



**JAMMU & KASHMIR GOVERNMENT  
POWER DEVELOPMENT DEPARTMENT  
STANDARD BIDDING DOCUMENT (SBD)**

**FOR**

**ELECTRIFICATION WORKS OF DISTRICT :KUPWARA**

**UNDER**

**PRADHAN MANTRI SAHAJ BIJILI HAR GHAR YOJANA**

**SAUBHAGYA**

**DISTT. KUPWARA**

**e-NIT No. :- 30 of 2018-19 Dated 18-07-2018**

**ELECTRIC MAINTENANCE & RE DIVISION  
HANDWARA**

# **INVITATION FOR e-BID**

**STANDARD BIDDING DOCUMENT AND TECHNICAL SPECIFICATIONS****1. INVITATION:**

For and on behalf of the Governor of Jammu and Kashmir State, e-Tenders (In Two Cover System) are hereby invited from Companies, Firms, contractors having Valid A-Class Electrical Contractor License issued by any State Govt. or Central Govt. and meeting eligibility Criteria for Electrification works **covering last mile connectivity and electricity connections to all un-electrified household/ habitations in rural/urban areas of Electric Handwara Block Kupwara.** The scope of work includes **site survey, planning, supply, loading, transportation, unloading, insurance, delivery at site, handling, storage, installation, testing, commissioning and documentation of all items/material required to complete the Electrification work which inter-alia include construction of 11 KV lines, 11/0.415 kV Substations, LT lines, internal electrification and allied works.** (as per scope of the bid) on partial turnkey basis with Key material like Steel tubular/PCC poles, Transformers, Conductor, AB Cable and consumer meters to be supplied by JKPDD.

- Bidders are advised to study the Bidding Document carefully. Submission of e-Bid against this SBD shall be deemed to have been done after careful study and examination of the procedures, terms and conditions of the Standard Bidding Document with full understanding of its implications.
- The tender document is available at website <http://jktenders.gov.in>. Interested bidders may view, download the e-Bid document, seek clarification and submit their e-Bid online up to the date and time mentioned in the table below:

A	Date & Time of downloading of Standard Bidding Document	The Standard Bidding Document can be downloaded over <a href="http://jktenders.gov.in">http://jktenders.gov.in</a> from 18-07-2018 9:00 AM
D	e-Bid submission (start) date & time (Submission of e-tender fee, EMD and other supporting documents in PDF/XLS format)	18-07-2018 09:00 AM
E	e-Bid submission (end) date & time (Submission of e-tender fee, EMD and other supporting documents in PDF/XLS format)	27-07-2018 04:00 PM
F	Online Commercial and Technical e-Bid opening date & Time	28-07-2018 11:00AM
G	Online financial e-Bid opening date & time (Only of the technically qualified bidders)	28-07-2018 01:00 PM
H	Venue of opening of technical & financial e-Bids	Office of Executive Engineer Electric Division Handwara.
I	Cost of e-Bid document	Rs. 1000/= (Rupees one Thousand only) (Non-refundable)
J	Amount of Earnest Money Deposit	Rs. 53360/= (Rupees fifty three thousand three hundred sixty only)

- The bidders need to submit the proof for purchase of e-Bid document as stated in the above table through Treasury receipt / Echallan pledged to Executive Engineer ED Handwara Payable at Handwara  
The scanned copy of the Treasury receipt / E –Challan must be uploaded along with the e-Bid.

4. All the e-Bids must be accompanied by the scanned copy of EMD in the form of CDR/FDR/Bank Guarantee issued by a nationalized/scheduled Bank only, pledged to the Executive Engineer ED Handwara Payable at Handwara. No Interest would be payable on Earnest Money deposited with the Department.
    - a. The date and time of opening of Financial-Bids shall be notified on Web Site <http://jktenders.gov.in>. This is conveyed to the qualified bidders automatically through an e-mail message on their e-mail address. The Financial-bids shall be opened accordingly online on the same Web Site at the Office of Executive Engineer ED Handwara.
  5. Intending bidders are requested to submit their offers along with technical specifications and annexure forming part of the tender document.
  6. The e-Bids will be electronically opened in the presence of bidder's representatives, who choose to attend at the venue, date and time mentioned in the above table or any subsequent day to the convenience of the Tender Opening Committee. An authority letter as bidder's representative will be required to be produced.
  7. The Department reserves the right to cancel any or all the e-Bids/ the e-Bid process without assigning any reason thereof. The decision of department will be final and binding.
  8. In the event of date specified for e-Bids opening being declared a holiday for department's office then the due date for opening of e-Bids shall be the following working day at the appointed time and place.
  9. All the required documents excluding Price Schedule/BOQ should be uploaded by the e-Bidder electronically in the PDF format, whereas Price Schedule/BOQ should be uploaded electronically in the same BOQ sheet provided with the SBD.
12. **Source of funds:** The department intends to use the installment wise funds released through REC, New Delhi. Ist installment of adhoc advance stands release.

Executive Engineer,  
M&RE Division  
Handwara.

**SECTION I:**

**INSTRUCTIONS**

**TO**

**BIDDERS**

## **A. General Instructions**

- i.
  1. The interested bidder can download the bidding document from the website <http://jktenders.gov.in>.
  2. Bidders are advised to download bid submission manual for the help of Bid Submission process from the "Downloads" option as well as from "Bidders Manual Kit" on website <http://jktenders.gov.in>.
- ii. To participate in bidding process, bidders have to get 'Digital Signature Certificate (DSC)' class III(b) as per Information Technology Act-2000, to participate in online bidding. The bidders have to submit their bids online in electronic format with digital Signature. This certificate will be required for digital signing the bid. Bidders can get above mention digital certificate from any approved vendors. The Bidders, who already possess valid Digital Certificates, need not to procure new Digital Certificate. The bids proposed without digital signature will not be accepted. No proposal will be accepted in physical form.
- iii. Bids will be opened online as per time schedule mentioned in table above.
- iv. Before submission of online bids, bidders must ensure that scanned copy of all the necessary documents have been attached with bid. (Note: Scan all the documents on 100 dpi with black and white option).
- v. The department will not be responsible for delay in online submission due to any reasons.
- vi. All the required information for bid must be filled and submitted online.
- vii. Bidders besides other details will also upload the scanned copies of DD, FDR, CDR or any other form as specified in the bidding document. The original instruments in respect of cost of tender document, EMD and relevant documents be submitted to the Tender Inviting Authority by Registered post/courier/By Hand and should reach before the last date of submission of Bid, otherwise quoted bid shall be rejected.
- viii. **Price quoted should be firm.**
- ix. The details of cost of documents, EMD specified in the SBD should be the same as submitted online (scanned copies) otherwise tender will summarily be rejected.
- x. Bidders are advised not to make any change in BOQ (Bill of Quantities) contents or its name. In no case they should attempt to create similar BOQ manually, otherwise the bid will be rejected automatically.
- xi. The BOQ downloaded should be used for filling the item rate as per columns mentioned in BOQ and it should be saved with the same name as it contains.
- xii. Bidders are advised to use "My Documents" area in their user on <http://jktenders.gov.in> e-Tendering portal to store important documents which are used in SBD like Entry Tax, GST Clearance Certificate, etc. and attach these certificates as Non-Statutory documents while submitting their bids. The guidelines regarding submission of bid online can be downloaded from website "[http //Jktenders.gov. in](http://Jktenders.gov.in)".

## **SCOPE OF WORK:**

- a) **The scope of work includes** site survey, planning, supply, loading, transportation, unloading, insurance, delivery at site, handling, storage, installation, testing, commissioning and documentation of all items/material required to complete the Rural Electrification work which inter-alia include construction of 11 KV lines, 11/0.415 kV Substations, LT lines, internal electrification and allied works. (as per scope of the bid) on partial turnkey basis with Key material like Steel tubular/PCC poles, Transformers, Conductor, AB Cable and consumer meters to be supplied by JKPDD.
- b) The Scope shall include procurement of material except Key material which shall be provided by PDD, packing and forwarding, insurance, transportation to project site including Key material from Divisional stores, handling and storage at site, installation, testing & commissioning of all the equipment and material required for the work.
- c) The Bidder in his own interest before quoting the price shall familiarize himself with the working environment so as to have through understanding of the scope and site requirements in the instant NIT.
- d) The quantity of work has been described separately in the Bill of Quantity (BOQ) annexed with this tender document. Location wise work detail is listed in **Annexure B**
- e) In case there is any contradiction between this document and J&K State Laws / Rules/Regulations/Financial Powers, the J&K State Laws /Rules/ Regulations / Financial Powers shall prevail.

## **B. BID Document**

### **1. Cost of Bidding Document:**

- a. The bidder shall bear all costs associated with the preparation and submission of its e-Bid and J&K Power development department hereinafter referred to as "the Purchaser", will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the e-Bid process. This SBD is available on the web site <http://jktenders.gov.in> to enable the bidders to view, download the e-Bid document and submit e-Bids online up to the last date and time mentioned in e-Tender notice/e-tender document against this e-Tender. The bidders shall have to pay the e-Bid document fee of Rs 1000/- (Rupees one Thousand Only) through Treasury receipt/ E-challan payable in favour of Executive Engineer ED Handwara

The scanned copy of the Treasury Receipt / E-Challan must be uploaded along with the e-Bid . This e-tender document fee will be non-refundable.

### **2. Contents of Standard Bidding Document:**

The E-Bid includes :

- a. Invitation for e-bid
- b. Instructions to bidders
- c. Commercial Details
- d. Financial e-bid
- e. Conditions of Contracts
- f. Technical Details

- 2.1 The bidder is expected to examine all instructions, forms, terms and specifications in the e-Bid document. Failure to furnish all information required as per the e-Bid document or submission of e-Bid not responsive to the e-Bid document will be at the bidder's risk and may result in rejection of the said e-Bid.

### 3. Amendment of e-Bid Document

At any time prior to the deadline for submission of e-Bid, the Purchaser may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the e-Bid document by amendments. Such amendments shall be uploaded on the website <http://jktenders.gov.in> through corrigendum and shall form an integral part of e-Bid document. The relevant clauses of the e- Bid document shall be treated as amended accordingly.

It shall be the sole responsibility of the prospective bidders to check the web site <http://jktenders.gov.in> from time to time for any amendment in the e-tender document. In case of failure to get the amendments, if any, the Purchaser shall not be responsible for it.

## C. PREPARATION OF e-Bid

### 4. Language of e-Bid

The e-Bid prepared by the bidder, as well as all correspondence and documents relating to the e-Bid exchanged by the bidder and the Purchaser shall be written in English language. Only English numerals shall be used in the e-Bid.

### 5. Documents Constituting the e-Bid

#### 5.1 The e-Bid prepared by the bidder shall comprise the following components:

**Commercial e-bid-** The bidder has to submit all the documents and to fulfill all the requirements as defined in Commercial e-bid in PDF format.

**Fee Details** - includes scanned copies of Cost of e-tender document and e-Bid Earnest Money Deposit (EMD) has to be furnished in PDF format.

**Technical e-bid:** The bidder has to submit all the documents and to fulfill all the requirements as defined in Technical e-bid in PDF format.

**Financial e-bid:**

**5.2 Price Schedule/BOQ:** The bidder has to submit BOQ sheet in the same XLS sheet and to fulfill all the requirements as defined in the standard bidding document after downloading from the website for this tender.

### 6. e-Bid Price

#### 6.1 As specified in the Technical Specifications, bidders shall quote for the entire facilities on a “single responsibility” basis such that the total bid price covers all the Contractor’s obligations mentioned in or to be reasonably inferred from the Bidding Documents in respect of the procurement and delivery, construction, installation and completion of the facilities.

#### 6.2 This includes all requirements under the Contractor’s responsibilities for Procurement of matching minor material, testing, pre-commissioning and commissioning of the facilities and, where so required by the Bidding Documents, the acquisition of all permits, approvals, clearances and licenses, etc.

#### 6.3 Items against which no price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the prices for other items.

#### 6.4 Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the Bidding Documents. In the BOQ, the bidder shall quote rates and total amount inclusive of all taxes, duties, freight, insurance WCT/Service Tax or any other applicable Tax or duties etc as in vogue at time of bidding.



6.5 Prices quoted by the bidder shall be "FIRM". However, Change in the statutory taxes if any shall be paid/recovered as applicable at the time of payment.

## 7 Earnest Money Deposit (EMD)

7.1 Bid shall be accompanied with earnest money to the tune of Rs 53360/= (Rupees fifty three thousand three hundred sixty only) in the form of CDR/FDR/Bank Guarantee valid for 180 days from a Nationalized/Scheduled only Bank pledged in favour of the Executive Engineer, EM&RE Division, Handwara payable at Handwara

7.2 SBD's (Standard Bidding Documents), which are not uploaded by the required amount of earnest money, will be summarily rejected.

7.3 The earnest money of the bidder(s) shall be forfeited if he (they) withdraws his (their) bid or revises the prices of his(their) offer within the validity period or violates any terms and conditions contained therein. The contract shall be deemed to have been entered into from the date of issue of letter of intent.

7.4 Earnest money deposit shall be released in favour of unsuccessful bidders immediately after finalization of tender.

## 8. Format and Signing of e-Bid

The e-Bid document shall be digitally signed, at the time of uploading, by the bidder or a person or persons duly authorized to bind the bidder to the Contract.

## 9 Submission of e-Bid

10.1 The Bid Submission module of website <http://jktenders.gov.in> enables the bidders to submit the e-Bid online in response to this e-tender published by the Purchaser. Bid Submission can be done only from the Bid Submission start date and time till the Bid Submission end date and time given in the e-tender.

The SBD (Standard Bidding document) must be complete in all respects. All the terms and conditions of SBD including technical specifications should be carefully studied for the sake of submitting complete and comprehensive SBD.

## 10. Deadline for Submission of e-Bid

e-Bid (Commercial, Technical and Financial) must be submitted by the bidders at website <http://jktenders.gov.in> not later than the time as prescribed in the table above (as per the server time displayed on the website).

## 12. Late e-Bid

12.1 The server time indicated in the window on the website <http://jktenders.gov.in> will be the time by which the e-Bid submission activity will be allowed till the permissible date and time scheduled in the e-tender. Once the e-Bid submission date and time is over, the bidder cannot submit his/her e-Bid.

## 13 Qualification of Bidders

Bidding is open to firms who can produce satisfactory evidence that they have necessary experience, financial resources and engineering organization to undertake such work to the satisfaction of the department. Bidders should clearly state their experience in supply, installation, testing and commissioning of 11 KV or above voltage Lines and 11/0.415 KV sub-stations besides any other electrical contracts executed.

13.1 The Completion Certificate / Experience Certificate referred to hereinafter; either for General Experience OR for Specific Experience issued and duly signed and sealed by the competent authority; should contain following information on their Letterhead:

- Scope of Work

- Amount of Work completed
- Date of Completion of Work
- Performance

13.2 The similar work or any sector, referred to hereinafter, means any work related to Electrical Distribution Network, i.e., 11 KV or above Lines and 11/0.415 KV sub-stations or above In case of composite work referred to by the bidder, for general experience or specific experience, the cost of Electrical works referred to the above shall be equal to or more than the specific experience referred.

13.3 The end date of experience called shall be reckoned as last date of the previous month of bid submission.

**13.4 In order to be qualified for award of Contract, the bidder will be required to satisfy the following minimum qualifying criteria:**

i. the bidder should have at least 3 years experience as on the last date of previous month of Bid submission as a prime contractor, Reputed Firm in the construction of works of a similar nature and complexity to that required under this contract, as per the requirements. Such works should have been executed successfully to the satisfaction of the owner / engineer in charge (certificate of satisfactory completion of the said works issued by the owner / engineer in charge not less than the rank of the Executive Engineer or equivalent must be enclosed) and include – construction, erection, testing and commissioning of 11kV or higher voltage lines, 11/0.415 KV substations and allied works;

ii. the bidder should have an average annual financial turnover during the last 3 years at least 50% of the estimated cost of the tender quoted for per year.

iii. **General Experience:** The Bidder should have successfully executed as main contractor, Reputed Firm (subject to conditions as above) work orders/contracts during the last 7 financial years with minimum cost of completed works as follows.

- i) One similar completed work costing not less than the amount equal to 80% of the estimated cost; Or
  - ii) Two similar completed works each costing not less than the amount equal to 50% of the estimated cost; Or
  - iii) Three similar completed works each costing not less than the amount equal to 40% of the estimated cost.
- Bidder should note that the actual value of works completed during the seven financial years mentioned herein shall only be considered

iv. **Specific Experience:** The Bidder should have experience of execution of turnkey/partial turnkey/job execution contracts in following areas :

- i) Minimum Five nos. sub stations of 11kV or higher voltage class and
- ii) Minimum 5 Km of route length of 11 kV or higher voltage lines and
- iii) electrical works mentioned above should be in successful operation after commissioning at least for one year as on the last date of month of Bid submission and
- iv. Such work done within 7 years from the last date of previous month of Bid submission date of submission shall be recognized.
- v. the Bidder should possess a valid Electrical Contractor's license issued by any state or central government agency; and
- vi. the bidder should be registered as a contractor/Reputed Firm with the Tax authorities (Income Tax and Commercial Tax).
- vii. the bidder shall have a Net Worth (which is defined as "Net value of the assets – Net value of liabilities") of not less than **30% (thirty percent)** of the Estimated Cost of the tender quoted for; and

- viii. The Employer reserves the right to decide regarding to acceptability of a particular contract executed by the Bidder in support of the 'specific experience' shall be final.

13.5 Notwithstanding anything stated above the department reserves the right to assess the bidder's capability and capacity to perform the work, should the circumstances warrant such assessment in the overall interest of the department.

13.6 In case a bid is submitted by a Joint Venture (JV), the lead partner of the JV shall meet, individually, the qualification set forth in minimum criteria.

13.7 Failure to comply with this requirement will result in rejection of the joint venture's bid.

#### 14. e-Bid OPENING AND EVALUATION

##### 15. Opening of Commercial & Technical e-Bid by the Purchaser

15. A. The Purchaser will open all commercial & technical e-Bids, in the presence of bidders who choose to attend at time specified in the table above at The Office of Executive Engineer, Electric division, Handwara

In the event of the specified date of e-Bid opening being declared a holiday for the Purchaser, the e-Bids shall be opened at the appointed time and place on the next working day.

##### 15 (B). Opening of Financial e-Bid

15. B.1 After evaluation of Technical e-Bid, the Purchaser shall notify those bidders whose Commercial & Technical e-Bids were considered non-responsive to the Conditions of the Contract and not meeting the technical specifications and Qualification Requirements indicating that their financial e-Bids will not be opened. The Purchaser will simultaneously notify the bidders, whose technical e-Bids were considered acceptable to the Purchaser. The notification may be sent by letter, fax or by email.

15. B.2 The financial e-Bids of qualified bidders shall be opened in the presence of bidders who choose to attend, and date for opening of financial bids will be communicated to the Commercial & Technically Qualified Bidders subsequently after completion of technical bids evaluation. The name of bidders, Unit Price quoted for various items etc will be announced at the bid opening meeting.

##### 16. Clarification of e-Bid

During evaluation of e-Bid, the Purchaser may, at its discretion, ask the bidder for a clarification of his/her e-Bid. The request for clarification and the response shall be in writing.

##### 17. Evaluation of Commercial & Technical e-Bid and Evaluation Criteria

The Purchaser will examine the e-Bid to determine whether they are complete, whether they meet all the conditions of the Contract, whether required e-tender fee, e-Bid EMD and other required documents have been furnished, whether the documents have been properly digitally signed, and whether the e-Bids are generally in order.

It shall be the discretion of the Purchaser to decide as to whether an e-Bid fulfils the evaluation criterion mentioned in this e-tender or not.

The bidders are advised not to mix financial e-bid documents with the PDF documents submitted for commercial and technical e-bid.

##### 18. Financial Evaluation and Comparison of e-Bid

The Purchaser will evaluate and compare the financial rates quoted in the price schedule/BOQ of e-Bids of those bidders whose commercial and technical e-Bids are found responsive as per the conditions of the e-tender.

No additional payments shall be made for completion of any contractual obligation beyond the quoted prices.

No weight age /preference shall be given to the bidder quoting any higher technical specifications against the technical specifications of the items asked in the e-bid.

18.4 The Purchaser's evaluation of a Financial bid shall be based on lowest rate quoted by the bid including all the taxes and duties.

19. Contacting the Purchaser

Any effort by a bidder to influence the Purchaser in its decisions on e-Bid evaluation, e-Bid comparison or contract award may result in rejection of the bidder's e-Bid.

E: AWARD OF CONTRACT:

20. The Department shall reserve the right of accepting the whole or a portion of any of the tender as it may deem fit, without assigning any reason thereof.

21. The Department reserves the right to itself for placing the contract in part or full and or split it among two or more bidders.

22. The Department reserves the right to reject all or any of the tenders without assigning any reason.

## **SECTION II:**

# **COMMERCIAL DETAILS**

## **Commercial details:**

Commercial e-Bid for NIT No: **30 of 2018-19 dated 18-07-2018**" shall contain the following documents digital signed by the bidder in the scanned form and PDF format only:

- i. Treasury Receipt/ E-challan as cost of Tender Document.
- ii. Earnest Money Deposit in the form CDR/FDR/Bank Guarantee.

**The e-Bids of the bidders not uploading the copies of above mentioned documents at (a) and (b) in scanned form shall be liable to be rejected.**

**GENERAL  
CONDITIONS OF CONTRACT  
(GCC)**

## GENERAL CONDITIONS OF CONTRACT (GCC)

### A. Definitions and Interpretation

#### 1. Definitions

1.1. The following words and expressions shall have the meanings hereby assigned to them:

- (a) “Arbitrator” means the person or persons appointed by agreement between the Employer and the Contractor to make a decision on or to settle any dispute or difference between the Employer and the Contractor referred to him or her by the parties.
- (c) “Commissioning” means operation of the Facilities or any part thereof, if any, by the Contractor as specified in the Technical Specifications, which operation is to be carried out by the Contractor for the purpose of Trial – Operation.
- (e) “Completion” means that the Facilities have been completed operationally and structurally and put in a tight and clean condition and that all works in respect of pre-commissioning of the Facilities has been completed wherever required, as per Technical Specifications and Commissioning followed by Trial – Operation has been completed.
- (f) “Contract” means the Contract Agreement entered into between the Employer and the Contractor together with the Contract Documents referred to therein.
- (g) “Contract Documents” means the documents listed in Contract Documents of the Form of Contract Agreement (including any amendments thereto);
- (h) “Contract Price” means the sum specified in Clause on Contract Price of the Contract Agreement, subject to such additions or deductions therefrom, as may be made pursuant to the Contract. For the purpose of Liquidated Damages and Contract Performance Guarantee, the “Contract Price” means the sum specified in Contract Price of the Contract Agreement.
- (i) “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.
- (j) “Contractor’s Equipment” means all plant, facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant and Equipment, or other things intended to form or forming part of the Facilities.
- (k) “Contractor’s Representative” means any person nominated by the Contractor and approved by the Employer hereof to perform the duties delegated by the Contractor.
- (l) “Day” means calendar day of the Gregorian Calendar.
- (m) “Defect Liability Period” means the period of validity of the warranties given by the Contractor commencing at Completion of the Facilities or a part thereof, if any, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof).
- (n) “Effective Date” means the date of Notification of Award from which the Time for Completion shall be determined.
- (o) “Employer” means the firm/corporation/ government entity, who is responsible for getting the Facilities implemented.
- (p) “Facilities” means the Plant and Equipment to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract.



- (q) "GCC" means the General Conditions of Contract hereof.
- (r) "Guarantee Test(s)" means the test(s) specified in the Technical Specifications to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Technical Specifications hereof during/after successful Commissioning followed by Trial - Operation.
- (s) "Installation Services" means all those services ancillary to the supply of the Plant and Equipment for the Facilities, to be provided by the Contractor under the Contract; e.g., transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all construction materials required), installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc.
- (t) "Notification of Award" means the official notice issued by the Employer notifying the Contractor that his bid has been accepted.
- (u) "Operational Acceptance" means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfillment of the Contract in respect of Functional Guarantees of the Facilities.
- (v) "Pre-commissioning" means the testing, checking and other requirements specified in the Technical Specifications that are to be carried out by the Contractor in preparation for Commissioning.
- (w) "SCC" means the Special Conditions of Contract.
- (x) "Taking Over" means the Employer's written acceptance of the Facilities under the Contract, after successful Trial - Operation.
- (ee) "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.

## 2. Interpretation

### 2.1 Contract

The Contracts to be entered into with the successful Bidder shall be as defined.

### 2.2 Contract Documents

All documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole.

### 2.3 Entire Agreement

The Contract constitutes the entire agreement between the Employer and Contractor with respect to the subject matter of Contract and supersedes all communications, negotiations and agreements (whether written or oral) of parties with respect thereto made prior to the date of Contract.

### 2.4 Amendment

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party hereto.

### 2.5 i. Independent Contractor

The Contractor shall be an independent contractor performing the Contract. The Contract does not create any agency, partnership, joint venture or other joint relationship between the parties hereto.

Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed.

### ii. Joint Venture

If the Contractor is a joint venture of two or more firms, all such firms shall be jointly and severally bound to the Employer for the fulfillment 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.

2.6 Notices

Unless otherwise stated in the Contract, all notices to be given under the Contract shall be in writing, and shall be sent by personal delivery, special courier, telegraph, facsimile or Electronic Data Interchange (EDI) to the address of the relevant party set out in the Contract Agreement.

2.6.1 Notices shall be deemed to include any approvals, consents, instructions, orders and certificates to be given under the Contract.

2.7 Governing Law & its Jurisdiction

The Contract shall be governed by and interpreted in accordance with laws of J&K and the Courts of J&K shall have exclusive jurisdiction in all matters arising under this Contract.

### 3. Scope of Facilities

3.1 Standards and Regulations: "BIS" Standards as applicable, REC standards /CEA regulations shall be applicable during execution of work.

### 4. Time for Commencement and Completion

4.1 The Contractor shall commence work on the from the Effective Date of Contract i.e. date of issuance of Letter of Award (LoA).

4.2 The Contractor shall attain Completion of the Facilities within the time stated under Time for Completion or within such extended time to which the Contractor shall be entitled.

### 5. Contractor's Responsibilities

5.1 The Contractor shall install and complete the Facilities with due care and diligence in accordance with the Contract.

5.2 The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer.

5.3 First-aid: The Contractor shall provide necessary first-aid facilities for all his employees, representatives and workmen working at the Site.

5.4 Cleanliness: The Contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc. during the period of Contract.

5.5 Security: The Contractor shall have total responsibility for all equipment and materials in his custody/stores, loose, semi-assembled and/or erected by him at Site. The Contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss.

### 6. Employer's Responsibilities

6.1 The Employer shall ensure the accuracy of all information and/or data to be supplied in the Contract.

6.2 The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract.

6.3 The Employer shall be responsible for the continued operation of the Facilities after Taking Over.

## B. Payment

## **7. Contract Price**

7.1 The Contract Price shall be as specified in Contract Price and Terms of Payment.

## **8. Terms of Payment**

8.1 The Contract Price shall be paid as specified in the corresponding Appendix – 1

## **9. Securities**

### **9.1 Performance Security**

9.1.1 The Contractor shall, within twenty-eight (28) days of the notification of Letter of Intent, provide a performance security for the due performance of the Contract in the amount equivalent to Ten percent (10%) of the Contract Price, with a validity upto ninety (90) days beyond the Defect Liability Period. The same shall be extended by the Contractor time to time till ninety (90) days beyond the actual Defect Liability Period, as may be required under the Contract.

9.1.2 The performance security shall be in the Form of unconditional Bank Guarantee.

### **9.2 Issuing Banks**

The Bank Guarantee for Performance Security are to be provided by the Contractor, which should be issued either :

(a) by a Public Sector Bank located in India, or

(b) a scheduled Indian Bank

## **10. Taxes and Duties**

10.1 The Contractor shall be entirely responsible for payment of taxes, duties, license fees and other such levies legally payable/incurred until delivery of the contracted supplies to the Employer.

10.2 Employer would not bear any liability on account of taxes. Employer shall, however, deduct such tax at source as per the rules and issue necessary Certificate to the Contractor.

## **11. Copy Right**

11.1 The copyright in all drawings, documents and other materials containing data and information furnished to the Contractor by the Employer herein shall remain vested in the Employer.

## **12. Representatives**

All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Executive Engineer, except as herein otherwise provided.

## **13. Design and Engineering**

13.1 Specifications and Drawings of REC to be followed.

The Contractor shall execute the basic and detailed engineering work in compliance with the provisions of the Contract, in accordance with good engineering practice.

## **14. Plant and Equipment**

14.1 The Contractor shall be responsible for proper handling and storage of these materials from the time of receipt up to the time of Taking Over of the Facilities by the JKPDD.

Upon receipt of such item, the Contractor shall inspect the same visually and notify the JKPDD of any detected shortage, defect or default.

## **15. Installation**

Contractor's Supervision: The Contractor shall give or provide all necessary superintendence during the installation of the Facilities. 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.

Labour:

- (a) The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged to use local labor that has the necessary skills.

## **16. Site Regulations and Safety**

### **16.1.1. Compliance with Labour Regulations**

During continuance of the contract, the Contractor 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.

### **16.1.2. Safety Precautions**

- 16.1.2.1. The Contractor shall ensure proper safety of all the workmen, materials, plant and equipment belonging to him or to Employer or to others, working at the Site. The Contractor shall also be responsible for provision of all safety notices and safety equipment required by the relevant legislations and the employer, as he may deem necessary.
- 16.1.2.2. The Contractor shall provide suitable safety equipment of prescribed standard to all employees and workmen according to the need.
- 16.1.2.3. The Contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment/network belonging to the Employer under any circumstances, whatsoever, unless expressly permitted in writing by Employer to handle such fuses, wiring or electrical equipment
- 16.1.2.4. No repair work shall be carried out on any live equipment. The equipment must be declared safe by issuance of **permit to work** be issued by PDD before any work is carried out by the Contractor.
- 16.1.2.5. In case any accident occurs during the construction/ erection or other associated activities undertaken by the Contractor thereby causing any minor or major or fatal injury to his employees' due to any reason, whatsoever, it shall be the responsibility of the Contractor to promptly inform the same to the employer and also to all the authorities envisaged under the applicable laws.
- 16.1.2.6. The Contractor shall follow and comply with all Employer Safety Rules, relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment.

## **17. Test and Inspection**

- 17.1 The Contractor shall provide JKPDD with a certified test report of material supplied by Contractor as required.

## **18. Completion of the Facilities and Operational Acceptance**

- 18.1 As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally as specified in the Technical Specifications, the Contractor shall so notify the Employer.

### **18.2 Pre-Commissioning**

Within three (3) days after receipt of the notice from the Contractor the employer shall deploy the operating and maintenance personnel.

18.2.1.1 As soon as all works in respect of Pre-commissioning are successfully completed, The JKPDD shall, within two (2) days intimate defects or deficiencies if any.

18.2.1.2 If the JKPDD notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described. If JKPDD is satisfied that the Pre-commissioning of Facilities or that part thereof have been successfully completed, JKPDD shall, advise the Contractor to proceed with the Commissioning of the Facilities or part thereof after inspection of facilities by TTIC Wing of JKPDD.

#### **18.2.2 Commissioning**

Commissioning of the Facilities or any part thereof shall be commenced by the Contractor immediately after being advised by the JKPDD.

18.2.2.1 The JKPDD will issue an Taking Over Certificate thereafter.

### **19. Quantity Variation**

- I. The quantity of all equipment/materials given in the Price Schedules of the bidding documents are provisional. The variation in quantity shall be limited to plus/minus (+/-) twenty percent (20%) of the item/contract price.
- II. For quantity variation of the individual items beyond twenty percent (20%), the matter shall be referred to the JKPDD for mutually agreed rates.

### **20. Electrical Inspector inspection:**

After successful completion of the work permission from State Electrical Inspectorate is required. Necessary fee etc. shall be paid by the Contractor.

Defects / in-complete works notified by Electrical Inspectorate shall be completed by the Contractor at no extra cost implication to Employer.

### **21. Defect Liability**

The Defect Liability Period shall be six (6) months from the date of Taking Over /Completion of Facilities (or any part thereof).

If during the Defect Liability Period any defect should be found in the materials and workmanship of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good such defect.

The Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:

- (a) improper operation or maintenance of the Facilities by the Employer
- (b) operation of the Facilities outside specifications provided in the Contract

### **22. Loss of or 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, arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or their employees up to commissioning of facilities.

## **23. Force Majeure**

“Force Majeure” shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected, and shall include, without limitation, the following:

- (a) war, hostilities or war like operations (whether war be declared or not), invasion, act of foreign enemy and civil war,
- (b) rebellion, revolution, insurrection, mutiny, usurpation of government, conspiracy, riot and civil commotion,
- (c) earthquake, landslide, volcanic activity, flood or cyclone, or other inclement weather condition, nuclear and pressure waves or other natural or physical disaster,

Neither party shall be considered to be in default or in breach of his obligations under the Contract to the extent that performance of such obligation is prevented by any circumstances of Force majeure, which arises after date of Notification of Award.

## **24. Extension of Time for Completion**

The Time(s) for Completion specified in the SCC shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:

- (a) any occurrence of Force Majeure
- (b) any changes in laws and regulations affecting operation of contract

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

## **25. Termination**

1. The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination. Upon receipt of the notice of termination, the Contractor shall either immediately or upon the date specified in the notice of termination

- (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition
- (b) remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Subcontractors' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition

In the event of termination of the Contract, the Employer shall pay to the Contractor the following amounts:

- (a) the Contract Price, properly attributable to the parts of the Facilities executed by the Contractor as of the date of termination
- (b) Termination for Contractor's Default

The Employer, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances by giving a notice of termination and its reasons there for to the Contractor,

- (a) if the Contractor becomes bankrupt or insolvent
- (b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of contract.
- (c) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

(d) If the Contractor

- i. has abandoned or repudiated the Contract
- ii. has without valid reason failed to commence work on the Facilities promptly or has suspended the progress of Contract performance for more than fourteen days (14) days after receiving instruction from the Employer to proceed.
- iii. persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause

then the Employer may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within seven (7) days of its receipt of such notice, then the Employer may terminate the Contract forthwith by giving a notice of termination to the Contractor.

## **26. Settlement of Disputes**

If any dispute of any kind whatsoever shall arise between the Employer and the Contractor in connection with or arising out of the Contract or the execution of the Facilities, abandonment or termination of the Contract, the parties shall seek to resolve any such dispute or difference, to the extent possible, amicably by mutual consultation.

If the parties fail to resolve such a dispute or difference by mutual consultation at the execution site level, then the dispute shall be referred by the Contractor to the Chief Engineer (Nodal Officer), who shall give written notice of his decision.

The decision/instruction of the Chief Engineer shall be deemed to have been accepted by the Contractor unless notified by the Contractor of his intention to refer the matter for Arbitration within seven (7) days of such decision/instruction.

## **27. Arbitration**

- i. All disputes or differences in respect of which the decision, if any, of Chief Engineer and/or the Head of the Implementing Authority has not become final or binding as aforesaid shall be settled by arbitration in the manner provided herein below.
- ii. The arbitration shall be conducted by three arbitrators, one each to be nominated by the Contractor and the Employer and the third to be appointed by both the arbitrators in accordance with the J&K Arbitration Act. If either of the parties fails to appoint its arbitrator within fourteen (14) days after receipt of a notice from the other party invoking the Arbitration clause, the arbitrator appointed by the party invoking the arbitration clause shall become the sole arbitrator to conduct the arbitration.
- iii. The venue of arbitration shall be head quarter of Employer.
- iv. The decision of the majority of the arbitrators shall be final and binding upon the parties.
- v. During settlement of disputes and arbitration proceedings, both parties shall be obliged to carry out their respective obligations under the Contract.

## **28. Contract Closing:**

On completion of handing over formality and successfully completion of defect liability/guarantee period and Certificate about completion of Defect Liability Period of the package by JKPDD will be issued.

## **29. Banning of business dealings**

**a. Employer shall ban business dealings with contractor on following grounds for the period as decided**

- a. If the contractor fails to submit Performance Security after issuance of Letter of award within 28 days.
- b. If the Contractor fails to accept the award of contract or has abandoned the Contract.

- c. If the Contractor is found to be non-performing in execution of contract by the Employer.
- d. If a disaster / major failure / accident / collapse of a structure / system is caused during erection or during defect liability period due to negligence of contractor or poor quality of execution.
- e. Misbehaviour or physical manhandling by the Contractor or his representative or any person acting on his behalf with any official of the Company dealing with the concerned contract is established.

#### **LIST OF ELIGIBLE SCHEDULED COMMERCIAL PRIVATE INDIAN BANKS**

<b>Sl. No.</b>	<b>Name of Banks</b>
1	HDFC Bank Ltd.
2	Axis Bank Ltd.
3	Kotak Mahindra Bank Ltd.
4	Federal Bank Ltd.
5	Indusind Bank Ltd.
6	Development Credit Bank Ltd.
7	ING Vysya Bank Ltd.
8	Karnataka Bank Ltd.
9	KarurVysya Bank Ltd.
10	Ratnakar Bank Ltd.
11	South Indian Bank Ltd.
12	Yes Bank Ltd.
13	ICICI Bank

#### **APPENDIX-1: TERMS AND PROCEDURES OF PAYMENT**

- I. Amount of “Billable Items” are worked out as per Price Schedule. Items otherwise required for completion of work but not listed in the Price Schedule shall also be in the scope of the contractor.
- II. The bidder should include the cost of all the items necessary to complete the work for successful commissioning of the equipment and no extra payment to any other allied items (not mentioned in BOQ) will be made.
- III. Upon award of the contract, contractor shall be free to take on the work at all the fronts or at specified fronts as advised by employer.

#### **Electrification including 11 kv Line, LT line, Distribution Transformer and Service Connections**

##### **1. Payment :**

##### **PAYMENT TERMS (Needs to be verified by PDD)**

**Payment shall be released as under after completion of Chargeable section of work and joint measurement with PMA & Client’s (PDD) representative.**

- 1. 90% against electrification, testing and commissioning of works on submission of required documents. The bill should be duly certified by PMA and submission of Joint Measurement Certificate & material reconciliation sheet.
- 2. 10% against successful commissioning of distribution transformer, LT line, LT service connections work in Hamlet/village/block and issuance of Taking over certificate including 100% compliance to the 3-tier quality assurance



observations and other quality checkpoints duly certified by PMA & PDD representatives and reconciliation of material at Site/ clearance certificate from PDD representative.

## **APPENDIX-2 : TIME SCHEDULE**

1. The Project Completion Schedule shall be as follows:

<b>Sl. No.</b>	<b>Activities</b>	<b>Duration in Months from the effective date of Contract</b>
1.	<b>Rural Electrification works of Saubhagya District Kupwara</b>	<b>15 days</b>

## **APPENDIX-III**

### **QUALITY ASSURANCE MECHANISM (QAM)**

The contractor shall be solely responsible & accountable for assuring quality in Saubhagya works.

The internal quality assurance mechanism followed by Client shall be termed as **level-zero** of overall quality assurance plan of the works.

#### **Quality checks under Level-zero of QAM:**

Level-zero is of utmost importance. Under this level, the contractor shall strictly perform following QA checks during the course of work execution:

- a. All infrastructures are to be verified for quality as per approved Drawings/Technical Specifications.
- b. 100% verification of Quantity.

QA checks shall be performed by Site Engineers of PMA to be deployed by EMPLOYER

### **THREE TIER QUALITY ASSURANCE MECHANISM**

Projects shall have a 3-tier Quality Assurance Mechanism (QAM). The 3-tier QAM shall exclude level-zero, the in-process quality assurance plan followed by the Project Implementation Agency (PIA) during the physical execution of the project.

#### **TIER — I**

1. Under Tier-I of Quality Assurance Mechanism, QA checks shall be performed by Quality Control/Inspection Engineers of PMA to be deployed by EMPLOYER. Assistant Ex. Engineer level officers will act as Project Implementing Agency's Quality Assurance Coordinator (PQCC) at Sub-Division level Quality Assurance responsibility.

- 1.1 100% sub-station as per Drawings/ Technical Specifications

1.1.1 100% sub-station are to be inspected 2 (two) stages. Stage-I inspection shall cover 10% and Stage-II inspection shall cover 100% sub-station including revisit of the villages inspected during stage-I inspection.

1.1.2. Stage-I inspection shall begin and end when the physical progress in the project is completed in a village. Two (2) nos. of villages in a District are to be thoroughly inspected at the very beginning when the electrification work is completed in these villages. These villages after rectification of defects will become modal quality village. The findings of inspection of these two villages shall be used for necessary improvement in Quality Assurance.

Inspection points in respect of Tier-I are:-

- a) Poles-Proper alignment, concerting and muffing.
- b) Cross-arms – Proper alignment.
- c) Finishing of fabricated steel items used.
- d) Insulators – Proper finish, cleanliness, insulation resistance.
- e) Binding, clamps and jumpers – To check whether these are in reach.
- f) Conductor and earth wire – Proper sag to check whether there are any cuts, etc.
- g) Guys: To check whether the Guy wire is tight and whether the Guy insulators are intact.
- h) Earthing System: To check whether the earthing connections of supports and fittings are intact. Measure earth resistance with earth tester.

After the visual inspection is over and satisfied, the conductor is tested for continuity/ground, by means of megger.

## **TIER — II**

EMPLOYER shall designate a senior officer to the level of Superintending/Executive Engineer as its State Quality Assurance Coordinator(SQAC). He will review the inspections carried out by Tier-II for 5% of villages.

1. Scrutinise 5% randomly selected sub-station as per approved drawings/ Technical Specifications.
2. Check for quality of material used and quality of workmanship.

## **TIER — III**

2. **Rural Electrification Corporation (REC)**, the nodal agency for works, shall operate Tier-III of Quality Assurance Mechanism. REC shall designate a officer as REC Quality Assurance Coordinator. Under this mechanism, adherence to system procedures and guidelines shall also be verified by inspection agency though REC Quality Assurance co-ordinator.

Inspection shall begin and when the physical progress in the project is completed in 30 % of villages respectively and necessary for improvement in Quality Assurance.

## **General Technical Instructions**

## **General Technical & Safety Instructions**

Following CEA regulations and REC Drawings shall be applicable during execution of work:

- a. **Construction Regulation – Central Electricity Authority (Technical Standards for construction of electrical plants and electric lines) Regulation, 2010 (as amended time to time)**
- b. **Safety Regulation for construction and O&M - Central Electricity Authority (Safety requirements for construction, Operation and Maintenance of electrical plants and electric lines) Regulation, 2011 (as amended time to time)**
- c. **Central Electricity Authority (Measures relating to safety and Electric supply regulations), 2010 and amendment regulation 2015 (as amended time to time)**
- d. **REC Construction Manual Drawings.**
- e. **In case of any discrepancy or variation in specifications this document and BIS/REC/CEA regulations, later shall prevail. In case of any other ambiguity in specifications, interpretation of JKPDD will be adhered.**
- f. **All the material and erection practices shall be as per tender specification and wherever not specified, shall be as per REC Standard.**

### **1.1 Route and Survey**

- 1.1.1. The scope of HT/LT length of feeder are enclosed with the tender documents. On award of the contract, contractor shall perform foot survey to access the route, pole location and thus Single Line Diagram of the line works.

### **1.2 Profile Plotting**

- 1.2.1. Span: The number of consecutive spans between the section points shall not exceed design length considering wind pressure, type of poles and size of conductor.
- 1.2.2. **Loading:** There shall not be any upward force on poles under normal working conditions and the suspension poles shall support at least the minimum weight span as provided in the design.

### **1.3 Road Crossing**

At all road crossings, the poles shall be fitted with horizontally aligned disc type tension insulator string but the ground clearance at the roads under maximum temperature and in still air shall be such that it should not fall below 6.1m in case of 11 KV lines. Also, cradle guarding is to be used at all the road crossing locations as per drawings / specifications enclosed. (REC Construction standard A-1)

### **1.4 Telecommunication, LT or HT Line Crossing**

The angle of crossing shall be as near 90 degrees as possible. However, deviation to the extent of 30 degree may be permitted under exceptionally difficult situations. Cradle guarding is to be used at all such crossing locations.

### **1.5 Clearances - General**

For the purpose of computing the vertical clearance of an over-head line, the maximum sag of any conductor shall be calculated on the basis of the maximum sag in still air and the maximum design temperature. Following clearances shall be maintained by the contractor while executing the work:

- 1.5.1. **CLEARANCE ABOVE GROUND OF THE LOWEST CONDUCTOR:** No conductor of an over-head line, including service lines, erected across a street shall at any part thereof be at a height less than
  - (a) For low voltage lines 5.8 metres
  - (b) For high voltage lines 6.1 metres
- 1.5.2. **CLEARANCE FROM BUILDINGS OF LOW VOLTAGE LINES AND SERVICE LINES:**

Where a low voltage over-head line passes above or adjacent to or terminates on any building, the following minimum clearances from any accessible point, on the basis of maximum sag, shall be observed:-

- a) For any pitched/flat roof, open balcony, verandah roof and lean-to-roof
  - i. When the line passes above the building a vertical clearance of 2.5 meters from the highest point; and
  - ii. When the line passes adjacent to the building a horizontal clearance of 1.2 meters from the nearest point, and

The horizontal clearance shall be measured when the line is at a maximum deflection from the vertical due to wind pressure.

#### 1.5.3. CLEARANCE FROM BUILDINGS OF HIGH VOLTAGE LINES:

Where a high voltage over-head line passes above or adjacent to any building or part of building it shall have on the basis of maximum sag a vertical clearance above the highest part of a building immediately under such line, of not less than

(a)	For High Voltage Lines	3.7 m
-----	------------------------	-------

### 1.6 Electrical System Data

Nominal voltage	11KV
Maximum system voltage	12KV
BIL (Impulse)	75KVp
Power frequency withstand voltage (wet)	28KV (rms)

### 1.7 Pole Location

In locating poles on lines, the following general principles should be kept in mind:-

1. Keep spans uniform in length as far as possible.
2. Locate to give horizontal grade.
3. By locating the poles on high places maintain proper ground clearance at the middle of the span. In extremely hilly or mountainous country, poles are located on ridges there by greatly increasing the spans without greatly increasing the pull on the conductor. This is possible because the sag can be made very large and will maintain the required ground clearance. Poles should not be placed along the edges of cuts at or embankment or along the banks of creeks or streams.

### 1.8 Construction

The construction of overhead-lines may be divided into the following parts:-

- (1) Pit marking, pit digging.
- (2) Erection of supports and concreting.
- (3) Providing of guys to supports.
- (4) Mounting cross-arms, pin and insulators, and pin binding.
- (5) Paying and stringing of the conductor.
- (6) Sagging and Tensioning of Conductors.
- (7) Crossings.
- (8) Guarding.
- (9) Earthing.
- (10) Testing and Commissioning.

### 1.9 Erection of DP Structure for Angle Locations

For angles of deviations more than 10 degree, DP structure may be erected. The pit digging should be done along the bisection of angle of deviation.

After the poles are erected, the horizontal/cross bracings should be fitted and the supports held in a vertical position with the help of temporary guys of Manila rope 20/25 mm dia.

Wherever space is not found sufficient to install double Pole structure, single pole cut point may be installed. The support so erected must be grouted.

#### **1.10 Concreting**

The concreting mixture of one cum 1:2:4 ratios would mean 1 part cement, 2 parts coarse sand and 4 part 40 mm aggregate size stones. It may be noted that while preparing the concrete mixture, large quantities of water should not be used as this would wash away cement and sand. Concreting to be done for full embedded part, extended above the ground upto 20 cms. All HT Steel Tubular poles to provided with cement bottoming.

#### **1.11 Providing of Guys To Supports ( LT Line)**

*(REC Drg: G-1/G-2/G-3)*

Guys are installed at locations where terminal poles are erected at sectional cut points. Guys are installed to nullify tension on supports resulted due to conductors tension. One or more guys will have to be provided for all supports where there is unbalanced strain acting on the support, which may result in tilting/uprooting or breaking of the support.

In this work anchor type guy sets are to be used. These guys are provided at (i) angle locations (ii) dead end locations (iii) T - off points (iv) Steep gradient locations and (v) where the wind pressure is more than 50 kg / Sq.m.

The fixing of guys stays will involve (i) pit digging and fixing stay rod (ii) fastening guy wire to the support (iii) Tightening guy wire and fastening to the anchor. The marking of guy pit, digging and setting of anchor rod must be carefully carried out. The stay rod should be placed in a position so that the angle of rod with the vertical face of the pit is 30°/45° as the case may be.

G.I. stay wires of size 7/3.15 mm (10 SWG) & 7/4.00 mm (8 SWG), for 16 mm/20 mm stay rods respectively, are to be provided. 5.5 Kg. Stay Wire (7/ 3.15 mm) per Stay with 16 mm Stay rod for 11 KV lines are to be used.

For double pole structure (DP), four stays along the line, two in each direction and two stays along the bisection of the angle of deviation (or more) as required depending on the angle of deviation are to be provided. Hot dip galvanized stay sets are to be used. One stay to counter the angular deformation force shall be used.

#### **1.12 Guy Strain Insulators**

Guy insulators are placed to prevent the lower part of the Guy from becoming electrically energized by a contact of the upper part of the guy when the conductor snaps and falls on them or due to leakage. No guy insulator shall be located less than 2.6 m from the ground.

#### **1.13 Fixing of Cross-Arms**

After the erection of supports and providing guys, the cross-arms are to be mounted on the support with necessary clamps, bolts and nuts. The practice of fixing the cross arms before the pole erection is also there. Practice of punching holes in Steel Tubular poles is not be followed.

#### **1.14 Insulators and Bindings (Polymer)**

Line conductors are electrically insulated from each other as well as from the pole by 'Insulators'. Following two type of insulators shall be used for the line insulation:

- (1) Pin type
- (2) Strain type

The pin type insulators will be used for straight stretch of line. The insulator and its pin should be mechanically strong enough to withstand the resultant force due to combined effect of wind pressure and weight of the conductor in the span.

The strain insulators are intended for use at terminal locations or dead end locations and where the angle of deviation of line is more than 10°. Strain insulators are also intended to use at major road crossing locations.

The pins for insulators are fixed in the holes provided in the cross-arms and the pole top brackets. The insulators are mounted in their places over the pins and tightened. In the case of strain or angle supports, where strain fittings are provided for this purpose, one strap of the strain fittings is placed over the cross-arm before placing the bolt in the hole of cross-arms. The nut of the straps is so tightened that the strap can move freely in horizontal direction.

All HT/LT insulators shall be tested for insulation tests before installation on line. 11KV insulators shall be tested by 2.5 KV megger whereas LT insulators shall be tested by 500 Volts megger.

### **1.15 Conductor Erection**

The main operations are:-

- (a) Transportation of Conductor to works site.
- (b) Paying and Stringing of Conductor
- (c) Jointing of Conductor
- (d) Tensioning and Sagging of Conductor

While transporting conductors drums to site, precautions are to be taken so that the conductor does not get damaged/injured.

The conductor is pulled through come-along clamps to stringing the conductor between the tension locations.

All the joints on the conductor and earth-wire shall be of the compression type, in accordance with the recommendations of the manufacturer, for which all necessary tools and equipment like compressors, dies, etc., shall be obtained by the Contractor.

All the joints shall be made at least 15 meters away from the pole. No joints or splices shall be made in spans crossing over main roads, railways and small river spans. Not more than one joint per sub-conductor per span shall be allowed.

### **1.16 Tensioning and Sagging Operations**

The tensioning and sagging the conductors shall be pulled up to the desired sag and left in running blocks for at least one hour after which the sag shall be rechecked and adjusted, if necessary. The conductor shall be clamped after re-checking sagging in.

At sharp vertical angles, conductor and earth-wire sags and tensions shall be checked for equality on both sides of the angle and running block. The suspension insulator assemblies will normally assume verticality when the conductor is clamped.

### **1.17 Clipping In**

Clipping of the conductors into position shall be done in accordance with the manufacturer's recommendations. Jumpers at section and angle towers shall be formed to parabolic shape to ensure maximum clearance requirements.

### **1.18 Tying of Conductor on Pin Insulators**

Conductors should occupy such a position on the insulator as will produce minimum strain on the tie wire. The function of the wire is only to hold the conductor, in place on the insulator, leaving the insulator and pin to take the strain of the conductor.

In straight line, the best practice is to use a top groove insulator. These insulators will carry grooves on the side as well. When the conductor is placed on the top groove, the tie wire serves only to keep the conductor from slipping out.

On corners and angles (below 5degree deviations) the conductors should be placed on the outside of the insulators. On the far side of the pole, this pulls the conductor against the insulator instead of away from the insulator.

### 1.19 Earthing

( REC standard J-1/J-2)

Earthing shall generally be carried out in accordance with the requirements of latest CEA regulations (as amended from time to time) and the relevant regulations of the Electricity Supply Authority concerned and as indicated below:

- a) All metallic supports shall be earthed.
- b) For PCC poles the metal cross-arms and insulator pins shall be bonded and earthed at every pole for HT lines. All ST poles on HT to be earthed.
- c) All special structures on which switches, transformers, fuses, etc., are mounted / likely to mount should be earthed.
- d) The supports on either side of the road, railway or river crossing should be earthed.
- e) All supports (Steel & PCC) HT lines passing through inhabited areas, road crossings and along such other places, where Earthing of all poles is considered desirable from safety considerations should be earthed.
- f) At other locations the coil Earthing may be adopted. The coil Earthing consists of 10 m length of 8 SWG. G.I. wire compressed into a coil 450 mm length and 50 mm dia and buried 1500 mm deep as per

Following shall be the earthing requirements:

No	Description	Type of Earthing
1	Single Pole - PCC/steel tubular	1 No. Coil/Spike Earthing at each SP <i>REC:J-1/J-2</i>
2	Double pole - PCC/RS Joist/steel tubular	2 Nos. Coil/Spike Earthing at each DP <i>REC:J-1/J-2</i>
3	Substation Poles structure - PCC/steel tubular	GI Pipe Earthing 3 Nos <i>REC:J-2</i>
4	Road crossing	GI Pipe earthing on either side one each
6	DP with Isolating switch	Coil/Spike earthing 2+1 Nos

### 1.20 Anti-Climbing Devices

In order to prevent unauthorized persons from climbing any of the supports of HT lines without the aid of a ladder or special appliance, certain anti-climbing devices are provided to the supports. GI Barbed wire binding is to be adopted for this purpose at a distance of 30 to 40 cm at a height of 3.5 to 4 m from ground level. At-least 3.5 kgs barbed wire is to be used per pole for the purpose.

### 1.21 Testing and Commissioning

- a. Before charging any new line, it should be ensured that the required inspection fee for the new line is paid to the Electrical Inspector and approval obtained from him for charging the line.
- b. The line should be energized before the officer who has been authorized by the PDD in this regard.
- c. Before energizing any new line, the contractor of the line shall notify to the workmen that the line is being energized and that it will no longer be safe to work on line.
- d. Wide publicity by drum beating should be arranged in all the localities through which the line, that is to be energized passes, intimating the time and date of energizing and warning public against the risk in meddling with the line.
- e. The Officer-in-charge of the line shall personally satisfy himself that the same is in a fit state to be energized.

### 1.22 River Crossing



No special structures are to be erected for this work. River crossing more than normal span of poles are not considered under the package. For small rivers etc., data for the highest flood-level should be obtained for previous years. The structures should be located at such places that they should be approached under flood condition. Normal DP structures are to be used for such crossings on approval of employer.

In case of river crossing with longer span, special designed structures are to be used for the purpose.

### **1.23 Guarding**

(REC Drg: A-1/B-1/B-2)

Guarding is to be provided for the lines, so that a live conductor, when accidentally broken, is prevented to come in contact with other electric lines, telephone or telegraph lines, roads, and persons or animals and carriages moving along the road, by providing a sort of cradle below the main electric line.

The guarding shall consist of GI guard cross arm of length 2.5 mtrs made out of 65x65x6 mm angle & shall be hot dipped galvanized generally conforming to IS : 2633/72. The clamps shall also be hot dipped galvanized. Guarding shall be erected with ground & line clearances as per the I.E. rules. Cradle guard wire should be of 8 SWG GI Wire provided with lashing of 10 SWG GI wire at a distance of 2 m along the length of the guarding. Tension clamps, threaded eye bolts, turn buckles, thimble, tying wires and hardware are as per specified in the specifications.

The minimum height between any guard wires and live crossing conductor shall not be less than 1.5 m in case of a railway crossing.

### **1.24 Repair to conductors**

The conductor shall be continuously observed for loose or broken strands or any other damage during the running out operations. Repair to conductors, if necessary, shall be carried out with repair sleeves. Repairing of the conductor surface shall be carried out only in case of minor damage, scuff marks, etc. The final conductor surface shall be clean, smooth and free from projections, sharp points, cuts, abrasions, etc. The Contractor shall be entirely responsible for any damage to the poles during stringing.

### **1.25 LT Lines and Service connection**

( REC Drg: H-1/H-2)

- 1.25.1. The LT line shall be erected of single phase or three phase arrangements through Conductor/AB Cable depending on site requirements, Preferably LT lines rural with ACSR Conductor and urban/branch lines with ABC. Every 6<sup>th</sup> pole of LT line shall be earthed with GI spike/GI Coil as per specifications ( REC Drg: J-1/J-2)
- 1.25.2. All single phase service connections released under the schemes shall be provided with one earth point near the energy meter. This point is connected with the proper earthing system through GI wires. 10mm diameter earth knob in form of bolt and nut is to be installed on energy meter board.
- 1.25.3. Service connection is to be issued on proper surveying of the location. The service wire is to be hanged on supportive GI wire between pole support and the house. Before installing service wires and GI wire, GI pipe on the consumer premises is to be erected using clamps/ nails/proper binding etc. In pukka/brickwork/cement concrete foundations, house, GI support pipe is to be clamped by means of MS clips.
- 1.25.4. The consumer meter shall be installed at the premises of consumers at suitable height and at place which is not in direct approach of sun-light and rain water. Meters should be installed under the covering shade.

### **Distribution Transformer Sub-station:**

( REC Drg. F-2/F-3/F-4)

Following type of distribution transformers are standardized in the project:

1. 11/0.433 kV, 25 KVA, 3-Ph Distribution Transformers, Aluminium Winding with Bimetallic Terminal Connectors, Energy Efficiency Level-II as per IS: 1180 (Part-I): 2014 Or any other rating as per latest Indian Standard Specification

2. 11/0.433 kV, 63 KVA, 3-Ph Distribution Transformers, Aluminium Winding with Bimetallic Terminal Connectors, Energy Efficiency Level-II as per IS: 1180 (Part-I): 2014
3. 11/0.433 kV, 100 KVA, 3-Ph Distribution Transformers, Aluminium Winding with Bimetallic Terminal Connectors, Energy Efficiency Level-II as per IS: 1180 (Part-I): 2014

The Distribution Transformers shall be 11/0.4 KV non-sealed type Distribution Transformers. The transformers shall be double wound, three phase, CRGO M3 Grade (0.23mm) or better (The core shall be constructed from high grade, non-ageing, Cold Rolled Grain Oriented (CRGO) silicon steel of M3 Grade (0.23mm) laminations only. PRIME CORE M3 Grade (0.23mm) materials are to be used for transformers core. Current density for HV and LV winding should not be more than 1.6 Ampere per sq mm for Aluminium Conductor.

Distribution Transformers shall be subject to inspection during manufacturing (stage inspection), pre-delivery inspection, and inspection at site during pre-erection/post erection/post commissioning conditions.

The new distribution transformers shall be supplied with transformer oil filled up-to maximum permissible level and breather with silica gel. The distribution transformers must have been successfully type tested and the designs should have been in satisfactory operation for a period not less than two years as on the date of bid opening.

Compliance shall be demonstrated by submitting,

- (i) authenticated copies of the type test reports
- (ii) performance certificates from the users, specifically from Central Govt./State Govt. or their undertakings.

- 4 STAR LEVEL: Each Distribution Transformers must contain minimum 4 Star Label with style and information provided by the Bureau of Energy Efficiency (B.E.E), Ministry of Power, Government of India. The losses in Distribution Transformer should be as per Energy Efficiency Level-2 and above as specified in IS 1180 (Part-1):2014 for all kVA ratings of distribution transformers.
- 5 Bimetallic connectors of suitable capacities are to be provided on LT side and on HT side of the transformer.
- 6 Transformers should be tested for pre-commissioning checks which includes Insulation Resistance Test, ratio test and oil breakdown voltage test. Before formal energisation, oil leakages from the parts of the transformer, oil level in conservator tank, condition of silica gel, earth connection (two separate) between neutral and earthing, proper jointing of earth wires/flats at the joints and earth resistance of the individual earthing pits are to be checked and recorded.
- 7 On commissioning of the transformer, phase current and phase to phase voltage, phase to neutral voltage are to be recorded. The loading on the transformers should be balanced. The quantum of neutral current flowing through neutral shall be recorded. A record of pre-commissioning checks/tests are to be prepared and submitted to the Project Manager.

## **8. Distribution box and Power Cabling:**

Distribution boxes are to be installed as per specifications enclosed. The boxes are to be erected, electrically connected with the existing system, properly earthed, and labeled. The test report of pre-commissioning checks should be prepared and submitted.

The distribution boxes are to be earthed using 8 SWG GI wire direct connection to the earthing. 2 Nos Earthing bolts on the distribution boards should be provided of 10mm dia.

The single core power cables should be terminated with proper size lugs and gland. Necessary tagging, identification of cores and dressing of cables with nylon cable ties shall be in the scope of work. The unutilized holes in the DBs provided for cable entry needs to be plugged properly in a manner that it must stop access to reptiles, dust and water ingress.

The Low Tension bus bars are to be painted with two or more coats of brush-able epoxy compound suitable to insulate the bus bars for 415 volts exposure. The distribution box, for transformers should also house three phase trivector energy meter depending on capacity and type of distribution transformer as per specifications. For higher capacity transformers, CT operated meters are to be installed.

The single core un-armored power cables shall be used for connection from Distribution Transformer to Distribution Box and Distribution Box to Outgoing LT lines.

Atleast one meter cable is to be kept as spare at the individual ends.

Following arrangements shall be made for LT Distribution Transformers and LT Cables:

2. 25 KVA 1 Ph 40A TPN MCCB 3x25A SP MCCB 1Cx35 sqmm UA
3. 63 KVA 3 Ph 200A TPN Isolator 100 A 6x60A SP MCCB 1Cx70 sqmm
4. 100 KVA 3 Ph 200A TPN Isolator 160 A 6x90A SP MCCB 1Cx50/70 sqmm UA 1Cx120 sqmm UA

9. **1.1KV XLPE Aluminium Conductor**, Stranded, un-armored cable be used for connection of transformer LV bushing to Distribution Box and Distribution box to overhead line.

10. **Distribution Transformer Earthing** ( *REC Drg. F-5/F-10/ J-2*) shall be provided with 3 Nos earthing and making earth mat /risers using 50X6mm GI Flat. Earthing should be provided with GI earth pipe or Chemical Earthing depending of strata of soil in the location.

25x3mm GI Flat and 8 SWG GI shall be used for making earthing connection to various sub-station equipment as per given details. GI nuts, bolts and washers must be used for GI Flat-to-GI wire & GI wire-to-GI wire joints.

Substation wise measurement of earth resistance of earth pits earthing arrangement shall be recorded and submitted.

Description of equipment	:	Earth connection
Earthing pits	:	3 Nos. Earth Pipe 3 m long, 40 mm dia or Chemical Earthing
Earth mat and riser	:	50X6 mm GI Flat / 8 SWG GI wire

Standard requirements of earthing shall be as under:

- a) Earth Pit – 1 for Transformer Neutral,
- b) Earth pit - 2 for Lightening Arrester,
- c) Earth pit – 3 for Equipment body earthing

#### **Insulator and hardware:**

11 KV polymer/porcelain Disc/Pin insulator with suitable hardware fittings shall be used. Insulator should be tied properly using binding wire/helical form fitting. Bi-metallic clamps must be used at terminals.

**Anti-climbing device:** 3.5 kgs, 2.5mm dia (12 SWG) galvanized barbed wire shall be used on each sub-station support. Galvanized barbed wire should be properly dressed and crimped at termination. While wrapping the wire on support, proper tension should be maintained.

#### **Support foundation:**

Cement concrete in mixture 1 part cement, 3 part coarse sand, 6 part 40 mm size aggregate stone chips (1:3:6) shall be used in steel tubular poles. While erecting supports (poles), Spun cement concrete pipe size 500x1700 mm to be used as shuttering for concreting so that proper quantity of cement concrete mixture be used and assessed during inspection.

#### **Lighting Arrester:**

Distribution Class LAs on each phase shall be provided in the sub-station with base steel structure, terminals bi – metallic connectors / PG clamps and earth connectors. LAs are to be connected with separate earth connection. 25x3 mm GI flat shall be used for earth connection.

#### **New LT Line**

##### **1. Survey:**

Mapping of route of proposed new LT line by foot survey in rural/urban areas be performed mentioning various milestones. While surveying, existing electrical infrastructure in the locality should also be mapped. Line alignment (single line diagram) with fair correctness, be prepared.

SLD and foot survey report shall be approved by PDD and shall be used as basic document for assessment of works under the contract.

On completion of line work, as built Single Line Diagram and pole wise line diagram showing pole wise materials used and pole-to-pole span should be submitted to PDD. This details shall be used as reference documents by Quality & Quantity Inspecting officials to execute inspection works.

2. The LT line between distribution transformer and consumers shall be on ACSR conductor and LT Areal Bunched cables.
3. Support for LT overhead Line:
  - a) 8 M long Steel Tubular poles of Designation 540 SP 12 (IS 2713, Pt I, II, III 1980)
  - b) 9 M long Steel Tubular poles of Designation 540 SP 33 (IS 2713, Pt I, II, III 1980).Fabricated steel items:  
Fabricated steel items like clamps, stay clamp, etc shall be made of MS Channels, MS angle, MS flats. Fabricated steel structure items shall be hot dip galvanized and cleaned till good surface finish. The minimum coating of the zinc shall comply with IS: 2629 and IS: 2633 (with latest amendments).
4. Hardware:  
MS Nuts, bolts and washers (Galvanized) – 16 mm dia nuts, bolts & washers shall be used for tying of overhead structure wherever required.
5. Galvanized Stay Set with 50x8 mm stay clamp, guy insulator (1 No.), anchor plate (200x200x6mm), nut-bolts, 2 Nos turn-buckles, 1.8 m long, 16 mm diameter solid GS stay rod shall be used with 7/3.15 mm dia GI stranded wire.
6. Following earthing arrangements are envisaged for new LT lines:
  - i. GI Earthing spike made of 20mm solid rod or 8 SWG, 50 turns earthing coil
  - ii. Chemical rod earthing including electrode, chemical, with 2000mm long, 50 mm diameter GI pipe, GI Strip of 24x3mm minimum in hard rock locations only.
  - iii. 8 SWG GI wire for earthing and guarding

Every sixth LT line support shall be provided with one GI earthing spike made of 20 mm solid rod or GI Earth Coil and connected with 8 SWG GI wire. Overhead steel items shall be connected to GI earthing spike or GI Earth Coil using 8 SWG GI wire. (REC Drg J-1/J-2)

7. LT line shall form of Conductor/areal bunched

- i. 70 mm<sup>2</sup> LT AB Cable ( 3x70+1x16+1x50)
- ii. 50 mm<sup>2</sup> LT AB Cable (3X50+1x16+1X35)
- iii. 35 mm<sup>2</sup> LT AB Cable ( 3x 35+1x16+1x25)
- iv. 25 mm<sup>2</sup> LT AB Cable ( 3x25+16+1x25)

8. Connection from ABC cable:

. T-connector shall be used at LT line for tapping in case of conductor. Alternately, piercing type connector may be used for tapping of LT connection from ABC cable conductor.

### **LT Consumer Connection from Service Pole (As Per Rec Spec.5/1986)**

General arrangement for LT consumer connection shall be as depicted in *REC Construction Standard drawing H-1 and H-2*. For all identified BPL (Below Poverty Line) consumers, the contractor shall carry out following works:

- a. Service line from nearby LT pole/Distribution Board/Distribution Transformer,
- b. Installation of energy meter, metal meter box, double pole miniature circuit breaker, meter board and earthing point,
- c. Internal wiring works comprising of separate wooden/ Fiber Glass Reinforced Polyester sheet moulding compound (SMC) board, 5 A switch & socket, one separate LED light point, bakelite/wooden round base to house pendant holder, LED lamp, internal wiring between meter board to switch board and switch board to pendant holder.
- d. Testing of consumer meter at distribution licensee's test laboratory

### **Meter Board**

The meter board should be preferably of the box type with sides covered and back open i.e. the meter board will have a frame all round having a clear depth of 40mm to which front board will be fixed. Size of the meter board should be 350

x 200 mm. Each meter board shall be provided with 4(four) anchor bolts 6 mm. Meter board shall be of good quality wood or Fiber Glass Reinforced Polyester sheet moulding compound (SMC) board.

#### **Switch Board:**

Fiber Glass Reinforced Polyester sheet moulding compound (SMC) board {200x150x40 (minimum)} should be installed at normal operating height. Following accessories shall be installed on switch board:

- i. 2 Nos. ISI mark, Piano type 5A, 240V, Switch,
- ii. 1 No ISI mark, 5A, 240V, three-pin socket,

#### **Service Supports:**

Service supports comprising of G.I. Pipe, M.S. angle or Rigid Steel conduit and of sizes given in REC Construction Standard H-1 shall be used.

#### **Single Phase energy meter:**

Fully Static, class 1.0, compatible with state's existing metering system, 5-30A, 240 Volts. Meter body and cover shall be sealed after testing and adjustment with the sealing plier in association with PDD officials.

#### **GI Wire:**

3.15mm dia hard quality GI wire as per IS 280 is to be used to support the service wire coming from the LT line pole and for guy. The service wire shall have ground clearance of 5800mm across the road, 5500mm along the road and 4000mm elsewhere. The span should not be more than 35 meters

#### **PVC Pipe:**

PVC Pipe 25 mm<sup>2</sup> dia (ISI marked) for service termination – if PVC pipe is being used to receive service wire, then 3 meter length angle 35x35x5mm duly painted shall be used to support the pipe.

#### **Protection and Earthing:**

Meter board {200x350x40mm(minimum)} should house earth terminal as per CEA regulations and 16 A two pole MCB. It should be installed at 1500mm min height on the wall.

**House wiring:** Each BPL Household shall be provided with internal house wiring between switch board and Angle Holder. 1 No. 9W screw type LED Lamp shall also be provided. PVC insulated and PVC sheathed single core 1.5 sq mm multi-strands copper conductor cable as per IS 694/1990 (ISI marked) wiring on PVC pipe (ISI marked) IS 2509 as per specification shall be used. Clips for supporting the pipes at every 1 feet distance shall be used.

## **TECHNICAL SPECIFICATIONS**

**(Non-Key Material)**

### **1 TECHNICAL SPECIFICATION OF 11 KV COMPOSITE POLYMER DISC INSULATORS**

#### **1. SCOPE:**

This specification covers the design, manufacture, testing, supply and delivery of 11KV long rod Silicone Composite Polymer disc Insulators(Tongue & Clevis type) for conductors in tension application at angle/cut points consisting of:- (i) **Core**  
It shall be a glass-fiber reinforced 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 on boron free E-Glass 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 void free.

(ii) **Housing (Sheath)**

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

It should protect the FRP rod against environmental influences, external pollution and humidity. **It shall be directly molded 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 well as in the sealing/bonding area shall be free from voids.

(iii) **Weather-sheds**

**The composite polymer weather-sheds made of silicone elastomeric compound or silicon alloy shall be molded 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-shed 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.

(iv) **End Fittings**

Metal end fitting made of **MCI(malleable cast iron) /SGI (spheroidal graphite iron)/ forged steel**, hot dip galvanized, EMS 45 KN conforming to IEC 61109, IS-731-1971 & IS-2633/1972 (with latest edition/ amendments, if any). End fittings transmit the mechanical load to the core. They shall be connected to the rod by means of a controlled compression technique. The gap between fittings and sheath shall be sealed by a flexible silicone elastomeric compound or silicone 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 /IEC60120.

2. **APPLICABLE STANDARDS:**

The insulators shall comply with the requirement laid down in IEC 61109, IS-731-1971 and IS -2633 -1972 (with latest editions/amendments, if any) and shall be suitable for use on 3 phase, 50 cycles, 11 KV power system.

Following India/International Standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the specification, shall be referred while accessing conformity of insulators with these specifications.

Sr. No.	Indian Standard	Title	International standard
1.		Definition, test methods and acceptance criteria for composite insulators for A.C	IEC : 61109
		overhead lines above 1000V	
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	IEC60060-1
4.	IS-2486	Specification for insulator fittings 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 performance test and mechanical performance test on string insulators units	IEC:60575
6.	IS:13134	Guide for the selection of insulators in respect of polluted conditions	IEC60815

7.		Characteristics of string insulators units of the long rod type	IEC:60433
8.		Hydrophobicity classification guide	STRI guide 1.92/1
9.		Radio interference characteristics of overhead power lines and high-voltage equipment	CISPR:18-2 part-2
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 and other allied products	ISO : 1459 ISO : 1461
13.	IS:2629	Recommended Practice for Hot Dip Galvanization for iron and steel	ISO : 1461(E)
14.	IS:6745	Determination of weight of zinc coating on zinc coated iron and steel articles	ISO:1460
15.	IS:3203	Methods of testing of local thickness of electroplated coatings	ISO:2178
16.	IS:2633	Testing of Uniformity of coating of zinc coated articles	
17.		Standard specification for glass fiber Strands	ASTMD 578-05
18.		Standard test method for compositional analysis by thermogravimetry	ASTME 1131-03
19.	IS:4699	Specification for refined secondary zinc	

- iii) Tests for the purpose of this standard shall preferably be carried out under conditions of temperature and humidity specified in IS:196 (i.e. a temperature of  $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and relative humidity of  $65 \pm 2$  percent) and at the prevailing atmospheric pressure. When this is not possible, the tests may be carried out under conditions naturally obtainable at the same time of testing. The barometric pressure, air temperature and humidity shall be recorded for the purpose of correction. Corrections of test voltage for atmospheric conditions shall be as per IEC-61109. (with latest amendments, if any).

#### **4. GENERAL REQUIREMENTS:**

- i) The Supplier should have in house testing facilities for conducting acceptance test in accordance with IEC 61109 and well established manufacturing facility for manufacture and supply of polymer composite insulators.
- ii) **The material of housing/ Weather sheds shall have minimum 30% Silicone content by weight.**
- iii) **All parts made of Forged steel or Malleable cast iron /SGI (spheroidal graphite iron) shall be protected by hot dip galvanising, conforming to latest edition of IS:4826.** All castings shall be free from blow holes and other casting defects such as cracks etc.
- iv) All fittings shall be designed so that the harmful bimetallic corrosion is avoided and effects of vibration both on conductors and fittings are minimized. End fittings shall be free from crack, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth without projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- v) The insulators shall have satisfactory electrical characteristics in outdoor use, and to be free of degradation and cracking of the housing .
- vii) The insulators shall be free of the penetration of the moisture into the interfaces of the end fitting during long term outdoor use and shall possess long term tensile withstand load characteristics .
- viii) The insulators shall be free of voids and other defects in the core material and be non - igniting & non flammable when exposed to flame for short periods.
- ix) Supplier shall quote such silicone composite insulators which have proven use under similar environmental and operating condition. The supplier shall furnish evidence in the form of certification from the power utilities that the similar type of product supplied to them had been

performing satisfactorily.

- x) The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- xi) The core (FRP rod) shall be sound and free of cracks and voids that may adversely affect the insulators.
- xii) Weathersheds shall be uniform in quality they shall be clean, Sound, smooth and free from defects and excessive flashing at parting lines.
- xii) Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc. and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS: 13134.
- xiii) The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- xiv) All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. or 87  $\mu$ m thickness and shall be in according with the requirement of IS-4579. The zinc used for galvanizing shall be of purity 99.5% as per IS-4699. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The Galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one (1) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

## 5. INSULATOR CHARACTERISTICS:

The composite silicone polymer insulators shall have the dimensional, electrical and mechanical characteristics detail as under:

### i) DIMENSIONS

The various dimensions of the polymer disc insulators shall be so designed as to suit the electrical and mechanical characteristics given hereunder and adaptable to 11 KV power system.

### ii) TOLERANCES ON DIMENSIONS

The tolerances on all dimensions e.g. diameter, length and creep age distance shall be allowed as follows:-

$$\pm (0.04 d + 1.5) \text{ mm when } d \leq 300\text{mm}$$

$$\pm (0.025 d + 6) \text{ mm when } d > 300\text{mm}$$

where d being the dimensions in millimetres for diameter length or creepage distance as the case may be. **The minimum creepage distance shall be 320 mm for heavily polluted atmosphere.** However no negative tolerance shall be applicable to creepage distance.

### iii) ELECTRICAL:

The test voltage of the composite polymer insulator shall be as under:- a) Highest system voltage 12 KV (r ms)

- b) Nominal system voltage 11 KV
- c) Visible Discharge voltage test 9 KV (r ms)
- d) Dry power frequency withstand voltage 70 KV (r ms)
- e) Wet power frequency withstand test 35 KV (r ms)
- f) Minimum dry lightening impulse withstand voltage 75 KV(Peak).
- g) Dry flashover voltage As per relevant standard h) Wet flash over voltage As per relevant standard

### iv) MECHANICAL :

- (a) The insulator shall be suitable for the **minimum failing load of 70 KN.**

- (b) Pin ball shank diameter = 16 mm

## 6 INTERCHANGEABILITY

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

## 7 CORONAL AND RI PERFORMANCE

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part 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.



## **8 MARKING:**

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

- Name / Trade Mark of the manufacturer.
- Month & year of manufacture.
- Minimum failing load in Newton/Kg.
- Country of manufacture.

PSPCL reserves its right to get the word 'PSPCL' marked on each insulator in addition to marking as detailed above. The marking shall be on metal parts.

## **9 TESTS & TEST CERTIFICATES:**

The Insulators shall comply with the following tests as per IEC-61109-1992 and IS-2633/1972(with latest amendments, if any ,for galvanizing test):

### **DESIGN TEST:**

The following constitute the design tests as per IEC-61109 (clause-5):-

- Test on interfaces and connections of metal fittings.
- Assembled core load time test.
- Test of housing : Tracking and Erosion test.
- Test for the core material.

### **NOTE 1:**

Type tests certificates from a Govt. approved/ recognized Test House indicating the results of type tests conducted be submitted.

## **10 PACKING:**

All polymer insulators shall be suitably packed in corrugated boxes with internal supports as required. The packing shall be suitable for easy but rough handling and acceptable for road / rail transport. The material shall be packed to withstand normal transit. Safe delivery of the consignment shall be the responsibility of the supplier. Suitable cushioning, protective padding or spacers shall be provided to prevent damage or deformation during transit and handling. The supplier shall provide instructions regarding handling and storage precautions to be taken at site on the box itself.

Each corrugated box of insulators shall be clearly marked indicating the number of units, type of unit, test rating and order number along with instructions regarding handling as specified above

## **2. 11 kV Isolators**

### **1) SCOPE**

This specification provides for delivery of outdoor station type 11KV (Local) manual operating mechanism isolating without/ with earthing blades and complete in all respect with bi-metallic connectors. Operating mechanism, fixing details etc. shall be as described herein.

### **2) PARTICULARS OF THE SYSTEM**

The isolators to be provided under this specification are intended to be used on 3 phase A.C. 50 cycles, effectively grounded system. The nominal system voltages are 11 kV respectively.

### **3) STANDARD**

The Isolator shall comply in all respects with IS: 9921 or IEC Publication No.: 129. Equipment meeting any other authoritative standard which ensures an equal or better quality than the standard mentioned above will also be accepted.

### **4) 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. 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 400 A for 11 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 IS 9921 JEC publication No. 129, which are reproduced below

Standard declared voltage kv/rms	Rated voltage of the Isolator	Standard withstand positive kV (peak)	Impulse Voltage polarity	One minute power frequency withstand voltage KV (RMS)	
				Across the isolating distance	To earth and between poles
11 KV	12	85	75	45	35

The 11 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.

#### 5) TEMPRATURE RISE

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) ISOLATOR INSULATION

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.

#### 7) MAIN CONTACTS

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 similar components.

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 verification or strong winds.

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.

Auxiliary switches : Auxiliary switches are not required.

#### 8) CONNECTORS

The connectors for 11KV isolator shall be made of Aluminium alloy LM-9 or LM-25 and shall be suitable for Squirrel, Weasel and Rabbit ACSR Conductors for 11KV conductors with horizontal and vertical takeoff arrangement.

The clamps 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 .

All castings shall be free from blow holes, surface blisters, cracks and cavities.

#### POST INSULATOR

11KV insulators shall be of reputed make. 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

Each 11KVPost Insulators used in the isolators should have technical particulars as detailed below:-

		11KV
1.	Nominal system voltage KV (rms)	11
2.	Highest system voltage KV (rms)	12
3.	Dry P.F. One minute with stand KV (rms)	35
4.	Wet PF one minute withstand KV (rms)	35
5.	P.F. Puncture withstand test voltage KV	1.3 time the actual dry flash over voltage of the unit
6.	Impulse voltage withstand test KV (peak)	75
7.	Visible discharge test KV voltage	9

8.	Creepage distance mm (min)	320
9.	Tensile strength in KN	10KN
10.	Short time current rating for 3 Secs	25KA

### **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

## **3 11kV VOLTAGE CLASS SURGE ARRESTORS**

( Lighting Arrestor )

### **3.1 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.

### **3.2 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 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.

### **3.3 GENERAL REQUIREMENT**

- 3.3.1 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.

- 3.3.2 The surge arrester shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.
- 3.3.3 The surge arrester shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing / silicon polymeric of specified Creepage distance.
- 3.3.4 The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.
- 3.3.5 The surge arrester shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrester shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrester 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 Arrester.
- 3.3.6 The surge arrester shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrester shall change over to the conducting mode.
- 3.3.7 The surge arrester shall be suitable for circuit breaker performing 0-0.3 min-CO-3 min-CO- duty in the system.
- 3.3.8 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 arrester failure.
- 3.3.9 The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- 3.3.10 The Surge Arrester shall be thermally stable and the bidder shall furnish a copy of thermal stability test with the bid.
- 3.3.11 The arrester shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.
- 3.3.12 The surge arrester shall be provided with line and earth terminals of suitable size.

#### 3.4 ARRESTOR HOUSING

- 3.4.1 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.

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

- 3.4.2 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 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.
- 3.4.3 Sealed housings shall exhibit no measurable leakage.

#### 3.5 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. Arrester may also be required to be mounted on a bracket provided in the Transformers.

#### 3.6 FITTINGS & ACCESSORIES

- 3.6.1 The surge arrester shall be complete with fasteners and terminal connectors.
- 3.6.2 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 take off.

### 3.7 TECHNICAL PARTICULARS

- 3.7.1 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	11kV
ii)	Highest system voltage	12 kV
iii)	System earthing	Effectively earthed system
iv)	Frequency (Hz)	50
v)	Lightning Impulse withstand	75 Voltage (kVP)
vi)	Power frequency withstand	28 Voltage (kV rms)
vii)	Arrestor duty	
	-- Connection to system	Phase to earth
	-- Type of equipment to be protected	transformers & switchgear

#### 3.7.2 Surge Arrestors

i)	Type	Gapless Metal oxide outdoor
ii)	Arrestor rating (kV rms)	9
iii)	Continuous Operating voltage	7.65 (kV rms)
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 10 kA	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 10 kA	100

#### 3.7.3 Insulator Housing

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

## **4. Insulation Piercing Connectors, Anchor (Dead End) & Suspension Accessories & Other Accessories for Aerial Bunched Cables for Working Voltage upto and including 1100 Volts**

### **1.0 SCOPE**

This specification covers the design, manufacture, assembly, testing and supply of Accessories for anchoring, suspending & making connections to Aerial Bunched Cables rated 1100 volts and insulated with cross-linked polyethylene.

### **2.0 STANDARD**

The design, performance and test requirements shall confirm to this specification and the following standards. However in case of any conflict, the requirements of this specification shall prevail.

- NFC 33-020 Insulation Piercing Connectors
- NFC 33-209 LV Aerial Bunched Cables
- NFC 20-540 Environment Testing for Outdoor
- NFC 33-004 Electrical Ageing Test
- NFC 33-040 Suspension Equipments
- NFC 33-041 Anchoring Devices
- IS 14255 LV Aerial Bunched Cables

The Devices shall also be compatible with the cables of sizes & dimensions as defined in the Cable Specifications for the cables with which they are intended to be used.

### **3.0 CLIMATIC CONDITIONS**

For the purpose of designing the climatic conditions as specified in annexure-1 shall be considered.

### **4.0 CABLE DATA**

The standard sizes and characteristics of the phase and street lighting conductors, messenger wires shall be as specified in IS: 14255-1995.

The Accessories of LT XLPE Insulated Aerial Bunched Cables (ABC) with messenger cum neutral are specified below:

- a) Since ABC accessories are to be used with neutral-cum-messenger, their design should incorporate specific features to prevent damage to the insulation which meeting the required electrical, mechanical & thermal requirements.
- b) All mechanical, electrical & thermal ratings should meet or exceed 90% of the corresponding ratings of the cable, or the values specified herein, whichever are more stringent.

### **5.0 THE ABC ACCESSORIES**

The ABC Accessories shall consist of the following:

a)	Insulation Piercing Connectors (IPC)	:	For making tap-off/branch connectors/service connector to an ABC line.
b)	Anchoring Assembly (AA)	:	For fitting onto a pole for anchoring the end of a length of ABC, or for a major change in direction.
c)	Suspension Assembly (SA)	:	For supporting a length of ABC at an intermediate pole in a length, with small angle of deviation.
d)	Service clamp (sc)	:	For anchor Insulated service lines (armoured or unarmour)
e)	Transformer Connections	:	For connection to the transformer bushing.
f)	Junction Sleeves	:	For Phases, neutral messengers & Street lighting conductor.

g)	ABC Service Main Distribution Box	For Distribution of multiple no. of Service Connections from Main AB cable.
----	-----------------------------------	---

## 5.1 Insulation Piercing Connectors (IPC)

- 5.1.1 Insulation Piercing Connectors (IPC) are used for making Tee/Tap-off/Service connectors to an ABC/Bare Overhead Line.
- 5.1.2 Insulation Piercing Connectors are designed to make a connection between the uncut main conductor and a branch cable conductor without having to strip either cable to expose the conductor instead the tightening action of the IPC will first pierce the Insulation, then make good electrical contact between the main end and branch conductor while simultaneously insulating and sealing the connection.
- 5.1.3. Constructional Features of IPC
- 5.1.3.1 The housing shall be made entirely of mechanical and weather resistant plastic insulation material and no metallic part outside the housing is acceptable except for the tightening bolt.
- 5.1.3.2 Any metallic part that is exposed must not be capable of carrying a potential during or after connector installation.
- 5.1.3.3 Screws or nuts assigned for fitting with IPC (Insulating Piercing connector), must be fitted with torque limiting shear heads to prevent over tightening or under tightening (min & max torque values to be specified by Manufacturer).
- 5.1.3.4 The IPC must perform piercing and connection on Main and Branch cable simultaneously.
- 5.1.3.5 The IPCs shall be water proof and the water tightness shall be ensured by appropriate elastomer materials and not by grease, gel or paste alone.
- 5.1.3.6 Design of IPC should be such as to not cause damage to insulation of adjacent conductors due to vibration and relative movement during service.
- 5.1.3.7 The connector shall have a rigid removable end cap which can be slide fitted onto the main connector body on either right or left by the installer (depending on site requirement) for sealing the cut end of the branch cable. Once the connector is fitted, it should not be possible to remove the cap without removing the connector.
- 5.1.3.8 All the metallic parts of the connector should be corrosion resistant and there should not be any appreciable change in contact resistance & temperature after overloads & load cycling.
- The contact plates should be made of aluminium alloy.
  - Connector teeth should be factory greased & sealed to retard water or moisture ingress & corrosion.
  - The Insulation material should be made of weather & UV resistant reinforced polymer.
  - The outer metallic part should have potential free tightening bolts to allow safe installation on live lines.

## 5.2 Anchoring Clamp for Insulated Messenger:

The clamps should be designed to Anchor LT-AB cable with messenger. The clamp should consists of an Aluminium alloy corrosion resistant castled body, bail of stainless steel and self adjusting plastic wedges which shall anchor/hold the neutral messenger without damaging the insulation.

- No losable part in the process of clamping arrangement
- The clamp should conform to the standard NFC 33041 and 33042 or equivalent I.S. if any.
- The clamp body should be made of corrosion resistant Alluminium alloy, bail should be of stainless steel and wedges should be weather and UV resistant polymer.
- Ultimate tensile strength of the clamp should not be less than 15 km for 50/70sq.mm insulated messenger wire / 10 KN for 25/35 sq.mm insulated messenger wire.
- Slip load of the clamp should not be less than 3 KN for 50/70 sq.mm. messenger wire / 2 KN for 25/35 sq.mm. messeng

- 5.2.1 Anchoring assemblies are used to firmly attach the messenger of ABC to a support and transmit the mechanical tension.
- at the end of a run or to the supporting structures
  - at a major change in direction.

- 5.2.2 Each Anchoring Assembly shall include.
- One number tension bracket.
  - One number wedge type tension clamp
  - Flexible Rope for fixing tension clamp to bracket.

5.2.3 Anchoring assemblies shall be supplied in sets to ensure compatibility of the materials against corrosion or wear of moving parts.

5.2.1 Tension Bracket of AA

5.2.4.1 The tension bracket shall be made out of a single piece of Aluminium alloy suitable for attachment to a pole either by

- a) 16mm galvanized steel bolt (s) or
- b) two stainless Steel straps of 20 x 0.7 mm.

5.2.4.2 The tension bracket should be designed to ensure the Flexible rope cannot slip out at any angle.

5.2.4.3 The tension bracket should be rated and tested for the loads specified in Table-5. The load shall be applied at an angle of 45° from the normal to the surface of mounting of the bracket.

5.2.6 Wedge Type Tension Clamp of AA

5.2.6.1 Wedge type clamps shall be used for clamping the messenger without damaging the insulation.

5.2.6.2 The clamp shall be capable of clamping an uncut messenger so that it can continue without break to the connecting point or next span.

5.2.6.3 The clamp shall be fully insulating type of mechanical and weather resisting thermoplastic.

### 5.3 Suspension clamp for insulated neutral messenger:

The clamp should be designed to hang L.T – AB cable with insulated neutral messengers. The neutral messengers should be fixed by an adjustable grip device. A movable link should allow longitudinal and transversal movement of the clamp body.

- No losable part in the process of clamping arrangement.
- The clamp should conform to the standard NFC 33040 or equivalent I.S, if any.
- The clamp and the link made of Polymer should provide an additional insulation between the cable and the pole.
- The clamps and movable links should be made of weather and UV resistant glass fibre reinforced polymer.
- Clamps should be fixed with pole by eye hook / bracket. Bracket should be made of corrosion resistant aluminium alloy.
- Ultimate tensile strength of the clamp should not be less than 15 KN for 50/70 sq.mm. Insulated messenger wire 4.3 KN for 25/35 sq.mm. Insulated messenger wire.
- Maximum allowable load of the clamp should not be less than 20 KN for 50/70 sq.mm. insulated messenger wire/15 KN for 25/30 sq.mm insulated messenger wire.

5.3.1 Suspension Assembly is used for supporting an ABC by installation on the messenger at an intermediate point of support such as a pole. It can accommodate small angles of deviation upto 30°.

5.3.2 Each Suspension Assembly shall consist of:

- One number Suspension Bracket.
- One number moveable (articulated) connecting link.
- One number Suspension Clamp.



- 5.3.3 Suspension Assemblies shall be supplied in sets to ensure compatibility of the materials against corrosion or wear of rotating/moving parts.
- 5.3.4 Suspension Bracket of SA
- 5.3.4.1 The Suspension Bracket shall be made from single piece aluminium alloy suitable for attachment to a pole by either.
- a) 16 mm galvanized steel bolt or  
b) Two stainless steel straps.
- 5.3.4. 5.3.6.3 The Suspension Clamp shall be made fully of insulating type of mechanically strong and weather resistant plastic.
- 5.3.6.4 Bolts should not be used for clamping / locking the messenger in the Clamp.

## **6 LT upto (1100 V) XLPE Insulated**

### **1.0 SCOPE:**

- 1.1 The scope of this specification covers the supply inspection and testing the finished ISI marked LT (1100 volts, 31/2 x25 Sq.mm to 400 Sq.mm stranded, compact aluminum conductor, with XLPE insulated, PVC inner sheathed, galvanized steel strip armored/unarmoured and overall PVC sheathed Black colour cable conforming to IS:7098 /88 with latest amendments and as per specification detailed.

### **2.0 RATED VOLTAGE:**

- 2.1 The rated voltage of the cable shall be 1100 Volts AC with the highest system voltage of 1100 Volts between phases of the effectively earthed three-phase transmission system.
- 2.2 The cables shall be capable of operating continuously under the system frequency variation of  $\pm 3$  Hz, voltage variation of  $\pm 10\%$  and a combined frequency – voltage variation of  $\pm 10\%$ .

### **3.0 APPLICABLE STANDARDS:**

- i) Unless otherwise stipulated in the specifications, the latest version of the following Standards shall be applicable:
- IS 7098 (Part 2)-Cross-linked Polyethylene insulation for Cables.  
IS 8130-Conductors for insulated electrical cables and flexible cords.  
IS 10810(series)-Methods of tests for cables.  
IS 10418-Drums for electric cables.  
IS 3975-Specification for mild steel wires, strips and tapes for armouring of cables.  
IS 5831-Specification for PVC insulation sheath for electric cables.  
IS 10462-Fictitious calculation method for determination of dimensions of protective coverings of cables Part 1 - Elastomeric and thermoplastic insulated cables.
- ii) The cables manufactured to any other International Standards like BSS, IEC or equivalent standards not less stringent than Indian Standards are also acceptable. In such cases the Manufacturer shall enclose a copy of the equivalent international standard, in English language.

### **4.0 CONSTRUCTION:**

- 4.1 **Conductor:** - The cable conductor shall be made from stranded aluminum to form compact sector shaped conductor having resistance within the limits specified in IS:8130/1984 and any amendment thereof. The wires shall be laid up together with a suitable right hand lay. Stranded Class 2 – as per the IS:8 130 / IEC 60228/ BS 6360 standards.
- 4.2 **Insulation:** - The insulation shall be cross linked polyethylene applied by extrusion and shall be steam (wet) cured as per IS:7098(1)1988 and curing in hot water tank/bath is not accepted.:

<b>Sl.No.</b>	<b>Properties</b>	<b>Requirements</b>
1.	Tensile Strength	12.5N/mm <sup>2</sup> , Min.
2.	Elongation to break	200 percent, Min
3.	Aging in air oven: a) Treatment: Temperature: Duration: b) Tensile Strength variation: c) Elongation variation:	135±3°C 7 days ±25 percent, Max ±25 percent, Max
4.	Hot set: a) Treatment: Temperature: Time under load Mechanical stress b) Elongation under load c) Permanent elongation (set) after cooling	200±3°C 15 min 20N/cm <sup>2</sup> 175 percent, Max 15 percent, Max
5.	Shrinkage: a) Treatment: Temperature Duration b) Shrinkage	130±3°C 1 hour 4 percent, Max
6.	Water absorption (Gravimetric): a) Treatment: Temperature: Duration b) Water absorbed	85±2°C 14 days 1 mg/cm <sup>2</sup> , Max
7.	Volume Resistivity a) at 27°C b) at 70°C	1x10 <sup>14</sup> ohm-cm, Min 1x10 <sup>13</sup> ohm-cm, Min
8	Thermal Resistivity	350 degrees C cm/W
9	Power factor at maximum conductor temperature	0.008
10	Dielectric strength	22 kV/mm

**4.3.1** The XLPE insulation should be suitable for specified 1.1 KV system voltage.

**4.3.2** The manufacturing process shall ensure that insulations shall be free from voids.

**4.3.3** The insulation shall withstand mechanical and thermal stresses under steady state and transient operating conditions.

**4.3.4** The insulation of the cable shall be high stranded quality, specified in IS:7098 (Part-II/1985). Withstand continuous conductor temperature of 90 deg C, which means higher continuous rated current carrying capacity.

**4.3.5** The cables can operate even at conductor temperature of 130 deg C continuously and 250 deg C during a Short Circuit condition

#### **4.4 SHEATH :**

The sheath shall be suitable to withstand the site conditions and the desired temperature. It should be of adequate thickness, consistent quality and free from all defects. The PVC sheath shall be extruded as per IS:7098 (Part – I/1988). IEC:60502 Part– I,BS:6622, LSOH to BS:7835.

#### **4.5 ARMOUR :**

Armoring shall be applied over the inner sheath with single galvanized steel complying with the requirements of IS:3975/1979. The dimensions of the galvanized strip shall be as specified in table 4 of the IS:7098/Part-I/1988.

**4.6 OUTER SHEATH :** Extruded PVC ST2, outer sheath as per IS:5831/1984, IS:7098

Part 1, IEC:60502 Part – 1, BS:6622, LSOH to BS:78 35. shall be applied over armoring with suitable additives to prevent attack by rodents and termites. Outer sheathing shall be designed to offer high degree of mechanical protection and shall also be heat, oils, chemicals, abrasion and weather resistant. Common acids, alkalis, saline solutions etc., shall not have adverse effects on the PVC sheathing material used.

4.7 The cables should be suitable for use in solidly earthed system.

4.8 The parameters of the LT power cables to be supplied shall be as specified below

Nom. sectional area (Sq.mm)	Nom. Thickness of XLPE Insulation mm core	Armoured			Max.DC Conductor Resistance at 20°C (ohm/km)	AC current rating	
		Nom. Steel Armour size (mm)	Approx. Overall dia. (mm)	Approx. Weight (kg/km)		In air (amps)	In Grpund (amps)
25	0.90	4 X 0.8	22.8	821.0	1.200	95	97
35	0.90	4 X 0.8	24.9	961.0	0.868	117	116
50	1.00	4 X 0.8	28.1	1195.0	0.641	140	134
70	1.10	4 X 0.8	33.0	1569.0	0.443	176	167
95	1.10	4 X 0.8	35.8	1903.0	0.320	221	199
120	1.20	4 X 0.8	39.0	2303.0	0.253	258	227
150	1.40	4 X 0.8	42.9	2720.0	0.206	294	255
185	1.60	4 X 0.8	47.5	3276.0	0.164	339	287
240	1.70	4 X 0.8	52.7	4048.0	0.125	402	333
300	1.80	4 X 0.8	58.4	4872.0	0.100	461	375
400	2.00	4 X 0.8	65.6	6101.0	0.0778	542	426

4.9 The short circuit current of the LT cable to be as specified below

Sq.mm of LT Cable	Short Circuit Current(KA)
25	2.420
35	3.370
50	4.790
70	6.680
95	9.030
120	11.400
150	14.200
185	17.500
240	22.600
300	28.200
400	37.600

## 5.0 SYSTEM DETAILS:

### General Technical particulars

Nominal system voltage (rms) (U)

0.44KV

Highest system voltage (rms) ( $U_m$ )	1.1 KV
Number of Phase	3
Frequency	50Hz
Variation in Frequency	+/- 3%
Type of Earthing	Solidly Earthed
Total relay & circuit breaker Operating time	15 – 20 cycles

## 6.0 **MATERIALS:**

- 9.1 **Conductor:** -The conductor shall be of stranded construction. The material for conductor shall consist of the plain aluminum of H2 or H4 grade as per clause – 3 of IS 8130/ 1984.
- 9.2 The minimum number of wires shall be 53 for circular compacted 400 sq. mm aluminum conductor as per table – 2 of IS 8130/ 1984.

## 7.0 **CORE IDENTIFICATION:**

- 10.1. The core identification for 31/2 core cables shall be provided, by suitable means, like, by application of individual colour or colored stripes, or by numerals or by printing on the cores as per clause 13 of IS: 7098 - Part 2
- 10.2. For identification of different coloring of XLPE Insulation, or by using colored strips, red, yellow and blue colors respectively shall be used to identify the phase conductors.

## 8.0 **LAYING UP OF CORES:**

The cores shall be laid together with a suitable right hand lay. The interstices at the center shall be filled with a non-hygroscopic material.

## 9.0 **INNER SHEATH (COMMON COVERING):**

- 12.1 The laid up cores shall be provided with inner sheath applied either by extrusion. It shall be ensured that the shape is as circular as possible. The inner sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to remove it without damage to the insulation.
- 12.2 The thickness of the inner sheath (common covering) shall be given as follows:

CALCULATED DIAMETER IN MM OVER LAID UP CORES [REF IS 10462 (PART 1)]		THICKNESS OF INNER SHEATH (Min) mm
Over	Up to and including	
—	25	0.3
25	35	0.4
35	45	0.5
45	55	0.6
55	—	0.7

- 12.3 When one or more layers of binder tapes are applied over the laid up cores, the thickness of such tapes shall not be construed as a part of inner sheath.

## 10.0 **ARMOURING:**

- 13.1 Armouring shall be single strip steel wire applied over the inner sheath as closely as practicable. The direction of the lay of the armour shall be left hand.
- 13.2 The armour shall consist of galvanized strip steel The dimensions of the galvanized steel wires shall be 4 X 0.8 mm (Nominal)
- 13.3 The joints in the armour strip shall be made by brazing or welding and the surface irregularities shall be removed. A joint in

the wire shall be at least 300-mm from the nearest joint in any other wire in the complete cable.

- 13.4 Manufacturers shall furnish the calculation / data sheet for the short circuit carrying capability of the Armour.

#### **11.0 OUTER SHEATH:**

- 14.1 The outer sheath shall be applied by extrusion. It shall be applied over the armouring shall consist of poly-vinyl chloride (PVC) compound, conforming to the requirements of type ST-2 of IS 5831. Suitable additives shall be added to give anti termite protection.

- 14.2 \_ The minimum thickness of the PVC outer sheath shall be as per IS:10462 and as detailed.

Calculated diameter under the outer sheath [IS 10462 Part 1] – mm		Nominal thickness of the outer sheath (ts) – mm
Over	Up to and including	
–	15	1.24
15	25	1.40
25	35	1.56
35	40	1.72
40	45	1.88
45	50	2.04
50	55	2.20
55	60	2.36
60	65	2.52
65	70	2.68
70	75	2.84
75	–	3.0

#### **12.0 PACKING:**

- 20.1 The cables, as per specified delivery lengths, shall be securely wound /packed in non-returnable wooden drums, capable of withstanding rough handling during transport by Rail, Road, etc. The packing should withstand storage conditions in open yards. The cable drums shall conform to IS 10418-1982 or equivalent standard. The dimensional drawings of wooden drums shall be furnished with the Purchase order. The drum shall be provided with circumferential lagging of strong wooden planks. The end of the cable shall be sealed with good quality heat shrink sealing caps. The sufficiently required additional sealing caps shall be supplied for use of testing during laying and jointing at site and to seal spare lengths of cable. The packing should be able to withstand the rigorous of transport. The following information in bold letters in English shall be painted on the flanges.

- a. Name & Address of the manufacturer, Trade name/Trade mark/Brand
- b. ISI Marking
- c. Size of cable (Cross section) rated voltage, standard, insulation, cable code, drum No., and year of manufacture.
- d. Length of cables (Meters)
- e. Direction of rolling
  - i) Net weight (in Kg)
  - ii) Gross weight (in Kg)
  - iii) Owners purchase order reference.

#### **13.0 SEALING OF CABLE ENDS ON DRUMS:**

- 21.1 The cable ends shall be sealed properly so that ingress of moisture is completely prevented. The individual core endings shall be sealed effectively with water resistant compound applied over the core and provided with a heat shrinkable or push-on or Tapex or cold shrinkable type cap of sufficient length with adequate cushion space so that the conductor does not puncture the cap in case of movement of the core during unwinding or laying. Before sealing, the semi conducting layer on the cores may be removed for about 2 mm at each end, to facilitate checking the insulation resistance from one end, without removing the sealing cap at the other end.
- 21.2 The three cores should have an overall heat shrinkable or push-on or Tapex or cold shrinkable type cap with adequate end clearance, and sufficient cushioning to prevent puncturing of the overall sealing cap due to stretching of the cores. The sealing cap shall have sufficient mechanical strength and shall prevent ingress of moisture into the cable. The ends of single core cables shall also be sealed on the same lines to prevent entry of moisture.

**14.0 CABLE LENGTHS:**

The cables shall be supplied in continuous lengths of 500 m or more with 5% tolerance and cable shall be on the wooden drums only.

**15.0 QUANTITY TOLERANCE:**

A +3% tolerance shall be allowed on the ordered quantity including 300-m cable as spare. shall not be accepted.

## **6. 11 kV Composite Insulators**

**1) SCOPE :**

This specification covers the design, manufacture, testing and supply of 11KV Composite Insulators. The composite insulators shall be of the following type:

- i) Long rod insulators for conductors in tension application at angle / cut points the insulators shall be of tongue & clevis type.
- ii) Line post insulators or pin insulators for straight line locations

**2) SYSTEM PARTICULARS:**

a) Nominal System Voltage	11 kV	22 kV	33 kV
b) Corresponding highest system Voltage	12 kV	24kV	36 kV
c) Frequency	50 Hz with 3% tolerance		
d) Number of phase	3	3	3
e) Neutral earthing	effectively grounded.		

**3) STANDARDS :**

Unless otherwise specified elsewhere in the specifications insulators shall conform to the latest revisions of all relevant standards available at the time of placement of the order. The standards are listed in Annexure 'A'.

**4) GENERAL REQUIREMENTS**

- i) The composite insulators shall generally conform to latest Standards as listed in Annexure 'A'
- ii) The Composite Insulators will be used on lines on which the conductors will be A.A.A. Conductor of size up to 200 sq. mm. and ACSR of any size up to Panther (0.2 sq. inch copper equivalent). The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.
- iii) Insulator shall be suitable for both the suspension and strain type of load & shall be of tongue & clevis type. The diameter of Composite Insulator shall be less than 200 mm. The center-to-center distance between tongue & clevis shall be max. 300 mm for 11 kV.
- iv) Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc. and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS: 13134.
- v) The size of Composite insulator, minimum creepage distance and mechanical strength along with hardware fittings shall be as follows:

Sr. No.	Type of Composite insulators	Nominal System Voltage kV (rms)	Highest System Voltage kV(rms )	Visible Discharge Test Voltage kV(rms)	Wet Power Frequency Withstand Voltage kV(rms)	Impulse Withstand voltage kV(rms)	Minimum Creepage Distance (mm) (Heavily Polluted 25mm/kV)	Center to Center Distance Between Tongue & Clevis (mm)	Min. Failing load kN	Shed Diameter (mm) (min)
i.	Long Rod Insulator	11	12	9	35	75	320	300	45	75-100
		22	24	18	55	125	600	450	70	100
		33	36	27	75	170	900	550	70	100
ii.	Post/Pin Insulator	11	12	9	35	75	320		5	
		22	24	18	55	125	560		10	
		33	36	27	75	170	900		10	

## 5) TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS

Polymeric Insulators shall be designed to meet the high quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.

Polymeric Insulators shall consist of THREE parts, at least two of which are insulating parts:-

- (a) Core- the internal insulating part
- (b) Housing- the external insulating part
- (c) Metal end fittings.

### i) CORE

It shall be a glass-fiber reinforced 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-Glass 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 void free.

### ii) HOUSING:

The FRP rod shall be covered by a seamless sheath of a silicone elastomeric compound or silicone alloy compound of a thickness of 3mm minimum. It shall be one-piece housing using Injection Molding Principle to cover the core. The elastomer housing shall be designed to provide the necessary creepage distance and protection against environmental influences. Housing shall conform to the requirements of IEC 61109/92-93 with latest amendments

### iii) WEATHERSHEDS

The composite polymer weather sheds made of a silicone elastomeric compound or silicone alloy compound shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections It should protect the FRP rod against environmental influences, external pollution and humidity. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather shed 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.

### iv) METAL END FITTINGS:

End fitting transmit the mechanical load to the core. They shall be made of spheroidal graphite cast iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. Metal end fittings shall be suitable for tongue & clevis hard wares of respective specified mechanical load and shall be hot dip galvanized after, all fittings have been completed. The material used in fittings shall be corrosion resistant. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be properly attached to the core by a coaxial or hexagonal compression process & should not damage the individual fibers or crack the core. The gap between fitting and sheath shall be sealed by a flexible silicone elastomeric compound or silicone 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 IEC: 60120/ IS: 2486 - Part-II /1989.

## 6) WORKMANSHIP

- 7.1 All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Manufacturers shall offer only such insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission lines.
- 7.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- 7.3 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 7.4 The core shall be sound and free of cracks and voids that may adversely affect the insulators.
- 7.5 Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.
- 7.6 End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth with out projecting points or irregularities, which may cause corona.

All load bearing surfaces shall be sooth and uniform so as to distribute the loading stresses uniformly.

- 7.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. or 87 microm thickness and shall be in accordance with the requirement of IS:4759. the zinc used for galvanizing shall be of purity 99.5% as per IS:4699. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one (1) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

## MECHANICAL STRENGTH

The insulators shall be suitable for the minimum failing loads specified as under:

Designation of Insulator	Minimum failing load (KN)
A	44
	88

## 8. TESTS

The insulators shall comply with the following routine, type and acceptance tests as per IS:5300.

### 8.1

## 10. PACKING

All insulators shall be packed in wooden crates suitable for easy but rough handling and aeptable for rail transport. Wooden separators shall be fixed between the insulators to keep individual insulators in position without movement within the crate.

## 7. Helically Formed Fittings for 11 kV and LT Lines



## 1. SCOPE

This Standard specifies the requirements and tests for helically formed fittings for use on 11 KV and LT overhead lines. The following types of fittings are covered:-

- a) Conductor dead end fittings
- b) Distribution ties, side ties and double ties
- c) Conductor splices
- d) Guy grip dead-ends
- e) Tap connectors
- f) Service grip dead-ends
- g) Lashing rods

## 2. GENERAL REQUIREMENTS

- 2.1 Aluminium alloy, aluminium-clad steel and galvanised steel wires having required mechanical strength, corrosion resistance and formability, depending on the type of application shall be employed in the manufacture of the fittings. The material of the formed fittings shall be compatible with the conductors with which it is used.
- 2.2 In case of formed wires, no joints shall be permitted except those in the base rod or wire before final drawing.
- 2.3 Each formed set shall be marked with indelible and distinct colour to indicate starting/cross-over point of application to facilitate its application on the conductor.
- 2.4 The ends of the individual wires of the formed fittings shall be suitably debarred to provide a smooth finish so as to avoid any damage to the conductor due to sharp edges.
- 2.5 Suitable grit shall be applied to the gripping section of the formed fitting (except lashing rods) in order to enhance its gripping strength.

## 4. REQUIREMENTS OF FORMED FITTINGS FOR VARIOUS APPLICATIONS

### 4.1 Conductor Dead-end fittings

- 4.1.1 Formed conductor dead-end fitting for 11 KV lines consists of the following parts for use with disc insulators of clevis and tongue type:
  - a) Cross arms strap for attaching the fittings to the pole on one side and the disc insulator on the other. These fittings shall conform to the REC Specifications of 11 KV Porcelain Insulators and Fitting.
  - b) Aluminium alloy die cast thimble clevis for attaching the fitting to the tongue of disc insulator on one end and for accommodating loop of the helically formed fitting at the other end in its smooth internal contour. The thimble clevis is attached to the insulator through a steel cotter pin used with a non-ferrous split pin of brass or stainless steel. The thimble clevis shall have clevis dimensions as per IS : 2486 (Part II) - 1989 and shall have the minimum failing load strength of 3000 kg.
  - c) Helically formed fitting acting as the dead-end grip.
- 4.1.2 The die-cast aluminium alloy thimble clevis shall be manufactured with alloy A6 Designation of IS : 617 - 1975.
- 4.1.3 Nuts and bolts used shall be of galvanised steel conforming to IS : 1364 - 1967 and cotter pins conforming to IS : 2004 - 1978. Spring washers used shall be electro-galvanised.
- 4.1.4 The fitting for LT lines shall comprise of the helically formed fitting to suit the LT shackle insulator as per REC Specification of Porcelain Insulators and Insulator Fittings For 415/240V Overhead Power Lines
- 4.1.5 The fittings shall be made to suit the following conductor sizes for 11 KV/LT Lines conforming to REC Specification 1/1971(R-1993) and each fitting shall have a clear identification mark on PVC/metallic/plastic tag, indicating size of the conductor and voltage. The following colour code shall be used for the tag as also for the starting/cross-over marks for quick identification:

20 mm <sup>2</sup> ACSR(Squirrel)	Blue
30 mm <sup>2</sup> ACSR(Weasel)	Red
50 mm <sup>2</sup> ACSR (Rabbit)	Yellow
50 mm <sup>2</sup> ACSR (Rabbit)	Brown
50 mm <sup>2</sup> AAC (Ant)	Grey

- 4.2 Distribution ties side ties and double ties

- 4.2.1** Helically formed ties are used to hold the conductor to pin insulators or shackle insulators.]
- 4.2.2** Chloroprene pad shall be provided with the formed ties for use on 11 KV lines to avoid abrasion of the conductor
- 4.2.3** The conductor sizes and voltage class shall be clearly marked on each fitting and the fittings shall also be identified by color code as per clause 4.1.5.
- 4.2.4** To ensure proper fitting of 11 KV pin insulator ties, the purchaser shall furnish full-dimensions of the insulator top particularly the crown diameter, neck diameter etc. See REC specification 11KV porcelain insulators and fittings.
- 4.3 Conductor Splices**
- 4.3.1** Conductor splices for ACSR conductors shall consist of (i) galvanised steel formed splice for steel core (ii) aluminium alloy formed filler rod (iii) aluminium alloy formed splice for the aluminium strands of the conductor. For AAC conductor, splice is formed with aluminium alloy only.
- 4.3.2** Repair Splice: Repair splices are non-tension splices and are used where some of the outer strands of the conductor are damaged.
- 4.4 Guy Grip Dead-End**
- 4.4.1** Guy grip dead ends have one leg shorter than the other and are suitable for gripping the guy wire. These grips are applied on one side into the thimble eye of the stay rod and on the other side to the guy wire. These can also be used directly with guy insulators.
- 4.4.2** The fittings shall be made of two sizes to suit stay wires of 7/3.15mm(7/10SWG) and 7/2.5 mm(7/12SWG) having UTS values 3625 kg and 2300 kg respectively.
- 4.4.3** The fittings shall be clearly identified on a PVC/metallic/plastic tag for the size of stay wire with which these are to be used and, in addition, the following colour codes for the tag as well as the cross-over marks shall be adopted for proper identification:
- Guy grip for 7/3.15 mm stay wire - Green  
Guy grip for 7/2.5 mm stay wire - Black
- 4.4.4** The guy grip shall be supplied complete with thimble to suit the fitting. Thimble shall be made of hot-dipped galvanized steel.
- Note:** The guy grips to be used with guy insulators shall take into account the standard sizes of insulators as per REC specification and the type and size of the guy insulator shall be clearly specified by the purchaser.
- 7.3 Tensile Strength Test:**
- 7.3.1** Individual wire of the helically formed wires shall be straightened by light hammering and tested for tensile strength and elongation in accordance within the IS:398(Part II)-1976. The tensile strength and the elongation of the formed wires shall not be less than the values specified in tables 1, 2 and 3.
- 7.3.2** For thimbles and hardware other than formed fittings:  
The dead-end clevis thimble and straps shall be tested for tensile strength in accordance with the requirements of mechanical failing load as per IS:2486(Part I)-1993.
- 7.4** Electrical Resistance Test: This test shall be done on straightened aluminium alloy formed wires only. The conductivity of the wires should not be less than 39% IACS.
- 7.5** Wrapping Test: The individual wires of the formed fittings shall be tested as specified in tables 1, 2 and 3. The wires should not break or show fracture when tested as above.
- 7.6** Slip Strength Test: For the conductor dead-end and guy grip dead-end, the test shall be made in accordance with IS:2486(Part I)-1993 and the value of slip/breaking strength shall not be less than 85% of the breaking strength of the conductor for conductor dead-end fitting and 100% for guy wires dead end fittings. In case of tension splices, the test

shall be carried out as per IS:2121. No slippage or damage to the fitting shall occur at a value less than 100% of breaking load of the conductor. This test should be repeated after the resilience test.

**7.7** Resilience Test: A set of helically formed fitting is wrapped and un-wrapped on a piece of conductor 3 times successively. The helical fitting should not lose its resilience even after three applications and should be able to pass the slip strength test requirements mentioned in 7.6 thereafter.

**7.8** Unbalanced Holding test: Unbalanced holding strength is the ability of the formed ties to maintain a constant and uniform grip on the conductor when intermittent and repeated unbalanced loads impose a tension imbalance in the span. These imbalances occur due to wind induced motion, impacts, ice conditions and more so when the conductor is broken.

The test is intended to simulate the broken wire condition. A span of minimum 20 meters tensioned for 40% of UTS of the conductor shall be erected in the laboratory and a pin insulator alongwith the insulator tie under test shall be applied in the middle of span. The conductor used for this purpose shall be of the specific size with which the insulator tie is to be used. The test set up shall be such that it should be possible to apply a pull on one of the two dead ends of the conductor. For the purpose of this test, a steel replica of the insulator will be used. During the test, tension on one side of the pin insulator shall be suddenly released and effect observed. No slippage or damage to the fitting shall occur. After releasing tension from the other end, the fitting should retain the original form. This test will not only check the holding strength of the fitting but will also prove the resilience of the fitting in the event of broken wire.

The test shall be repeated. After releasing the conductor tension on one side, pulling force shall be slowly applied on the other dead-end to pull the conductor till slippage/damage occurs. This force shall not be less than 320 kg.

**7.9** **Fatigue Test:** The fittings should be subjected to fatigue test alongwith the conductor by imparting 10 million cycles of peak to peak amplitude at a frequency above 30 cycles for minimum span length of 20 meters, at 40% of UTS of conductor. The amplitude of the vibrations at the antinodal points should be atleast 50% of the diameter of the conductor. The test should be carried out for 10 million cycles as continuously as possible after which the conductor fitting and insulator should be examined. There should be no damage to the conductor or the insulator where the fitting is attached. The fitting should also be able to withstand the test without any damage.

**7.10** Galvanising Test: Galvanising test should be carried out in accordance with IS:4826-1979 for uniformity and IS:6745-1972 for weight of zinc coating and the fittings will meet the requirements of Table 3.

**7.11** Pull-Off Strength Test: This test is intended to simulate the conductor pull-off conditions created by various factors including elevation difference of the supporting structures on the two sides of the tie. A span of minimum 20 metres tensioned for 40% of UTS of the conductor shall be erected in the laboratory with a conductor of the specified size with which the fitting is intended to be used. A steel replica of pin insulator alongwith the insulator tie under test shall be applied in the middle of span so that a suitable pull-off force can be applied on the pin by means of a machine. The pull-off strength of the tie shall not be less than 200 Kg. for all the three sizes of ACSR.

**7.12** Electrical & Mechanical Test on Tap Connectors: The tap Connectors shall conform to all the electrical and mechanical properties as per IS:5561.

## **8. PACKING AND MARKING**

**8.1** All helically formed items covered under this specification shall be carefully handled to prevent distortion and damage. These items shall be packed and stored in suitable cartons.

**8.2** Different colour codes shall be adopted for different conductor sizes and catalogue number and range of outside diameter of the conductor shall be indicated on the packing.

**8.3** Clevis thimbles and other hardware for conductor dead-ends shall be packed in wooden crates with all necessary markings.

**8.4** The packings of the fittings should carry the following informations.

- a) Purchaser's name
- b) Manufacturer's name and trade mark
- c) Size of conductor, line voltage (when required) and numbers
- d) Batch number, date, month and year of manufacture
- e) Any other marking agreed to between manufacturer and user.

## 8. 11 kV Air Break Switches

### 1) SCOPE

This specification provides for manufacture, testing at works and supply of 11KV & 33KV AB switches. The 11KV and 33 KV AB switches shall conform to IS: 9920 (Part-I to IV)

### 2) AB SWITCHES

The 11KV & 33KV Air Break Switches are required with two poles in each phase. The AB Switches shall be supplied complete with phase coupling shaft, operating rod and operating handle. It shall be manually gang operated and vertically break and horizontal mounting type.

**The equipment offered by the bidder shall be designed for a normal current rating of 200 Amps and for continuous service at the system voltage specified as under:**

- i) 11 KV AB Switch : 11KV + 10% continuous 50 C/s solidly grounded earthed neutral system  
 ii) 33KV AB Switch : 33 kV + 10% -do-

The length of break in the air shall not be less than 400 mm for 11KV AB Switches and 500 mm for 33 KV AB Switches. The 11KV & 33KV AB Switches are required with post insulators. The AB switches should be suitable for mounting on the structure. The mounting structure will be arranged by the bidder. However, the AB Switches shall be supplied with base channel for mounting on the structure which will be provided by the owner. The phase to phase spacing shall be 750mm in case of 11KV AB Switches & 1200mm in case of 33KV AB Switches.

### 3) POST INSULATORS

The complete set of three phase AB Switches shall have stacks of post insulators.

11KV AB Switches: 3 No. 11KV Post Insulator per stack

33KV AB Switches: 3 No. 33KV Post Insulator per stack

The post insulators should conform to the latest applicable Indian standards IS: 2544 Specification for Porcelain Post insulator of compact solid core or long rod insulators are also acceptable. Creepage distance should be adequate for highly polluted outdoor atmosphere in open atmosphere. The porcelain used for manufacture of AB Switches should be homogeneous free from flaws or imperfections that might affect the mechanical dielectric quality. They shall be thoroughly vitrified, tough and impervious to moisture. The glazing of the porcelain shall be of uniform brown in colour, free from blisters, burns and other similar defects. Insulators of the same rating and type shall be interchangeable.

The porcelain and metal parts shall be assembled in such a manner that any thermal expansion differential between the metal and porcelain parts through the range of temperature variation shall not loose the parts or create undue internal stresses which may affect the electrical or mechanical strength. Cap and base of the insulators shall be interchangeable with each other. The cap and base shall be properly cemented with insulators to give perfect grip. Excess cementing must be avoided.

Each 11KV & 33KV Post Insulators should have technical particulars as detailed below:

		11 kV	
i	Nominal system voltage kV (rms)	11	
ii	Highest system voltage kV (rms.)	12	
iii	Dry Power Frequency one kV minute withstand voltage (rms) in KV	35	
iv	Wet Power frequency one minute withstand voltage (rms) in KV	35	
v	Power Frequency puncture kV (rms) voltage	1.3 times the actual dry flashover voltage	
vi	Impulse withstand voltage kV (Peak)	75	
vii	Visible discharge voltage kV (rms)	9	
vii	Creepage distance in mm (minimum)	320	

The rated insulation level of the AB Switches shall not be lower than the values specified below:-

Sl. No	Standard declared voltage KV/RMS	Rated Voltage of the AB Switches	Standard impulse with stand voltage (positive & negative polarity kV (Peak)		One Minute power frequency withstand voltage kV (rms)	
			Across the Isolating distance	To earth & between poles	Across the Isolating distance	To earth & between poles
i	11KV	12KV	85KV	75KV		

ii	33KV	36KV	195KV	170KV		
----	------	------	-------	-------	--	--

#### 4) **TEMPERATURE RISE**

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

#### 5) **MAIN CONTACTS**

AB Switches shall have heavy duty self-aligning type contacts made of hard drawn electrolytic copper/brass. The various parts should be accordingly finished to ensure interchangeability of similar components. The moving contacts of the switch shall be made from hard drawn electrolytic copper brass. This contact shall have dimensions as per drawing attached so as to withstand safely the highest short-circuit currents and over voltage that may be encountered during service. The surface of the contact shall be rounded smooth and silver-plated. In nut shell the male and female contact assemblies shall ensure.

1. Electro-dynamic withstands ability during short circuits without any risk of repulsion of contacts.
2. Thermal withstands ability during short circuits.
3. Constant contact pressure even when the lower 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 variations or strong winds.
4. Wiping action during closing and opening.
5. Fault alignment assuring closing of the switch without minute adjustments.

#### 6) **CONNECTORS**

The connectors shall be made of hard drawn electrolytic copper or brass suitable for Raccoon/Dog ACSR conductor for both 11KV & 33KV AB Switches. The connector should be 4 -bolt type.

#### 7) **OPERATING MECHANISM**

All AB Switches shall have separate independent manual operation. They should be provided with ON/OFF indicators and padlocking arrangements for locking in both the end positions to avoid unintentional operation. The isolating distances should also be visible for the AB Switches.

The AB Switch will be supplied with following accessories:

Sl	Item	Size of 11KV AB Switch	
i	Operating Rod (GI dia) ISI mark	Length 5.50 meter dia: 25MM	
ii	Phase coupling square rod (GI) ISI mark	Length 1800 mm Size 25x25 mm	
iii	Hot dip galvanized Operating handle (GI)	1 No.	

The AB Switches shall be capable to resist any chance of opening out when in closed position. The operating Mechanism should be of robust constructions, easy to operate by single person and to be located conveniently for local operation in the switchyard. The GI pipe shall conform to('B' class or Medium class Blue strip) ISS: 1239-68 and ISI marked by embossing. The vertical down rod should be provided with adequate joint in the mid section to avoid bending or buckling. Additional leverage should be provided to maintain mechanical force with minimum efforts.

All iron parts should be hot dip galvanized as per IS 4759-1979 and zinc coating shall not be less than 610 gm/sq. meter. All brass parts should be silver plated and all nuts and bolts should be hot dip galvanized.

#### 8) **ARCING HORNS**

It shall be simple and replaceable type. They should be capable of interrupting line-charging current. They shall be of first make and after break type.

#### 9) **BUSH**

The design and construction of bush shall embody all the features required to withstand climatic conditions specified so as to ensure dependable and effective operations specified even after long periods of inaction of these Air Break Switches. They shall be made from highly polished Bronze metal with adequate provision for periodic lubrication through nipples and vent.

#### 10) **DESIGN, MATERIALS AND WORKMANSHIP**

All materials used in the construction of the equipment shall be of the appropriate class, well finished and of approved design and material. All similar parts should be accurately finished and interchangeable.

Special attention shall be paid to tropical treatment to all the equipment, as it will be subjected during service to extremely severe exposure to atmospheric moisture and to long period of high ambient temperature. All current carrying parts shall be of non-ferrous metal or alloys and shall be designed to limit sharp points/edges and similar sharp faces.

The firm should have the following type test certificate. The type test should be from CPRI or equivalent lab:-

1. Test to prove capability of rated peak short circuit current and the rated short time current. The rated short time current should correspond to minimum of 10K Amp and the peak short circuit current should correspond to minimum of 25K Amps.
2. Lightning impulse voltage test with positive & negative polarity.
3. Power Frequency voltage dry test and wet test
4. Temperature rise test
5. Mill volt drop tests

The above tests should be performed on the AB Switches, manufactured as per owner approved drawing with the specification. Along with the type test certificate, the certified copy of the drawing (from the testing lab) should also be kept for inspection of our officer. Also the test certificates should not be older than 5 years from the date of opening of tender.

Dimension of 11 & 33KV AB Switches in (Max.)Tolerance 5%.

Sl.	Particulars	11KV AB Switch	
i	MS Channel	450x75x40	
ii	Creepage distance of Post Insulator	320mm (Min)	
iii	Highest of Port shell	254 mm	
iv	Fixed contact assembly		
	i) Base	165x36x8	
	ii) Contact	70x30x6	
	iii) GI cover	110x44	
	v) Spring	6 Nos.	

#### 11) Moving Contact Assembly

i	Base Assembly	135x25x8	
ii	Moving	180x25x9	
iii	Bush	Bronze Metal	
iv	Thickness of Grooves	7	

#### 12) Connectors

i	Connector	60x50x8 (Moving & fix both)	
---	-----------	-----------------------------	--

The bidder should provide AB Switches with terminal connectors, set of insulators, mechanical inter works and arcing horns sets. The base channel for the mounting of AB Switches shall also be included in the scope of AB Switches. The operating mechanisms together with down pipe operating handle etc. are also included in the scope of supply.

## **9. 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 ONE 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 aluminum 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 the M-14 bolt shall in no case be less than 1900 Kg. and the 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.

## **10. 16MM DIA STAY SETS (GALVANIZED)**

The stay sets (Line Guy set) will consist of the following components:-

- a) **ANCHOR ROD WITH ONE WASHER AND NUT:** Overall length of rod should be 1800 mm to be made out of 16 mm dia GS Rod, one end threaded upto 40mm length with a pitch of 5 threads per cm and provided with one square GS washer of size 40x40x1.6mm and one GS hexagonal nut conforming to IS:1367:1967 & IS:1363:1967. Both washer and nut to suit threaded rod of 16mm dia. The other end of the rod to be made into a round eye having an inner dia of 40mm with best quality welding.
- b) **ANCHOR PLATE SIZE 200x200x6MM:** To be made out of GS plate of 6mm thickness. The anchor plate should have at its centre 18mm dia hole.
- c) **TURN BUCKLE & EYE BOLT WITH 2 NUTS:** To be made of 16mm dia GS Rod having an overall length of 450 mm, one end of the rod to be threaded upto 300 mm length with a pitch of 5 threads per cm and provided with two GS Hexagonal nuts of suitable size conforming to IS:1363:1967 & IS:1367:1967. The other end of rod shall be rounded into a circular eye of 40mm inner dia with proper and good quality welding.
- d) **BOW WITH WELDED ANGLE:** To be made out of 16mm dia GS rod. The finished bow shall have an overall length of 995mm and height of 450 mm, the apex or top of the bow shall be bent at an angle of 10 R. The other end shall be welded with proper and good quality welding to a GS angle 180mm long having a dimension of 50x50x6mm. The angle shall have 3 holes of 18mm dia each.
- e) **THIMBLE:** To be made on 1.5 mm thick GS sheet into a size of 75x22x40mm and shape as per standard shall be supplied.
- f) **Galvanizing:** The complete assembly shall be hot dip galvanized.
- g) **WELDING:** The minimum strength of welding provided on various components of 16mm dia stay sets shall be 3100 kg. Minimum 6 mm fillet weld or its equivalent weld area should be deposited in all positions of the job i.e. at any point of the weld length. The welding shall be conforming to relevant IS: 823/1964 or its latest amendment. Minimum length of weld to be provided at various places in the stay sets shall be indicated by the bidder. Welding if, found short in lengths as per final approved drawings shall be rejected.
- h) **THREADING:** The threads on the Anchor Rod, Eye Bolt & Nuts shall be as per specification IS: 4218:1967 (ISO Metric Screw Threads). The nuts shall be conforming to the requirement of IS: 1367:1967 & have dimensions as per IS: 163:1967. The mechanical property requirement of fasteners shall conform to property clause 4.6 each for anchor rod & Eye bolt and property clause 4 for nuts as per IS: 1367:1967.

AVERAGE WEIGHT OF FINISHED 16MM STAY SETS 7.702 KG. (MINIMUM) (EXCLUDING NUTS THIMBLES AND WASHERS) 8.445 KG. (MAXIMUM)

1. **TEST CERTIFICATE:** The contractor shall be required to conduct testing of materials at Govt./Recognized testing laboratory during pre – dispatch inspection for Tensile Load of 3100 Kg/4900 Kg. applied for one minute on the welding & maintained for one minute for 16 mm and 20 mm dia stay sets respectively.
2. **IDENTIFICATION MARK:** All stay sets should carry the identification mark of word DDUGJY and size of the stay set. This should be engraved on the stay plate and on stay rods to ensure proper identification of the materials.

The nuts should be of a size compatible with threaded portion of rods and there should be no play or slippage of nuts.

Welding wherever required should be perfect and should not give way after erection.

3. **TOLERANCES:** The tolerances for various components of the stay sets are indicated below subject to the condition that the average weight of finished stay sets of 16mm dia excluding nuts, thimbles and washers shall not be less than the weight specified above :-

No. Item	Section Tolerances	Fabrication Tolerances	Material
1 Anchor Plate	6mm thick + 12.5% - 5%	200x200mm + 1%	GS plate 6mm thick
	8mm thick + 12.5% - 5%	300x300mm + 1%	GS plate 8mm thick
2 Anchor Rod	16mm dia + 5% - 3%	Length 1800mm + 0.5%	GS Round 16mm dia
		Rounded Eye 40 mm inside dia + 3%. Threading 40mm+11% - 5	GS Round 16mm dia
	20mm dia + 3% - 2%	Length 1800mm + 0.5%	GS Round 20mm dia
		Round Eye 40mm inside dia + 3%. Threading 40mm +11% -5%	GS Found 20mm dia
3 Turn Buckle Bow	16 mm dia + 5% - 3%	Length 995mm + 1% 16mm dia	GS Round 16mm dia
		Length 180mm + 1% 50x50x6mm	GS Angle
		Channel length 200mm + 1%	GS Channel 100x50x4.7mm
4 Eye Bolt Rod	16mm dia + 5% - 3%	Length 450mm + 1% Threading 300mm + 1% Round Eye 40mm inside dia + 3%	GS Round 16mm dia
	20mm dia + 3% - 2%	Length 450mm + 1% Threading 300mm + 1% Round Eye 40mm inside dia + 3%	GS Round 20mm dia

## 11. GI Stay Wires

### 1. SCOPE

This Specification covers details of G.I. stranded stay wires for use in rural distribution system.

### 2. APPLICABLE

### STANDARDS

Except when they conflict with the specific requirements of this specification, the G.I. Stranded Wires shall comply with the specific requirements of IS:2141-1979. IS:4826-1979 & IS:6594-1974 or the latest versions thereof.

### 3. APPLICATION

### AND

### SIZES

- 3.1 The G.I. stranded wires covered in this Specification are intended for use on the overhead power line poles, distribution transformer structures etc.

3.2 The G.I. stranded wires shall be of 7/3.15mm standard sizes.

#### 4. MATERIAL

The wires shall be drawn from steel made by the open hearth basic oxygen or electric furnace process and of such quality that when drawn to the size of wire specified and coated with zinc, the finished strand and the individual wires shall be of uniform quality and have the properties and characteristics as specified in this specification. The wires shall not contain sulphur and phosphorus exceeding 0.060% each.

#### 5. TENSILE GRADE

The wires shall be of tensile grade 4, having minimum tensile strength of 700 N/mm<sup>2</sup> conforming to IS:2141.

#### 6. GENERAL REQUIREMENTS

6.1 The outer wire of strands shall have a right-hand lay.

6.2 The lay length of wire strands shall be 12 to 18 times the strand diameter.

#### 7. MINIMUM BREAKING LOAD

The minimum breaking load of the wires before and after stranding shall be as follows :

No. of wires & const.	Wire dia (mm)	Min. breaking load of Single wire before stranding (KN)	Min. breaking load of the standard wire (KN)
7(6/1)	3.15	5.45	36.26

#### 8. CONSTRUCTION

8.1 The galvanised stay wire shall be of 7-wire construction. The wires shall be so stranded together that when an evenly distributed pull is applied at the ends of completed strand, each wire shall take an equal share of the pull.

8.2 Joints are permitted in the individual wires during stranding but such joints shall not be less than 15 metres apart in the finished strands.

8.3 The wire shall be circular and free from scale, irregularities, imperfection, flaws, splits and other defects.

#### 9. TOLERANCES

A tolerance of (±)2.5% on the diameter of wires before stranding shall be permitted.

#### 10. SAMPLING CRITERIA

The sampling criteria shall be in accordance with IS:2141.

#### 11. TESTS ON WIRES BEFORE MANUFACTURE

The wires shall be subjected to the following tests in accordance with IS:2141.

- i) Ductility Test
- ii) Tolerance on Wire Diameter

#### 12. TESTS ON COMPLETED STRAND

The completed strand shall be tested for the following tests in accordance with IS:2141.

- a) Tensile and Elongation Test :  
The percentage elongation of the stranded wire shall not be less than 6%.
- b) Chemical analysis

c) Galvanising Test :

The Zinc Coating shall conform to “Heavy Coating” as laid down in IS:4826

### 13. MARKING

Each coil shall carry a metallic tag, securely attached to the inner part of the coil, bearing the following information:

- a) Manufacturers’ name or trade mark
- b) Lot number and coil number
- c) Size
- d) Construction
- e) Tensile Designation
- f) Lay
- g) Coating
- h) Length
- i) Mass
- j) ISI certification mark, if any

### 14. PACKING

The wires shall be supplied in 75-100 Kg. coils. The packing should be done in accordance with the provisions of IS:6594.

## 12. 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.

Clamps & connectors shall conform to type tests and shall be subjected to routine and acceptance tests on minimum 3 samples per lot as per IS: 5561. Type tests report for all clamps and connectors for temperature rise test, tensile test, shall be furnished by the Contractor.

### **13. Mid Span Compression Joint and Repair Sleeve**

#### **1.0 Mid Span Compression Joint**

**1.1** Mid Span Compression Joint shall be used for joining two lengths of conductor. The joint shall have a resistivity less than 75% of the resistivity of equivalent length of conductor. The joint shall not permit slipping off, damage to or failure of the complete conductor or any part thereof at a load less than 95% of the ultimate tensile strength of the conductor.

**1.2** In ACSR conductors, the joint shall be made of steel and Aluminium for joining the steel core and Aluminium respectively. The steel sleeve should not crack or fail during compression. The Brinell Hardness of steel sleeve shall not exceed 200. The steel sleeve shall be hot dip galvanised. The Aluminium shall have Aluminium/alloy. Aluminium plugs shall also be provided on the line of demarcation between compression and non compression zone.

#### **2.0 Repair Sleeve**

Repair Sleeve of compression type shall be used to repair conductor with not more than two strands broken in the outer layer. The sleeve shall be manufactured from Aluminium and shall have a smooth surface. The repair sleeve shall comprise of two pieces with a provision of seat for sliding of the keeper piece. The edges of the seat as well as the keeper piece shall be so rounded that the conductor strands are not damaged during **installation**.

### **14. Wedge Connectors**

#### **TECHNICAL SPECIFICATION FOR H.T./L.T. WEDGE TYPE LINE CONNECTORS**

##### **1. SCOPE:**

The specification covers design, manufacture, shop testing, packing & delivery of HT & LT Wedge Type overhead line connectors for Jumpers, cut-points, T-connections and service connections.

##### **2. STANDARDS:**

Unless otherwise specified elsewhere in this specification, the rating as well as performance and testing of the HT & LT overhead line connectors shall conform to the latest revisions available at the time of placement of order of all the relevant standards as listed below:-

a) ANSI C 119.4

b) I.S.5561/1970.

##### **3. GENERAL TECHNICAL REQUIREMENTS FOR HT WEDGE CONNECTORS ( AMPACT TYPE ):-**

###### **3.1. WEDGE CONNECTORS**

The connector shall conform to ANSI C 119.4. It consists of a spring 'C' member and a Wedge, both made from a special Aluminium alloy of high ductility and electrical conductivity. The 'C' member and a Wedge shall be factory coated with a conductive inhibitor containing abrasive particles to help in cleaning the contact surface during installation.

The connector shall be useful for the conductor size of diameter more than 10.05 mm such as RACCON, DOG, PANTHER AND above.

AMPACT Wedge type connectors shall use a power-activated cartridge for installation with proper conductor combinations. During the assembly, the wedge shall be inserted at a speed of about 40 m/s (130 ft/s) using the specified tool. High-speed insertion with the specified inhibitor shall be very effective in abrading all sliding surfaces and in disrupting surface oxide film to generate large number of contact spot in the electrical surfaces.

When connected, this tap shall provide a reliable electrical and mechanical connection for solid, stranded or compressed conductor combinations including AAC, AAAC and ACSR.

### 3.2. C " MEMBER:

The C member shall be formed from extruded aluminium so that the grain (extrusion direction) runs perpendicular to the conductor (e.g. from C-groove end to C-groove end). This orientation of grain direction provides for lower rates of stress relaxation in the metal and will maintain the level of contact pressure at or near the value at initial installation for the life of connection. Susceptibility to stress corrosion cracking will also improve.

The material used shall be specially designed with tighter tolerances on the chemical composition to ensure consistency of the C- member production regarding dimensions and mechanical properties.

### 3.3. WEDGE:

The dimensions for the wedges are manufactured to close tolerances to ensure repeatability and reliability of the connection.

### 3.4. INHIBITOR:

An oxidation inhibitor shall be applied to the surface there by elimination of oxidation of metallic surface. The chemical composition of the inhibitor shall be synthetic and compatible with the rubber gloves used by the utilities. This inhibitor shall contain special Aluminium abrasive particles, optimized in size and quantity, to ensure repeatability and reliability of the electrical contact made in every connection.

- 3.5. The connector shall be cartridge fired 'C' wedge type conforming to ANSI-C119.4 (AA): Extra Heavy Duty Class tested. The connectors shall have maximum contact surface with conductor and, extremely low and stable contact resistance and minimum power loss. These shall maintain constant force within the connection for the life of the connector/clamp while compensating for thermal expansion or creep and increased life span.

The mechanical stresses generated during the wedge insertion shall cause plastic deformation of the C-clamp and shall increase the geometrical confirmation of the clamp to the conductor.

### 3.6. TOOL :-

The tool is having 4 moving parts: the ram, the power unit, the breech cap and the gas release knob. The gas produced by the cartridge during the installation is captive inside the power unit. This allows the tool to remain self-supporting on the lines during installations until the gas release knob is turned counterclockwise. This allows the gas produced by the cartridge to be released and the tool to be removed. Tool is to be used on conductors above Rabbit only.

### 3.7. CARTRIDGE: -

Power charge repeatability (PCR) is critical to the supply of a reliable product, which can be applied safely and consistently every time. These cartridges are designed with the primer cap enclosed to

ensure that it can only be used with the specified tool and to ensure that there is no accidental firing. Cartridges are to be used on conductors above Rabbit only.

4. FREEDOM FROM DEFECTS: -

- 4.1. The wedge type connectors shall be smooth and free from cavities, blowholes, and such other defects, which would likely cause them to be unsatisfactory in service.
- 4.2. The wedge type connectors shall be so designed and proportioned that they are capable of safely withstanding stresses to which they may be subjected (including those due to short circuit and climatic conditions) and that the effects of vibration both on conductor and connector itself are minimized. They shall be designed, manufactured, and finished so as to avoid sharp radius of curvature, ridges and excrescences, which might lead to, localised pressure on or damage to the conductor in service.
- 4.3. Bimetallic connectors shall be used to connect conductors of two dissimilar metals.
- 4.4. Sufficient contact pressure should be maintained at the joint by the provision of the required number of bolts or other fixing arrangements. But the contact pressure should not be so great as to cause relaxation of the joint by cold flow. The joint should be such that the pressure is maintained within this range under all conditions of service.

5. TESTS:

5.1. TYPE TESTS: -

The following Type Tests shall be carried out on three samples as per I.S. 5561/1970.

- a. Tensile Test.
- b. Resistance Test
- c. Temperature Rise Test.
- d. Short Time Current Test.
- e. Dimensional Check.

5.2. TEST CERTIFICATE:

The tenderer shall furnish detailed type test reports of the offered Wedge Type Connector for the tests as per clause 7.1 of this specification. All the above Type Tests shall be carried out as per the relevant standards at laboratories which are accredited by the National Accreditation Board of Testing and Calibration Laboratories (NABL) of Government of India to prove that the Wedge Type Connector offered meet the requirements of the specification. These type tests should have been carried out within five years prior to the date of opening of this tender.

- i. their offered Wedge Type Connector are already fully type tested at Laboratories accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL).
- ii. there is no change in the design of type tested Wedge Type Connector and those offered against this tender

5.3. ACCEPTANCE TESTS:

- a) Tensile Test.



- b) Resistance Test.
- c) Dimensional check

The acceptance tests are to be carried out in presence of Company's representative. The supplier shall, therefore, give sufficient advance notice to the Company for arranging witnessing of the tests.

#### 5.4. ROUTINE TESTS:

- a) Visual inspection.
- b) Dimensional Check.

#### 5.5. TESTING FACILITIES AND DETAILS OF EQUIPMENTS:

The supplier / tenderer shall clearly state as to what testing facilities are available in the works of manufacturer and whether the facilities are adequate to carry out type, routine and acceptance tests as per specification. The bidder shall provide the facilities to purchaser's representative for witnessing the tests in the manufacturer's works. If any test cannot be carried out at manufacturer's works reason should be clearly stated in the tender.

#### 6. MARKING:

- 6.1. Each C- member and wedge is marked with distinct identification code. This identification code is also marked on the packaging to ensure that the correct parts are used for the application. The installer can make a quick visual check before installing.
- 6.2. On each wedge the distinct identification code is located on the side of the largest radius groove to ensure consistent and error-free installation.

#### 7. PACKING:

- 7.1. For packing, wooden cases / Boxes / Double Gunny bags shall be used. The packing shall be fit to withstand rough handling during transit and storage at destination. The heads and threaded portion of fasteners fitting should be properly protected against damage. The gross weight of the packing shall not normally exceed 50 kg per box or case. All different fitting components shall be packed in different cases and shall be completed with minor accessories fitted in places. All Nuts shall be hand- tightened over the bolts and screwed up to the farther point. The tenderer should be approved the packing list before dispatching the material.

- 8. The vendor shall furnish the 4yrs satisfactory performance from govt end utility.

**Signature and Seal of the Bidder**

**Sd/-  
Executive Engineer,  
ED Handwara**







