of the Bidder)
Date:
Place

Annexure 11 : Format for Certificate of Skilled Technical Manpower

[To be submitted individually for each partners of the Joint Venture indicating the number of skilled manpower for relevant technical skillset.]

[On the Official Letterhead of the Company/firm]

[Reference No.]

F

From: [Address of the Bidder]

[Telephone No., Fax No.,
Email][Date]

To

The CGM (PP&D)
Assam Power
Distribution Company
Limited 6th Floor ,
Bijulee Bhawan,
Paltanbazar Guwahati,
Assam

Sub: Certificate of Skilled Human Resource[Insert name of JVpartner].

Ref: Your Tender No. dated (the
"BID DOCUMENT").

Dear Sir,

This is to certify that[Insert name of JV Partner] having its Registered Office at
..... [Insert Registered Address of the JV Partner] with PAN No.
..... [Insert PAN No.] are in the business of..... [Insert briefly
the nature of the business], and has the following skilled human
resource related to the nature of the BID DOCUMENT:

Sr. Name Qualification Area of Expertise Years of Experience

SN	Name of Personnel	Qualification	Area of expertise	Years of experience
1				
2				
3				
4				
5				

This is to certify that the abovementioned information is true to the best of my knowledge.

Thankingyou,

[Official seal of the Company/firm] Date: [Date]

Sincerely yours,

Place:[Place]

-----***End of Forms of Bid***-----