

## PART 2 : EMPLOYER'S REQUIREMENTS

### Section – 6 Employer's Requirements

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# 1 OVERVIEW OF THE SCOPE OF WORKS

The work is to be executed on turnkey basis, the scope of which includes survey, network design, supply, manufacturer's quality assurance, testing (where specified/ required), transportation, storage, erection, including all civil/ structural works, site testing, commissioning of all items & materials including all associated activities though not exclusively specified herein and are required for the completion and satisfactory performance of the entire works as intended.

The scope of works also include General Technical Instructions enclosed at Annexure-B.

This specification intends to cover but not limited to the following activities, services and works:

- a) Providing engineering data, and drawing for review, approval and records.
- b) Supply, testing, packing, transportation and insurance from the manufacturer's work to the site.
- c) Receipt, storage, insurance, preservation and conservation of equipment's at the site.
- d) Fabrication, pre-assembly (if any), erection, testing and putting into satisfactory operation of all the equipment's/ materials including successful commissioning.
- e) In addition to the requirements indicated in this section, all the requirements as stated in Technical specifications shall also be considered as a part of this specification as if completely bound herewith.
- f) Providing all materials, equipment's and services specified or otherwise, including survey, which are required to fulfill the intent of ensuring operability, maintainability and the reliability of the complete works covered under this specification.
- g) During warranty period the bidder is required to provide all the services and activities mentioned in the contract.
- h) Preparation of project completion report/ closure proposal along with a report clearly indicating completion of any outstanding/ remedial work that needs to be carried out.
- i) Handing over the works to the employer for taking into commercial services.

It is not the intent to specify all aspects of design and construction of equipments mentioned herein. The systems, subsystems and equipments shall conform in all respect to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation. Accordingly, scope of works under this contract is as under:

- 1.1 Execution of all other works as per tender document. All Steel structure except STPs shall be hot dip galvanized as per relevant Indian Standard.
- 1.2 All the raw materials such as steel, zinc for galvanizing, reinforcement steel and cement for foundation, coke for earthing, bolts, nuts & washers, danger plates, phase plate, number plate etc. required shall be included in the scope of supply. Bidders shall clearly indicate in their offer, the sources from where they propose to procure the key raw materials and the components.
- 1.3 A set of drawings are enclosed with this bid document. These are tender drawings and are to be approved by the Employer. These drawings are indicative in nature and therefore, must be referred while preparing drawings for approval.
- 1.4 All the new assets created under RDSS to be properly GIS tagged with the help of mobile App provided by the Employer.
- 1.5 The engraving of word "Developed under RDSS" in materials viz., Poles, Transformers (All types), Cables, Energy Meter etc is mandatory requirement. The Employer shall ensure strict compliance of this requirement. Also, while processing payments to the Contractor, suitable documentary evidence / photographs must be asked by the Employer in support of the compliance.
- 1.6 Major infrastructures like new primary substation, new Distribution Transformer, new lines etc developed under RDSS needs to be clearly denoted by a signboard that should represent

- a) About the Work
- b) Date of Commissioning
- c) Estimated cost
- d) Scheme
- e) Employer's details
- f) For Transformers, rating in kVA

The signboard shall comply to the technical specifications (as per BOQ) and shall reflect as a separate billable item in the price schedule. Colour coding of the DTs is essential.

**1.7 The Manufacturing Quality Plan (MQP) shall be finalized by the Employer in consultation with the contractor/manufacturer in line with the Technical Specifications and as per Employer's practices**

Supply of Plant and Services under this tender covers all interventions required for satisfactory operations of the facilities unless specifically excluded. Scope includes Design, Supply, survey, installation, erection testing and commissioning, on turnkey basis. The types of works envisaged in the RDSS scheme are:

**A. Loss Reduction :**

- a) Feeder Segregation – Segregation of Agricultural/Mix feeders
- b) Feeder Bifurcation
- c) Reconductoring works
- d) Cabling in Natural Disaster Prone Areas
- e) HVDS
- f) AB Cabling
- g) Installation of Capacitor Banks

All items to be supplied and erected shall be strictly as per the specifications given in the Bid and should comply the relevant standards and any amendments thereof.

Any deviation taken by the bidder and not specifically / clearly brought out in the price schedule will not be considered as a valid deviation.

In addition to the works mentioned above the bidder is required to take care of the activities listed below:-

**2 SURVEY**

The Contractor shall carry out, and be responsible for, final design of the works, including any site surveys, subsoil investigations and all other things necessary for proper planning design and execution. The initial site surveys will be carried out for tentative freezing of the material requirement and the work content finalization, within one month of commencement of project, and this will be a joint survey, along with the PMA and sample check by the employer. The same shall

be reviewed progressively on quarterly basis for freezing of the material requirement and work content. Design shall be prepared by qualified designers who are engineers and experienced in design of transmission and distribution systems. Employer shall provide all options proposed for loss reductions to the contractor. Contractor, while surveying the execution of work, shall keep this requirement in view and suggest best loss reduction options in descending order. Means, maximum loss reduction option shall be proposed on priority. Also, while executing the works, same priority of works must be followed.. The changes in design should be approved by Engineer-in-charge of Employer.

Based on the finalized network design, the Bidder shall carry out the field survey for deciding location of poles, distribution transformers etc. Besides, field survey will also cover the following:

- a) Locations of new distribution transformers.

Feeder wise Bill of Quantity (BOQ), for each proposed work will be prepared by the Bidder and submitted to the Employer's Engineer-in-charge for his approval before commencement of actual work.

### **3 PROJECT MANAGEMENT SYSTEM**

#### **3.1 General**

The Contractor shall assign a project manager with the authority to make commitments and decisions that are binding on the Contractor. Employer will designate an officer incharge to coordinate all project related activities. All communications between employer and the Contractor shall be coordinated through the project manager and officer incharge of Employer. The project managers shall also be assisting employer in communicating project related information to other stake holders.

Bidder shall submit the manpower deployment plan along with the bids, describing the key roles of each person.

The role and responsibilities of contractor shall be as follows:

- a) To prepare, maintain and update project detailed Work Execution Plan for successful implementation of project like approval of GTP, approval of sub-contractor, approval of drawings, supply of materials, mobilization of men, material and equipment etc. at site for successful completion of works, Compile and up-load physical as well as financial progresses, compile the progress of works at Employer level and to assist in forwarding it to all stake holders.
- b) To actively participate with employer in resolving all issues relating to project implementation including ROW, Forest Clearances and Railway Crossings and permission from NHAI for NH crossing.
- c) To actively participate in monitoring, reviewing and analyzing the physical, financial and

quality assurances works' progress of RDSS works and also to take suitable measures on compliance of observations being raised during monitoring/review meetings with employer.

- d) To upload and up-date project wise physical progress in RDSS web portal. Physical as well as financial progresses shall be uploaded in standard Bill of Material format of the contract. Also, to submit invoices as per released RDSS guidelines to Employer for release of payments/funds.
- e) To oversee the progress and compliance of the Quality Assurance Mechanism as per RDSS guidelines.

### **3.2 Project Schedule**

As per the schedule the bidder shall submit a preliminary implementation plan along with the bid. The detailed project implementation schedule shall be submitted by the contractor after the award of contract for employer's approval, which shall include at least the following activities:

- a) Surveying of site.
- b) Documents submission and approval schedule
- c) Pre-Dispatch Inspection schedule
- d) Dispatch Schedule
- e) Installation & commissioning schedule
- f) Training schedule, if any.

The project schedule shall include the estimated period for completion of project and its linkage with other activities etc. It is expected that the contractor should share updated project schedule based on the actual progress done at site, priorities of the employer, availability of material etc once per quarter along with the Progress report.

### **3.3 Progress Report**

A progress report shall be prepared by the Contractor each month against the activities listed in the project schedule. The report shall be made available to employer on a monthly basis, e.g., the 10th of each month. The progress report shall include all the completed, ongoing and scheduled activities.

### **3.4 Transmittals**

Every document, letter, progress report, change order, and any other written transmissions exchanged between the Contractor and employer shall be assigned a unique transmittal number. The Contractor shall maintain a correspondence index and assign transmittal numbers consecutively for all Contractor documents. Employer will maintain a similar correspondence numbering scheme identifying documents and correspondence that employer initiates.

## **4 QUALITY ASSURANCE AND EVALUATION MECHANISM**

The Quality Assurance (QA) will be carried out by Employer. The Employer may engage an Authorized representative of employer responsible & accountable for assuring quality in RDSS works. Key activities would include:

Formulation of a detailed comprehensive Quality Assurance Mechanism (QAM) plan/Guaranteed Technical Particulars as the case may be in the State for the works to be carried out under RDSS scheme with an objective to create quality infrastructure works. The QAM and Inspection Plan shall be integral part of the contract agreement with turnkey contractor or equipment supplier and erection agency as the case may be in case of turnkey/ or departmental execution of works.

Ensuring that the quality of materials/equipment supplied at site and execution of works carried out at field under RDSS scheme is in accordance to Manufacturing Quality Plan (MQP)/Guaranteed Technical Particulars (GTP) and Field Quality Plan (FQP)/Approved Drawings/Data Sheets respectively.

#### **4.1 Quality checks to be ensured by Turnkey Contractor:**

Turnkey Contractor shall strictly ensure QAM checks during the day to day course of project execution, which are as follows:

- a) Pre-dispatch inspections of all materials viz. as per MQP/GTP, Approved Drawings, Technical Specifications, Datasheet, GTP, applicable national & international standards as per GCC Clause 23.
- b) 100% verification of feeders created under the scheme.
- c) 100% verification of materials utilized under the scheme.
- d) 100% verification of works done in Loss Reduction and Modernization & System Strengthening.

##### **4.1.1 Vendor approval:**

All the materials procured for RDSS works shall be purchased from the authorized vendors approved by the Quality Assurance Department of Employer. Approved vendors list is uploaded periodically on the Employer web portal.

New vendors/suppliers may be approved by Employer, provided capability of manufacturer(s) is assessed suitably by visiting the factory premises and checking the testing facility available before accepting it as an approved vendor. If required, State Electricity Board/Power Department/ Distribution Companies may adopt vendors already approved by CPSEs.

##### **4.1.2 FQP for Civil works:**

Employer shall prepare a separate FQP/field execution drawings which shall be approved by their competent authority which shall be uploaded at web portal. The turnkey shall adhere to this FQP/drawings while carrying out physical works.

##### **4.1.3 FQP for testing & commissioning:**

Employer shall prepare a comprehensive Pre- commissioning test Check-list for testing & commissioning of Distribution transformer Substation etc. The electrical system shall be energized only after performing all tests as described in the pre-commissioning test checklist. and inspection from the electrical inspector of the state (or as the practice may be). Proper records in this regard, including tests on earth resistance, insulation resistance of 11 kV line & Distribution Transformer

etc. shall be maintained, jointly signed by Employer and turnkey representatives.

4.1.4 **Quality Assurance Mechanism (QAM)** to be followed by the Contractor is as below:

a) The Contractor shall be responsible and accountable for assuring quality in the scheme works. Accordingly, the Contractor shall formulate a comprehensive Quality Assurance mechanism (QAM) and Inspection Plan with an objective to build quality infrastructure under the project, which should be approved by the Employer. Alternately, the Employer may also provide its QAM which needs to be complied by the Contractor. The QAM and Inspection Plan shall be an integral Part of the contract agreement with turnkey Contractor or equipment supplier/vendor and erection agency as the case may be in case of partial turnkey and departmental execution of works. Documentation with regard to Quality Assurance and Inspection Plan shall be maintained by the Contractor and kept in proper order for scrutiny during the course of project execution and for future reference. The Contractor has to ensure that the quality of materials/equipment's supplied at site and execution of works carried out at field is in accordance to the Manufacturing Quality Plan (MQP)/Guaranteed Technical Particulars (GTP) and Field Quality Plan (FQP)/Approved Drawings/Data Sheets respectively.

b) Some key indicative measures for effective implementation of the QAM by the Contractor are given below. However, these are for reference and need to be followed as per relevant provisions of the contract.

**I. Supply:**

- i. Verification of qualifications of the subcontractor / manufacturer for supply of plant / equipment and materials. Factory inspections may be conducted if required.
- ii. Verification of material data, specifications, drawings and samples submitted by the subcontractor / manufacturer including GTPs.
- iii. Verification of type test reports including qualifications of the test laboratory, completeness and acceptance of the type test reports.
- iv. Witnessing acceptance tests carried out by the subcontractor/ manufacturer.
- v. Carrying out pre-dispatch inspections as per relevant guidelines of this tender/ contract.
- vi. Inspection of storage facilities of the subcontractor/ manufacturer.

**II. Works:**

- i. Carry out field inspections on sample basis during implementation to verify works are carried out in compliance to technical specifications and acceptable quality of workmanship.
- ii. Issue Site Observation Reports (SOR) and follow-up with the subcontractor/ manufacturer for implementation of any remedial actions.
- iii. Upon completion, carry out joint inspections together with the Employer's staff and for final measurements and quality inspections.
- iv. Follow-up any on technical issues for corrective action during defects liability period with the subcontractor/ manufacturer.

- c) It should be noted that no functional guarantees are applicable for equipment installed as a part of this contract hence Guarantee Tests are not applicable.
- d) The Employer either self or through any third party agency including PMA whom it deems fit would be responsible to monitor the QAM measures including verifications and inspections mentioned above.
- e) The Employer or its appointed third party shall design systems and procedures to implement QAM system including formats for submittals by the Contractor in line with the above requirements and provisions of the Contract.
- f) The Contractor shall cooperate with and follow these QAM systems and procedures to ensure proper implementation of an effective quality assurance and evaluation mechanism.

4.1.5 **Pre-commissioning test record:** All pre-commissioning test check list shall be documented properly and signed by the quality engineer of the turnkey Contractor & countersigned by Employer's representative and shall be kept for future reference. These documents shall be maintained by Employers in proper order and shall be made available at site for verification by Quality Monitors during inspection and finally be handed over to O&M department) at the time of handing over of energized assets.

#### 4.1.6 Roles and Responsibility of Contractor in ensuring Quality of Plant and Facilities

- 1) Turnkey contractor shall be primarily be responsible for supply of quality materials. Hence, turnkey contractor shall take all necessary actions including following:
  - a) To assess the capabilities and capacity of manufacturer to whom they intend to appoint as sub-vendor,
  - b) To keep strict control over manufacturing of materials by controlling procurement's of right raw materials, periodical stage inspections, to ensure process control and to get the materials invariably inspected in manufacturing stage as well as after manufacturing but before dispatch at the works of manufacturer to ensure quality of materials/equipment.
  - c) To ensure stage inspection and final dispatch inspection, turnkey contractor should deploy his/her quality assurance team to inspect the materials with Employer/third party inspector as well as independently as per requirements.
- 2) **Receipt inspection:** On receipt of materials at site, it would be the prime responsibility of turnkey contractor to verify materials physically in accordance to agreed technical specifications. Physical parameters like dimensions (length, width, height, area of conductor), weight per unit, Insulation Value, length of cable/conductor in sample drum(s), clear embossing on cables through sequential marking depicting name of manufacturer, size of cable and length in meter. Once the Contractor is satisfied, materials must be offered for joint inspection to Employer.
- 3) Earlier, on receipt of materials at site, dispatch documents shall be verified jointly by Employer, Employer's appointed Third Party, Turnkey Contractor and materials supplier (if representative is full time available at site. During inspection, quantities of items, sealing on the materials, serial numbers of the items, sequential embossing (proper visible/legible without any additional efforts) and name plates on the materials shall be checked. Dispatch challans shall be verified for details of consigner and consignee, materials descriptions,

quantities transported, pre-dispatch clearance certificate/waiver of inspection. In case of high value equipment, capacity of equipment in terms of current carrying capacity, operating voltage and KVA ratings should be recorded.

4) **Clearance for installation:** Once, materials on receipt are accepted by turnkey contractor as well as Employer representative, they will be eligible for erection, testing and commissioning.

5) **Sampling from field:** Any material, including materials listed below, may be picked from site (at the option of Employer based on its requirements and perception of risk) for testing at test laboratory chosen by inspecting official. 1. Distribution Transformer, 2. Overhead Conductor, 3. Pole, 4. Insulator, 5. Insulators, 6. Cables (ABC/XLPE)

a) Inspecting official (*Employer's official/ Employer appointed third party representative*) will have right to pick any of the supplied equipment whether it is lying in site stores, is under erection, is under local transportation from site stores to erection location or is already commissioned. The equipment shall be sealed jointly in presence of representatives of Employer, Employer's appointed Third Party, Contractor, and Supplier/manufacturer (if his representative is available at site). Employer at its discretion may invite manufacturer's representative to participate in sealing of materials..

b) Sealed equipment, shall be sent to test laboratory for verification of routine/type test results. At the time of sealing, details of equipment available at site shall be recorded like cable/conductor drum number, power/distribution transformer unique number, status of sequential legible embossing on cables, name of manufacturer etc.

c) For testing of equipment, Employer shall empanel test laboratories located in or nearer to the state wherefrom sample is picked up.

d) Such picked up materials at a random shall be tested for all routine, acceptance and type tests feasible to conduct in the empaneled laboratory along with verification of type test report ( as applicable, from the respective Labs). The laboratory expenses including all other expenditures that shall incurred towards packing, transport, inspection, testing charges etc. are to be borne by the Employer.

e) In cases, where pre-dispatch and factory test results/NABL accredited lab test report are found mismatched with tests results on the sample picked from field; actions shall be taken against willful defaulted manufacturer and turnkey contractor or both.

f) Willful defaulter shall be those manufacturers and turnkey contractor whose material is found to be manufactured using inferior quality raw materials, second hand core materials, under-size/under-weight of cable/conductor in various parts of cable/conductor drum, not conforming to transformer load losses as defined in agreed technical specifications/contract conditions, improper or no sequential legible embossing on cable etc.

g) This mismatch shall generally be, but not limited to the deviations in results from guaranteed technical specifications of materials in terms of capacity (KVA capacity, current carrying capacity, heating capacity, tensile strength, mechanical strength etc., operational efficiencies (errors in measurements of power, power/load losses, power

consumption etc., weights of key component materials (aluminum, copper, insulation materials, steel components etc.), sub-standard specifications of key component (measured specifications are in deviation from guaranteed specifications as per technical specifications of the project and inferior/illegible embossing/sequential marking on cables are found, following two actions shall be taken:

- i. Sub-vendors/vendor registration of the manufacturer shall be discontinued in all the power utilities of the country for a period of 5 years including in power utility concerned where this act is found,
  - ii. Entire lot of materials/equipment supplied by the defaulting manufacturer shall be rejected whether supplied materials/equipment is lying in site-stores, in transit, under erection, testing & commissioning or has already been commissioned. All costs related to removal of such rejected materials and reinstating fresh lot of materials shall be borne by turnkey contractor without any cost implication to power utility.
  - iii. Turnkey contractor shall be responsible for repetitive failures of materials in field testing in a turnkey-contract. In such situations, registration of turnkey contractor firm shall be discontinued in all the power utilities of the country for a period of 5 years including in power utility concerned where this act is found,
- h) In cases, where field testing results are slightly mismatched with factory test results / pre-dispatch test reports/NABL accredited lab test report but are in permissible limits as per GTP/Data Sheet/Technical Specifications, no action shall be taken against the turnkey contractor/manufacturer.
- i) In cases where turnkey contract is reluctant/not willing to support the Employer in selecting sample for testing by way of non-association in sampling, sampling and testing related activities of equipment, all actions related to sample selection, sealing and testing including dismantling, loading, unloading, transportation etc, will be taken by Employer on risk & cost of the turnkey contractor. The non-cooperative act on part of turnkey contractor shall be circulated amongst all power utilities in the country. In such situations, registration of turnkey contractor firm shall be discontinued in all the power utilities of the country for a period of 5 years including in power utility concerned where this act is found.
- 6) The Contractor should develop the quality assurance programme which shall generally cover the following:
- a. Organization structure for the management and implementation of the proposed quality assurance programme :
  - b. Documentation control system;
  - c. Qualification data for bidder's key personnel;
  - d. Procedure for purchases of materials, parts, components and selection of sub-Contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
  - e. System for shop manufacturing and site erection controls including process

- controls and fabrication and assembly control;
- f. Control of non-conforming items and system for corrective actions;
- g. Inspection and test procedure both for manufacture and field activities.
- h. Control of calibration and testing of measuring instruments and field activities;
- i. System for indication and appraisal of inspection status;
- j. System for quality audits;
- k. System for authorizing release of manufactured product to the Employer.
- l. System for maintenance of records;
- m. System for handling storage and delivery; and
- n. A manufacturing quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.
- o. A Field quality Plan covering field activities

- 7) **Electrical Inspector inspection:** After successful completion of the work permission from State Electrical Inspectorate is required. Necessary fee etc. shall be paid by the Employer. However if Contractor pays such fee it shall be reimbursed on actual basis on documentary evidence. In case of defects / in-complete works notified by Electrical Inspectorate, these shall be completed by the agency at no extra cost implication to Employer.

**4.2 Concurrent Quality Monitoring by Nodal agencies: In addition to the in-house quality checks and processes followed by the Employer, the Nodal Agency of RDSS (REC/PFC) shall also carry out concurrent inspection of works through Third Party Quality Monitoring Agency (TPQMA). The Contractor needs to comply with the requirements and cooperate for effective implementation.**

**4.2.1 Scope of Quality Assurance Mechanism by RDSS Nodal Agency (REC/PFC):** The Nodal Agency (REC/PFC) shall carry out concurrent inspection of works through TPQMA. To enable the same, the Employers shall share the physical and financial progress of the works through portal of the scheme or otherwise. In addition to the above, the Nodal Agencies may also carry out concurrent quality monitoring on random sample basis as per the need through its own/TPQMA manpower.

TPQMA shall verify the quality of works carried out in the Project after site visits. The sample size for inspection/verification of works completed (the indicative sample size is applicable only for fullu completed works) is given below:

- a) 5% of HT feeders ( in terms of sanctioned /awarded length of projects i.e. district covering at least 5% of total sanctioned no of HT feeders) for each voltage level and/configuration (OH/AB/UG/HVDS) including bay extensions as applicable.
- b) 5% of HT feeders reconductoring/replacement/renovation works( in terms of sanctioned /awarded length of projects i.e. district covering at least 5% of total sanctioned no of HT feeders) for each voltage level and/configuration (OH/AB/UG)
- c) 5% of LT Lines (in terms of sanctioned /awarded length of projects i.e. district/Circle) for each configuration (OH/AB/UG).
- d) 5% of LT Lines reconductoring/replacement/renovation works (in terms of

sanctioned /awarded length of projects i.e. district/Circle) for each configuration (OH/AB/UG).

- e) 5% of any other works sanctioned in DPR with sanctioned value more than 5% of sanctioned cost.
- f) IT/OT/SCADA/DMS infrastructure – primarily at system level for high level functional checks.

#### 4.2.2 Field Works Quality Inspection:

- 1) The TPQMA shall carryout field inspections for each project area (district/package) in 3 (three) stages i.e. on completion of 30% ( Stage-I) and 70% (Stage-II) of financial progress corresponding to the physical progress respectively and a final inspections( Stage-III) for verification of rectification of defects / discrepancies/non conformities identified in the previous stages of inspections .
  - a) TPQMA also verify the Contract Management Part once for each project and upload deviations, if any observed in respect of the guidelines/ Standard Bidding Document, adherence to QAM, Contractual provisions pertaining to defects identification and rectification. (In this part TPQMA would give thrust on adherence on systems and procedures of RDSS schemes by turnkey contractors during project implementation).
  - b) As only random inspections are to be carried out by TPQMA agencies leaving around 90 to 95% materials/works unchecked therefore there should be some stringent penal clause to be made if materials /works verified by TPQMA found faulty/wage. The TKC is required to rectify the observations / defects detected within 7 days of notification. However based on severity the Employer may direct the Contractor on resolution mechanism / process and timeline.
- 2) **Deployment of mobile vans for quality inspection:** The Employer/ Nodal Agency reserves the right to also deploy mobile vans with Testing facility to test the plants and facilities by selecting random samples from store or from site. The Employer may take sample from any lot placed in store including the lot on which Pre-Dispatch Inspection was not carried out or from the installed materials which it feels are not performing as it was intended to. In such a case if the material/ facility fails, the same shall be replaced with new material, and one more random sample would be selected from the same batch for testing. If the material fails the test again, then the whole lot shall be replaced by the Contractor at its own risk and cost.

4.2.3 **Cross verification of field /TPQMA works by Nodal Agency:** The Nodal Agency also reserves the right to monitor the field /materials to the tune of 1% of total inspections carried out by TPQMA.

4.3 **Material Inspection: For the purpose of inspection, materials have been segregated into two categories as mentioned below:**

4.3.1 Category – A (Pre-Dispatch Inspection & Testing at NABL accredited Labs):

- a) This category shall include high ticket materials (Power Transformers, Distribution Transformers, Circuit Breakers, AB/XLPE Cables, Overhead Conductor (AAAC/ACSR),

Insulator which involves more and important testing procedures and hence the inspection of these materials will be carried out in the factory before the dispatch of the material.

- b) In addition, Employer shall also ensure that for major materials as discussed above, samples from 1<sup>st</sup> lot and one other lot randomly selected by the Employer shall be directly sent to NABL accredited test labs for third party testing. It is also to be noted that material clearance of the lots under testing shall only be given post receipt of successful test results. Contractor shall also mandatorily depute its authorized official for pre – dispatch inspection at manufacturing facility along with the Employer officials. The inspection and testing report would be jointly signed by the Employer and the Contractor. All the expenses related to testing would be bearded by the Contractor.
- c) Apart from the above-mentioned protocol any one power transformer shall be selected by Employer from the supply schedule from the vendor, which shall be jointly sealed and tested for short circuit testing on turnkey-Contractor’s expenses.
- d) The material inspection by TPQMA (deployed by Nodal Agency) are primarily envisaged by picking random samples from the site stores except for Power Transformers. The TPQMA shall be part of PDI for at least 1 lot of Power Transformers covering 5% quantity spread across two major manufacturer or suppliers along with the representative of the Employer and Contractor.
- e) Material Inspection by TPQMA (deployed by Nodal Agency) by sampling from field: Following materials shall be picked from site stores for testing at NABL testing laboratories empaneled by NodalAgency/TPQMA.
  - i. Distribution Transformer 2. Overhead Conductor 3. Pole 4. Insulators 5. Cables (ABC/XLPE)
  - ii. The equipment shall be sealed jointly in presence of TPQMA, representative of Employer, Contractor and supplier/manufacturer (if its representative is available at site).
  - iii. At least one sample of each material shall be subjected to inspection from each project area (District/Package). The TPQMA/Nodal agency may devise a mechanism for randomize selection of the samples.
  - iv. The Employer shall be responsible for safe handling, packaging and transportation of the sealed material up to the identified testing laboratories. All expenses related to logistics andtransport shall be reimbursed to the Employer/TPQMA, as the case may be by Nodal Agencies.
  - v. The TPQMA shall also witness the testing at the testing laboratories.
  - vi. The laboratory expenses towards inspection, testing charges etc. shall be borne by TPQMA/Nodal Agency.

4.3.2 **Category – B (On-site inspection):** This category includes the materials for which a factory inspection is not warranted and the material can be inspected upon arrival at the site before the installation. In case the Employer is apprehensive about the quality of the material supplied it reserves the right to send the selected lot to the NABL accredited testing lab for third party testing.

- 4.3.3 Employer also reserves the right to send any installed equipment / materials to the NABL accredited testing lab for testing. The Employer would have to reimburse the expenses related to transportation of material from site to testing lab and all testing expenses in this regard.
- 4.3.4 The material which has to be tested at laboratory shall be sealed in the presence of authorized official of Employer and Contractor.
- 4.3.5 If the materials tested at Laboratory fails then the entire lot would be rejected. Contractor shall bear the responsibility of sending back such failed materials from site. Any subsequent delay in contract performance due to failure of materials in the test laboratory would be on account of Contractor and no time extension would be provided by the Employer in this regard. Any LD levies in this regard would be borne by the Contractor.
- 4.3.6 Pre-dispatch Inspection (PDI) for Category-A
- 4.3.7 Pre-dispatch inspection shall be performed on the identified materials at manufacturer's work place for which Contractor shall be required to raise requisition giving at least 10-day time. Depending on requirement, inspection shall be witnessed by representatives of Employer, TPQMA, Contractor and/or representative of the Nodal Agency. TPQMA shall carry out pre-dispatch inspection of major materials randomly in a single lot containing minimum 10% materials at manufacturer works. The TPQMA shall perform pre – dispatch inspection test of below materials:

- 1) Ring Main Unit (RMU),
- 2) Insulators,
- 3) Cables / Conductors

- 4.3.7.1 Tests to be conducted during the Pre-dispatch Inspection: All the tests shall be carried out in accordance with the latest relevant IS published from time to time by BIS and as per technical specification.

The above list of tests is only indicative in nature and if the Employer feels, it can add some tests based on latest IS Standards. If the Employer faces any issues with respect to actual performance of a material, then it can issue a notice to the Contractor for testing of that material at its sole description.

- 4.3.7.2 The Contractor shall ensure receipt of material at site within 21 days from date of receipt of dispatch instructions. In case materials are not received within 21 days from date of issue of dispatch instruction, the dispatch instruction shall stand cancelled. All expenditure incurred by Employer in performance of dispatch instruction shall be recovered from turnkey Contractor. A fresh pre – dispatch inspection would be required to issue a dispatch instruction for supplying the same lot at the site.
- 4.3.7.3 The turnkey Contractor shall ensure that pre-dispatch inspection for materials are intimated only when the material is completely ready for inspection. On due date of inspection, if it is found that materials are not ready in required quantities or the inspection could not be carried out due to non-availability of requisite calibrated certificate of instruments with manufacturer, closing of works on scheduled date of inspection, non-availability of sufficient testing/material handling staff at manufacturer works etc, all expenditures incurred on deployment of various inspecting officials

along with a fine of Rs 50,000/- shall be recovered from the bills of the agency and re-inspection shall be carried out on expense of the Contractor. 2<sup>nd</sup> such situation at same manufacturer/supplier shall result in rejection of name of manufacturer from list of approved vendors/sub-vendors. In case sub-standard materials (old component, re-cycled materials, re-used core material, re-used transformer coil material etc) offered for inspection and are noticed during the inspection, materials shall be rejected and approval of sub-vendor shall also be cancelled for all RDSS projects.

#### **4.4 Implications for not meeting quality requirements by Contractor**

##### **4.4.1 In case of failures in testing:**

- a) The turnkey Contractor shall ensure that pre-dispatch inspection for materials is intimated only when the material is completely ready for inspection. On due date of inspection, if it is found that materials are not ready in required quantities or the inspection could not be carried out due to non- availability of requisite calibrated certificate of instruments with manufacturer, closing of works on scheduled date of inspection, non-availability of sufficient testing/material handling staff at manufacturer works etc, all expenditures incurred on deployment of various inspecting officials along with a fine of Rs 50,000/- inclusive of GST shall be recovered from the bills of the agency and re-inspection shall be carried out on expense of Contractor.
- b) 2<sup>nd</sup> such situation at same manufacturer/supplier shall result in rejection of name of manufacturer from list of approved vendors/sub-vendors. In case sub-standard materials (old component, re- cycled materials, re-used core material, re-used transformer coil material etc) offered for inspection and are noticed during the inspection, materials shall be rejected and approval of sub- vendor shall also be cancelled for all RDSS projects.
- c) In case, a material fails the pre-dispatch inspection as per GCC Clause 23, and also fails the subsequent repeat inspection of the rectified/replaced material, the complete lot of material under inspection will be required to be replaced by the manufacturer/supplier. If in subsequent inspection of the new lot, the material again fails the inspection, then materials shall be rejected, and approval of vendor/sub-vendor shall also be cancelled for all RDSS projects. In such scenario any subsequent delay in contract performance due to failure of materials in the test laboratory would be on account of Contractor and no time extension would be provided by the Employer in this regard. Any LD levies in this regard would be borne by the Contractor.
- d) Apart from the above, in case of default by vendors/manufacturers, Contractor shall also be penalized based on the no. of materials/lots get rejected as per below table:

	<b>No. of Material/lot rejected in a project/district</b>	<b>% Penalty imposed on contract price</b>
1	>5	5.0%
2	>3	2.5%
3	>1	1.0%

##### **4.4.2 In case of defects found during Field inspection:** There are three categories of defects found in

field inspection as defined below:

- a) **CRITICAL DEFECTS:** These defects must be rectified before charging. Critical defects are those which endanger life and property. Dangerous deficiencies on safety, ground clearances, equipment earthing and protection would come this category. These are defects in presence of which the Electrical Inspector would not allow charging of the electrical installation. That is, if equipment are already energized, it should be de-energized and rectified without delay. If critical equipment like distribution transformer HT and LT line have been installed dangerously, the defect type would fall under critical category of defect. Example : LA is not connected , DT neutral earth is missing , Earth electrodes not installed, Ground clearance not as per IE rule, Oil level low in transformer etc.
- b) **MAJOR DEFECTS:** These defects must be rectified before operational handover (to Operation and Maintenance wing). These are major deviations from drawing and specification. These are serious deviation with respect to contract. The electrical installation can be charged temporarily. However, the defects should preferably be rectified before charging. Example : Pole not pitched at proper depth, Brick-bats/foundation inadequate, use of undersized earth wire, precariously loose electrical connections and mechanical fitting.,
- c) **MINOR DEFECTS:** These defects are very minor in nature. Such defects in electrical installations keep surfacing during operation and maintenance. The installation may be charged with these defects. However they must be rectified Example: Danger board not proper, energy meter not installed before contractual handover (before final payment is released and contract is closed), missing barbed *wire*, *stay wire loose*, *loose fasteners*, *vegetation too close to HT/Lt line*.

Note:

- 1) These defects are broad in nature. Actual field defects need to be defined more accurately by inspectors.
- 2) All pictures depicting defects should be numbered. Their number mentioned in the report shown in the table
- 3) An infrastructure schematic (single line diagram) showing DTRs, HT and LT poles duly numbered by the inspector shall be submitted along with the report. Their number shall be used to describe location of defects to be rectified subsequently.

The corresponding penalties to be imposed has been captured below:

Sr. No.	Defect criteria	% Penalty imposed of contract cost
1	Critical Defects	1.0%
2	Major Defects	0.5%
3	Minor Defects	0% if rectified within 30 days

## 4.5 Annexure-A

### I. Checklist for Quality Assurance of 11KV Line

S. No	Description	Status (Yes/No)	Observations	Location	Picture No.
1	Availability of approved survey report with single line diagram				
2	Correct alignment of 11 kV line				
3	Type of poles used as per scope of the work				
4	Type of foundation used as per scope of work				
5	Record whether line is passing through water logging area and its foundation is grouted in cement concrete				
6	Proper verticality of poles				
7	Conductors are passing through the top groove of the insulator ( creepage distance compromised)				
8	More than one joint in one span				
9	Any deflecting tension on 11 KV pin insulator				
10	Proper tensioning of overhead conductor				
11	Any knot/wrapping of overhead conductor is there during erection				
12	Proper binding of insulators is done				
13	Stay plates are properly grouted in cement concrete mixture				
14	Proper tensioning is there on stay set				
15	Proper alignment of Stay wire with overhead conductor is there to nullify tension				
16	Guy insulator(2 nos), anchor plate/ thimble/ hardware are provided with stay set				
17	Proper erection of stay clamp using 12 mm dia nuts and bolts and 50x6 mm (or more) size Clamp				
18	If every 6th pole in a section of line is provided with stay sets to avoid line deflection				
19	Proper galvanization of stay wire and stay set				
20	Thimble is provided on turn buckle of stay set				
21	Proper phase to phase clearances are maintained on the line				
22	Steel overhead structure is properly earthed using 8 SWG wire				

S. No	Description	Status (Yes/No)	Observations	Location	Picture No.
23	Each 11 kV pole individually earthed using 8 SWG Earth wire and separate Earth pit/Earthing Coil.				
24	Quality and size of danger plates is as per scope of work				
25	Danger plate is installed at appropriate height using proper clamp as per scope of work				
26	Anti-climbing device (barbed wire/spike) are installed at appropriate height on individual Support				
27	Individual pole is numbered				
28	Individual pole is imposed/painted with the name of scheme				
29	Surface of the PCC poles is finished and there are no steel wire visible				
30	No physical damages appeared on PCC pole Surface				
31	Cradle guard earthing is provided on each road crossing or on each LT line crossing				
32	Proper tensioning of the cradle guard wires				
33	Proper Guard wires are provided in case of Road crossing as per drawing specification				
34	8 SWG G.I. wire is properly dressed with support for V-Cross arm/Channel/Top clamp earthing				
35	GI wire to GI wire jointing is done properly crimping with ferrules.				
36	GI wire connection to earth pit is using 12 mm GI nut bolt and washer				
37	Earth pipe is properly inserted inside earth without pipe hammering				
38	RCC slabs is provided over individual pipe earth pits				
39	Proper jumpering using binding practices/PG Clamp				
40	If under sized conductor used				
41	Proper conductor clearances to ground is there to avoid bird fault on end sectionizer support where disc insulator are used				

<b>S. No</b>	<b>Description</b>	<b>Status (Yes/No)</b>	<b>Observations</b>	<b>Location</b>	<b>Picture No.</b>
42	Proper pole to pole span length in the line. I should not be less than 40 m.				
43	If Pole to pole span is less than 40 m, record the reason with pole numbers				
44	Number of poles used per kilometer of the line				
45	Record type and size of overhead conductors used in the line				
46	Shuttering is used during casting of cement concrete foundation				
47	Cement-concrete grouting foundation of end Supports				
48	Measure quantum of cement concreting in any one sample support				
49	Measure cement concreting foundation in any one sample of stay set pit				
50	Proper galvanizing is done on steel structure				
51	Disc Insulators are installed precariously ( loose bolts/ missing cotter pins)				
52	D -shaped loop for jumpers are maintained				
53	Any broken insulator found in the line				
54	Surface finish and painting on Steel tubular pole/RSJ/H Pole/Rail pole				
55	Adequate tree cutting on either side of line done				
56	Pole to pole schedule enclosed with proforma				
57	Pole numbering with "RDSS " inscription no done ( properly)				
58	Engraving of poles (Name of Manufacturer, SL Nos etc.) not done				
59	Guy insulator not used in stay wire				
60	Inadequate length of barbed wire				

## II. Checklist for Quality Assurance of LT Line

S. No	Description	Status (Yes/No)	Observations	Location	Picture No.
1	Availability of approved survey report with Single line diagram				
2	Correct alignment of LT line				
3	Type of poles used as per scope of the work				
4	Type of foundation used as per scope of Work(water logged area) PCC 1:3:6				
5	If line is passing through water logging area and its foundation is grouted in cement Concrete				
6	Proper verticality of poles				
7	Any deflecting tension on LT pin insulator				
8	Proper tensioning of overhead conductor/LT cable/ABC Cable				
9	Any knot/wrapping of overhead conductor /LT cable /ABC Cable is there during erection				
10	Proper binding of insulators cable both / tension work is done				
11	Stay plates are properly grouted in cement concrete mixture				
12	Proper tensioning is there on stay set				
13	Proper alignment of Stay wire and stay set with overhead conductor is there to nullify tension				
14	Proper erection of stay clamp using 12 mm dia nuts and bolts and 50x6 mm (or more) size clamp				
15	If every 6th pole in a section of line is provided with stay sets to avoid line Deflection				
16	Proper galvanization of stay wire/stay set				
17	Thimble is provided on turn buckle of stay Set				
18	Proper phase to phase clearances are maintained on the line				
19	Steel overhead structure is properly earthed using 8 SWG wire				
20	Quality and size of danger plates is as per scope of work				

S. No	Description	Status (Yes/No)	Observations	Location	Picture No.
21	Danger plate is installed at appropriate height using proper clamp as per scope of Work				
22	Anti-climbing device (barbed wire/spike) are installed at appropriate height on individual support				
23	Individual pole is numbered				
24	Individual pole is imposed/painted with the name of scheme				
25	Surface of the PSC poles is finished and there are no steel wire visible				
26	No physical damages appeared on PSC pole Surface				
27	Cradle guard earthing is provided on each road crossing or on each LT line crossing				
28	Proper tensioning of the cradle guard wires				
29	Separate earthing on both the sides of road/line for cradle guarding are there				
30	8 SWG G.I. wire is properly dressed with support for V-Cross arm/Channel/Top clamp earthing				
31	GI wire to GI wire jointing is provided using Ferrules by crimping.				
32	GI wire connection to earth pit is using 12 mm GI nut bolt and washer				
33	Earth pipe is properly inserted inside earth without pipe hammering				
34	RCC Slab is provided over individual pipe earth pits				
35	Jumpering using best binding practices/PG Clamp				
36	Proper conductor clearances to ground is there to avoid bird fault on end sectionizer support where disc insulator are used				
37	Average pole to pole span length in the line. It should not be less than 40 m.( in case of ABC 20 m)				
38	If Pole to pole span is less than 40 m, record the reason with pole numbers				
39	Number of poles used per kilometer of the Line				

S. No	Description	Status (Yes/No)	Observations	Location	Picture No.
40	Type and size of overhead conductors/ABC cable used in the line				
41	Shuttering is used during casting of cement concrete foundation				
42	Cement-concrete grouting foundation of end supports				
43	Quantum of cement concreting in any one sample support				
44	Cement concreting foundation in any one sample of stay set pit				
45	Galvanizing properly is done on steel structure				
46	Any broken insulator found in the line				
47	Possible damage on ABC cable surface				
48	Piercing connections are used to take-off connection from ABC cable				
49	Muffing is used in A poles.				
50	Adequate tree cutting on either side of line Done				
51	Pole to pole schedule enclosed with Proforma				

## 5 TYPE AND ACCEPTANCE TEST

The following type, acceptance and routine tests and tests during manufacture shall be carried-out on the material. For the purpose of this clause:

- 5.1. Contractor shall supply the materials of type & design which has already been Type Tested. Contractor shall provide copy of such tests at site in support of type-tested materials supplied under the contract. No extra payment or time shall be granted for type testing of materials. In exceptional case to case basis, employer will decide to permit type testing of material at Contractor's cost.
- 5.2. Acceptance Tests shall mean those tests which are to be carried out on samples taken from each lot offered for pre-dispatch inspection, for the purposes of acceptance of that lot.
- 5.3. Routine Tests shall mean those tests, which are to be carried out on the material/equipment to check requirements which are likely to vary during production.
- 5.4. Tests during Manufacture shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the Contractor to ensure the desired quality of the end product to be supplied by him.

- 5.5. The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Contractor and the Employer.
- 5.6. The standards and norms to which these tests will be carried out are listed against them. Where a particular test is a specific requirement of this Specification, the norms and procedure of the tests shall be as per IS/IEC Standard this specification or as mutually agreed to between the Contractor and the Employer in the Quality Assurance Programme.
- 5.7. For all type test and acceptance tests, the acceptance values shall be the values specified in this Specification, Approved Quality Plan or guaranteed by the Bidder, as applicable.

## **6 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE**

- a. All equipment being supplied shall conform to type tests including additional type tests, if any as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections. The Contractor shall intimate the Employer the detailed program about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.
- b. The reports for all type tests and additional type tests as per technical specification shall be furnished by the Contractor along with equipment/material drawings. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO/IEC Guide 25/17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by the representative(s) of Employer or Utility. The test-reports submitted shall be of the tests conducted within last 5 (five) years prior to the date of bid opening. In case the test reports are of the test conducted earlier than 5 (five) years prior to the date of bid opening, the Contractor shall repeat these test(s) at no extra cost to the Employer, however the delay in supply due to type-test will not be acceptable during the project.
- c. In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all additional type tests not carried out, same shall be carried out without any additional cost implication to the Employer.
- d. The Employer, his duly authorized representative and/or outside inspection agency acting on behalf of the Employer shall have at all reasonable times free access to the Contractor's/sub-vendors premises or Works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Contractor shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Employer and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

- e. The Contractor shall give the Employer/Inspector ten (10) days written notice of any material being ready for joint testing including Contractor and Employer. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Employer/Inspector, unless witnessing of the tests is virtually waived, will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test /inspection, failing which the Contractor may proceed alone with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of tests in triplicate.
- f. The Employer or Inspector shall, within seven (07) days from the date of inspection as defined herein give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Employer/Inspector giving reasons therein, that no modifications are necessary to comply with the Contract. If any modification is made on the equipment on the basis of test results not in conformity with the contract, the modified equipment shall be subject to same sequence of test again without any additional cost to Employer.
- g. When the factory tests have been completed at the Contractor's or Sub-Contractor's works, the Employer/Inspector shall issue a certificate to this effect within seven (07) days after completion of tests but if the tests are not witnessed by the Employer/Inspector, the certificate shall be issued within seven (07) days of receipt of the Contractor's Test certificate by the Engineer/Inspector. Failure of the Employer/Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Employer to accept the equipment should, it, on further tests after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of dispatch instruction by the Employer.
- h. In all cases where the Contract provides for tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, transport, loading & unloading, packing, apparatus and instruments as may be reasonably demanded by the Employer/Inspector or his authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Employer/Inspector or to his authorized representative to accomplish testing.
- i. The inspection by Employer and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.
- j. The Employer will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.
- k. The Employer reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests

shall be provided by the Employer.

## 7 PRE-COMMISSIONING TESTS

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests shall be provided by the Employer as per its standard practices. or as included in the Contractor's quality assurance programme.

## 8 COMMISSIONING TESTS

All required instrumentation and control equipment will be used during such tests and the Contractor will use all such measuring equipment and devices duly calibrated as far as practicable. However, the Contractor, for the requirement of these tests, shall take immeasurable parameters into account in a reasonable manner. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The Contractor will apply proper corrections in calculation, to take into account conditions, which do not correspond to the specified conditions.

- a) Any special equipment, tools and tackles required for the successful completion of the Commissioning tests shall be provided by the Contractor, free of cost.
- b) The specific tests to be conducted on equipment have been brought out in the respective chapters of the technical specification. However where the pre-commissioning tests have not been specified specifically they shall be as per relevant IS code of practice or as mutually agreed.
- c) The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning and operation of the equipment including the Electrical Inspector. Necessary fee to perform these works shall be paid by Employer.

## 9 GIS MAPPING & ASSET TAGGING

### a. General Information

The State owned power distribution utilities have implemented GIS based asset tagging activities in the past and migrated asset information into GIS platform. Bidder should update various attributes of new / upgraded infrastructure created under RDSS over the same platform. Various electrical assets

i.e Power Transformers, Distribution Transformer, HT & LT lines with overhead conductor, poles, insulators, stay wire etc and Underground distribution system consists of Feeder pillar, UG cable etc; automation devices like RMU's FPI, Auto-reclosures etc needs to be updated in the existing GIS platform. The GIS platform and the associated mobile-app will be provided by the Employer.

**“The scope of the bidder included to updating the GIS co-ordinates and the associated mapping information of the new assets created/upgraded and the existing network already created under COPA on the platform provided by the Employer using the mobile app. All the above features shall be installed by the successful bidder at his own expenses and accordingly the bidder shall quote. The mapping shall also include Feeder metering in NPP Portal & DAMS portal.”**

## **b. Key activities under the scope:**

- a) After successful award of the contract and finalization of Bill of Quantity (BoQ), the TKC should collect list of attributes (Data Model) for each of the assets purposed under the scheme from the project nodal / GIS incharge of the Utility.
- b) The purposed methodology for delivery of these attributes as well as GPS coordinates of the assets up to the defined accuracy level to be decided mutually so that updating the same in existing GIS platform would not be a challenges at the later stage. A point of contact (PoC) is recommended at this stage to avoid any future complicity.
- c) The vendor should create a physical marking procedure with consultation and approval of Employer and mark each assets and consumer that have been surveyed
- d) Vendor will start collecting intended data from newly commissioned and / or upgraded infrastructure commissioned in RDSS and submit the same with the Employer nodal / team for approval.
- e) The Employer's project in charge would get these data verified through their team, once completed they will get duly verified by Executive Engineer and circle SE and shall submit same to IT office for further review.
- f) It is to be noted that updating of GIS asset information is mandatory requirement for the issuance of completion certificate by the employer.

## **10 DOCUMENTATION**

### **10.1 General**

- 10.1.1 To ensure that the proposed systems conform to the specific provisions and general intent of the Specification, the Contractor shall submit documentation describing the systems to employer for review and approval. The Contractor shall obtain approval of employer for the relevant document at each stage before proceeding for manufacturing, system development, factory testing, site testing, training etc. The schedule for submission/approval of each document shall be finalised during the discussions before placement of the contract, this schedule shall be in line to overall project schedule.
- 10.1.2 Each document shall be identified by a Contractor document number, the employer document number, and the employer purchase order number. Where a document is revised for any reason, each revision shall be indicated by a number, date, and description in a revision block along with an indication of official approval by the Contractor's project manager. Each revision of a document shall highlight all changes made since the previous revision.
- 10.1.3 All technical description, specifications, literature, correspondence, prints, drawings, instruction manuals, test reports( both factory and at site), progress photographs, booklets, schedules and all supplementary data or documents furnished in compliance with the requirements of the Contract, shall become the property of the Employer and the costs shall be considered as included in the Contract price.
- 10.1.4 The Contractor shall be responsible for any time delay, misinterpretation, error and conflict during design, manufacturing, testing and erection of the Works resulting from non-compliance with the requirements of this Specification.

10.1.5 The Employer shall have the right to make copies of any documents, data, reports, information etc. supplied by the Contractor in connection with the Works. The Employer shall not impart the information of these documents to any other manufacturer or competitor but he shall be free to use these for preparation of technical papers, reports etc.

10.1.6 All documentation shall be in English language.

## **10.2 Requirements for submission of documents, information and data by the Contractor**

10.2.1 The Contractor shall submit to the Employer all documents in accordance with an approved schedule of submissions and shall submit any further information (in the form of drawings, documents, manuals, literature, reports etc.) when asked by the Employer while commenting/approving any drawings/documents etc.

10.2.2 The documents which are subject to the approval of the Employer shall be identified by the Contractor with the stamp "FOR APPROVAL". All other documents shall be submitted to the Employer for information and shall be identified by the Contractor with the stamp "FOR INFORMATION".

10.2.3 The sequence of submission of the documents shall be subject to the approval of the Employer. The sequence of submissions of all documents shall be such that the necessary information is available to enable the Employer to approve or comment the document.

10.2.4 The Contractor shall supply 4 hard copies of all drawings and documents.

10.2.5 In case a "SUBSEQUENT" revision of any document is made due to any reason whatsoever, a revision of the same, highlighting the changes shall be resubmitted for the Employer's specific approval/ information.

## **10.3 Documents for approval**

10.3.1 The Employer shall be allowed fifteen (15) calendar days to approve the Contractor's submissions. The submissions for approval, shall be returned to the Contractor marked in one of the following ways :

Category I:	Approved
Category II:	Approved with Comments.
Category III:	Returned for correction.
Category IV :	For information

10.3.2 The first notations "I" or "II" shall be deemed to permit the Contractor to proceed with the work shown on the document, except in the case of notation "III" the work shall be done subject to the corrections indicated thereon and/or described in the letter of

transmittal. The Contractor shall bear the full responsibility for proceeding with the Works prior to receipt of the release in notation "I" from the Employer.

- 10.3.3 In case of notation "II", the Contractor shall include the alterations required & resubmit the document within fifteen (15) days from date of Employer's letter of transmittal.
- 10.3.4 In case of notation "III", the Contractor shall include the alterations required and resubmit the document to the Employer, within fifteen (15) days, from date of letter of transmittal, so that such document can be returned with the notation "I" or "II".
- 10.3.5 It may also be noted that the approval/commenting by the Employer does not relieve the Contractor of any of his contractual obligations and his responsibilities for correctness of dimensions, materials, weights quantities or any other information contained therein, as well as the conformity of designs with Indian Statutory Laws and the Technical Specifications as may be applicable. The approval also does not limit the Employer's rights under the Contract.
- 10.3.6 The approved documents shall be considered as the working documents. However the Technical Specification and connected documents shall prevail over these documents in case a decision is required on interpretation.

#### **10.4 Documents for information**

The Contractor shall not delay the Works pending the receipt by the Contractor of the comments on documents submitted to the Employer for information. However, the Employer shall have the right to comment on all the documents submitted by the Contractor, when, in the opinion of the Employer the document does not comply with the Contract or otherwise. The Contractor shall satisfactorily demonstrate that the information contained in the aforesaid document does meet the requirements of the Contract or revise the document in order that the information shall comply with the requirements of the Contract.

#### **10.5 Basic reference drawings**

- 10.5.1 The reference drawings are enclosed with the bid document, which forms a part of the specification. The Contractor shall develop a new layout in line with the specification and take the approval of the EMPLOYER. The Contractor shall maintain the overall dimensions of the substation, buildings, bay length, bay width, phase to earth clearance, phase to phase clearance and sectional clearances, clearances between buses, bus heights but may alter the locations of equipment to obtain the statutory electrical clearances as required for the substation.
- 10.5.2 All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.
- 10.5.3 Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items

shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

- 10.5.4 Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer, if so required.
- 10.5.5 The review of these data by the Employer will cover only general conformance of the data to the specifications and documents interfaces with the equipment provided under the specifications. This review by the Employer may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Employer shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.
- 10.5.6 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the Contractor of any of his responsibilities and liabilities under the Contract.
- 10.5.7 All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

## **11 RETURN OF REPLACED OLD MATERIALS TO THE AREA STORES OF EMPLOYER**

- a) Old PVC wire will be rolled into bundles. The bundles should be tightened firmly and properly with PVC sticker strip or string. A tag should be attached with each bundle to indicate the weight of the bundle. As far as possible, bundle should consist of wire of the same size and same metal. Similar action is required to be taken in case of GI wire.
- b) Old conductor of same size shall be rolled into bundles. Bundles should be tightened firmly and PVC sticker strip or string regarding size of conductor shall be mentioned. Size, type & Weight of each bundle shall also be indicated on the sticker strip.
- c) Materials released due to bay capacity augmentation and/or due to replacement like power transformers, distribution transformers, insulator, meter board, cut outs etc are also required to be returned to Employer's stores through proper documentation.
- d) All other line materials released like, conductors, poles, cross arms; fabricated

material, etc. shall be properly accounted for and returned to Employers store after recording all necessary details including weight, length etc. wherever necessary. A detailed procedure for return of the old materials shall be prescribed by Project Management Agency.

- e) In respect of accountable of devolution of released material, the process as formulated by Employer time to time shall be followed by the Contractor

## **12 MISCELLANEOUS ACTIVITIES**

- Commencement of Supply & Works: The Contractor shall ensure that the supply and installation of material and service under the contract is as per approved PERT / completion schedule of works. The Contractor is to commence supply with the type tested materials with necessary routine test/ acceptance test certificates for a particular lot duly approved by EMPLOYER or the EMPLOYER's authorized agencies.
- The Contractor shall submit Type test and routine test certificates as applicable, issued by NABL accredited / third party independent standard laboratories like CPRI, NPL etc.
- Unit rates: The unit rates quoted shall include details which are obviously and fairly intended, and which may not have been included in these documents but are essential for the satisfactory completion of work. The unit rate quoted shall be inclusive of deployment of all plants, equipments, men, materials, skilled & unskilled labour etc. essential for satisfactory completion of work.
- The prices for fabricated materials shall include all works relating to fabrication, galvanizing, insurance, storage and delivery ex-Contractors stores, unloading and loading. The quoted prices shall also include the cost of necessary quantity of steel and zinc, freight charges up to site store and other indirect charges incurred in connection with supply of finished materials.
- Quantities/ length of 11 KV line and LT line, distribution transformers stations, etc. indicated in the price schedules are provisional. Any quantity variation in individual item and in contract value shall be governed as per GCC clause 39. The Contractor shall execute the work based on the actual survey and as approved by the Engineer-in-charge or person authorized by him.
- The scope of work also covers supply of other items, not specifically mentioned in this specification and/or bill of materials but are required for the successful installation, testing, commissioning and satisfactory performance of the 11 KV lines, distribution transformer stations, LT lines, service lines etc.

### **The following works & services shall also be provided by the Contractor.**

- a) Unloading the equipments from the rail or road transport and moving those to storage area. Demurrage/ wharf age charge, if any incurred, shall be paid by the Contractor
- b) Opening of packing cases, inspection and checking of materials for any damage or loss in transit shall be the responsibility of the Contractor. All claims with the concerned authorities e.g. rail, transport, insurance etc. shall be lodged by the Contractor.

- c) Complete erection of equipment's, etc covered under the contract, final preparation for testing, commissioning, final run and acceptance tests and putting the sub-station/ plant/line etc. into operation.
- d) All consumable, stores required for the above erection and commissioning works.
- e) All erection tools, lifting tackles, and all equipments, tools & tackles for transportation at site.
- f) Workshop, as required within the work area.
- g) Third party insurance <sup>[1]</sup> at site and insurance of personnel employed at site as required under Workman's Compensation Act. Security arrangement for watch and guard as required shall be made by Bidder at his own cost.
- h) All the technical/ skilled staff deployed for the job must possess the required qualifications and necessary licenses and permits.
- i) Contractor shall take all safety precautions during work and the workmen must use safety belts, hand gloves, masks and other safety devices as may be necessary for safety of the personnel.
- j) The Contractor shall provide operating personnel during trial tests and till the PSS, DSS, lines and equipments etc. are taken over by EMPLOYER as specified in taking over Clause, defined later.
- k) Any other work not covered above but required for successful completion of the project has to be carried out by the Contractor at his own cost.

<sup>[1]</sup> **Note:** Before receipt of equipment at site but without limiting his obligations and responsibilities under this clause hereof, the Contractor shall insure against his liability for any equipment, material or physical damage, loss or injury which may occur to any property, including that of EMPLOYER and project management agency, or to any person including employee of the EMPLOYER, by or arising out of the execution of the contract or in the carrying out of contract. The third party insurance cover shall be provided for the period from date of Ex-factory dispatch till taking over of the entire equipment after testing, commissioning and trial operation, if any.

Third party insurance shall be affected for an adequate amount to cover for all marine, transportation, field transportation, erection, testing and commissioning till handing over to Employer,. Terms shall include a provision whereby, in the event of any claim being brought or made against EMPLOYER in respect of which the Contractor would be entitled to receive indemnity under the policy, the insurer will indemnify EMPLOYER and project management agency against such claims and any costs, charges and expenses in respect hereof. Contractor shall lodge the claim if need so arise, the employer shall be the Employer of the equipment/materials and the claims shall be settled in the name of Employer.

## 12. WORKS

### 13. HT Reconductoring works using Bare OH

#### 1.00 Survey

Mapping of route of proposed new 11 kV line by foot survey (GPS) 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) on political map with fair correctness, be prepared. SLD and foot survey report shall be approved by Project Manager 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 Project Manager. This details shall be used as reference documents by Quality Inspecting officials to execute inspection works.

#### **Conductor used : ACSR Raccoon as per specification**

#### 2.00 Support (pole):

Following types of support are envisaged for 11 KV overhead line:

- a) 9 m/200 kgs PSC Poles - (PSC Pole as per state practice)
- b) 11 Vertical member ISA 90x90x8mm;O/o spacing 90mm at top & 350mm at bottom; Horizontal ties ISA 50x50x6mm; bottom support horizontal ties - 500 mm.
- c) 12 Vertical member ISA 90x90x8mm;O/o spacing 90mm at top & 350mm at bottom; Horizontal ties ISA 65x65x6mm; bottom support horizontal ties - 500 mm.
- d) 13 m long A pole Vertical member ISA 90x90x8mm Normal size; Horizontal ties ISA 65x65x6mm; bottom support horizontal ties - 580 mm
- e) 14 m long A pole Vertical member ISA 100x100x8mm -- diagonal tie 50x50x8mm; Horizontal ties ISA 65x65x6mm; bottom support horizontal ties - 580 mm

#### 3.00 Fabricated steel items:

Fabricated steel items like **A-pole**, V cross arm, top clamp, DC cross arm, bracket, clamps, cross bracings, bracings, strain plate, shall be made of MS Channels, MS angle, MS flats as per approved drawings.

While fabricating, good quality electrical cutting tools and drill machine shall be used to ensure no sharp edges and perfect holes as per approved drawings. Gas cutting set should not be used for fabrication of MS steel items. Weld material shall be distributed equally between the two materials that were joined. The weld shall be free of waste materials such as slag. The weld

surface should not have any irregularities or any porous holes (called porosity). The joint shall be tight. Most welds need to demonstrate the required strength. One way to ensure proper strength is to start with a filler metal and electrode rating that is higher than your strength requirement.

The fabricated steel structures materials shall be hot-dip galvanized thoroughly internally and externally according to IS: 2629 and IS: 2633 (with latest amendments). Galvanizing shall be checked and tested in accordance with IS: 2633.

Fabricated steel structure items shall be galvanized both inside and out. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the smelter bath that could have a detrimental effect on the durability of the zinc coating. Before pickling, all welding, drilling, cutting and grinding shall be completed and all grease, paint, varnish, oil and welding slag shall be completely removed.

All protuberances which could affect the life of galvanizing shall also be removed. To avoid the formation of white rust all galvanized material shall be packaged in such a way to ensure adequate ventilation between parts during shipping and storage.

Testing of galvanizing shall be performed for Uniformity of thickness as per IS 2633/1986, Mass of coating as per IS 6745/1972 and quantity of zinc, water quenching & centrifuging as per IS 2629/1985.

#### 4.00 Hardware:

MS Nuts, bolts and washers (Galvanized) – of appropriate sizes shall be used for tying of overhead structure items like cross arms, top clamps, brackets, clamps, bracing, strain plates etc.

While erecting, proper dimensions of nut-bolts and washers must be ensured. 2 to 3 threads only be visible of the bolt after full tightening of nut on requisite torque. The hardware shall be hot dip galvanized. The minimum coating of the zinc shall comply with IS: 2629 and IS: 2633. Galvanizing shall be checked and tested in accordance with IS: 2633. Before shifting them to site for erection, they shall be offered for inspection and approval by Project Manager.

#### 5.00 Stay Set:

Stay set shall include the following items

GI Stay Set includes

1. Stay Insulator Porcelain 11k V - 2 Nos
2. Anchor Plate 200 x 200 x 8 mm GI (HT Stay Plate GI)
3. STAY TIGHTNER HT
4. Stay Wire 7/8 (7/3.15mm) GI (HT Stay Wire)

5. Stay Rod (Anchor Rod) GI 20 mm dia (HT Stay Rod)
6. Helically formed Guy-Grip HT
7. Thimble GI 75 mm x 22 mm x 40 mm ,1.5 mm Thickness (For HT and LT)
8. Stay clamp (GI ) etc as required as per technical specification, approved drawings and scope of work.

Stay set shall be used at all turning locations, conductor dead end supports, double pole structure, triple pole structure, four pole structure to nullify the tension of conductor. Erection of storm guys at suitable location in straight line may also be provided.

0.2 cmt (dimension 0.5mx0.5mx0.8m) cement concreting in mixture 1 part cement, 3 part coarse sand, 6 part 40mm size aggregate stone chips (1:3:6).

#### 6.00 Earthing:

Following earthing arrangements are envisaged for new 11 kV lines:

- a) 40 mm dia., 2500 mm long GI pipe earth electrode with test link, RCC pit, RCC cover plate , bentonite powder and other accessories complete

In rocky soil where getting required earth resistance is a challenge, chemical rod earthing shall be used. Overhead line structure shall be connected to chemical earth electrode using 8SWG GI wire.

GI flats and GI wires must be properly dressed, bundled and fixed on supporting structure at 1 to 2 feet intervals.

#### 7.00 Insulator and hardware –

11 KV polymer Disc/Pin insulator with suitable hardware fittings shall be used. Insulator should be tied properly using helical form fitting.

The individual insulator shall be checked for insulation resistance before overhead line installation. Insulator should properly be cleaned before installation. No damage/crack insulator should be used.

#### 8.00 11 KV AB Switch:

11 kV, 3-ph, 400 A, 3 Pin type, Vertical/Horizontal Mounting type, Gang Operated, AB Switch shall be installed at cut points and at suitable locations as per instructions of Project Manager. B Class GI pipe shall be used (without any joints) for operation of switch. AB Switch structure and handle must be earthed using 8 SWG GI wire.

1. AB Switch to be installed on DP only
2. Provide a channel at about 90 cm below AB switch for facilitating maintenance.

3. Phase to phase clearance minimum 76 cm.
4. Handle earth using flexible braided copper belt.
5. 2 nos pipe earths
6. Handle may be faced away from road.
7. Handle 1-1.2 meter above ground level. Operating pipe is to be extended by welding to the required length especially when A type poles are used.

#### 9.00 Pole numbering:

Each support pole shall be numbered properly labelled using yellow base and black indication marks (number or digits). 40/50 mm height digits/words should be used for this purpose. Base shall be made using 2 or more coats of yellow enamel paint till good surface finish. Base preparation shall be completed before shifting of poles to site for erection. Base painting and marking of digits should be performed by a skilled and trained painter using branded enamel paint, Project Manager shall approve type and brand of enamel paint. Warning instruction, if any, of availability of two sources of 33/11 kV supply on same structure, at source structure, at cut points should exclusively be provided as per state practice.

#### 10.00 Anti-climbing device only in step poles:

3.5 kgs, 2.5mm dia (12 SWG) galvanized barbed wire shall be used on each 11 kV **step pole**. Galvanized barbed wire should be properly dressed and crimped at termination. While wrapping the wire on support, proper tension should be maintained.

#### 11.00 Danger board only in step poles:

Each step poles shall be provided with a danger board with pole clamps as per approved drawing. Danger board should be in bi-lingual languages (local language and English). Clamp for danger board, nut-bolts and washers shall be painted with two or more coats of red-oxide and aluminum paints respectively till smooth surface before installation.

#### 12.00 Support foundation:

All Double pole (DP), cut point poles, Distribution Transformer substation poles and poles erected on water logging area shall be grouted using cement concrete mixture. Prior approval of Project Manager shall be obtained for concreting of PSC poles in water logging area. While preparing route survey report, water logging areas shall be earmarked.

While erecting supports (poles) in water logged area shuttering must be used for concreting so that proper quantity of cement concrete mixture be used and assessed during inspection. During concreting proper compaction by means of mobile vibrator be provided. While starting work of support erection, gang wise shuttering and mobile vibrator shall be offered for inspection to Project Manager. While erecting support, mercury level gauge must be used to ensure vertical erection of support.

13.00 Quality & Quantity inspection and compliance to the observation:

The line works, before or after commissioning/energization, shall be inspected by Quality Inspectors and State Inspection Inspectorate. Contractor shall provide all requisite details of line like approved survey report, as built drawings and joint measurement sheet to the inspector to conduct. Contractor shall rectify defects/deficiencies and submit compliance to the observations with supporting photographs in digital form within one month from receipt of observations.

14.00 Tree-cutting/trimming of tree:

The Contractor shall count, mark and put proper numbers with suitable quality of paint at his own cost on all the trees that are to be cut/trim to obtain required tree clearance. Contractor shall pay compensation for any loss or damage for tree cutting due to Contractor's work. Wherever forest clearance is envisaged for execution of work, clearance of forest department for tree cutting, if required, shall be arranged by the Project Manager and compensation shall also be paid by the Project Manager. Necessary fee if required to pay to Govt. dept. for arranging such clearances shall be paid by Project Manager. However, the Contractor would require to provide all necessary assistance for execution of this work. Treeming/Touching clearance is in the scope of Turnkey Contractor only

15.00 Statutory clearances:

During execution of 11 KV Line work, all statutory clearances shall be ensured for ground clearance, line-to-line clearance, road crossing clearance, horizontal and vertical clearances from buildings/objects etc. All road crossings and line crossings shall be guarded as per specifications. Conductor joint should not be provided in mid span length. Instead, it should be nearer to the support.

16.00 Following works shall also be executed by Contractor under this head –

16.01 Augmentation of 3 phase 11 kV line using additional supports matching with length and type of existing support is envisaged on following type of supports:

- a) 9 m/200 kgs PSC Poles - (PSC Pole as per state practice)
- b) 11 Vertical member ISA 90x90x8mm;O/o spacing 90mm at top & 350mm at bottom; Horizontal ties ISA 50x50x6mm; bottom support horizontal ties - 500 mm.
- c) 12 Vertical member ISA 90x90x8mm;O/o spacing 90mm at top & 350mm at bottom; Horizontal ties ISA 65x65x6mm; bottom support horizontal ties - 500 mm.
- d) 13 m long A pole Vertical member ISA 90x90x8mm -- Normal size; Horizontal ties ISA

65x65x6mm; bottom support horizontal ties - 580 mm

- e) 14 m long A pole Vertical member ISA 100x100x8mm -- diagonal tie 50x50x8mm; Horizontal ties ISA 65x65x6mm; bottom support horizontal ties - 580 mm

16.02 Augmentation of existing conductor with following type of new ACSR conductor including jointing sleeves, binding materials and helical formed fittings etc as required are envisaged under this work-

- a. 6/4.09 + 1/4.09 mm (80 mm<sup>2</sup> Al. Area) - Raccoon by replacing the existing rabbit/weasel/squirrel conductor

16.03 While executing this work, mid span pole with all fittings may be provided matching with existing poles of the line.

16.03.1 Replacement of damaged insulators

16.03.2 Straightening of tilted supports by providing additional foundation or by providing boulders etc as required.

16.03.3 Revamping of pole earthing and replacement of GI earth wire.

16.03.4 Labelling, providing danger board, providing anti climbing device and painting of all the Step poles shall be in the scope of work

16.03.5 Replacement of damaged/bent V-cross arms & top clamps with new ones

16.03.6 Providing of stay set wherever required

16.03.7 Providing of guarding wherever required

16.03.8 Removal of old conductor in coil form, removal of old steel structure, removal of old conductor fittings, removal of any other worn out/defective material and deposit them in Employer's store within a reasonable time as decided by Project Manager

Item-wise scope of works under renovation/augmentation of 11 kV line is detailed out under scope of new 11 kV line. It shall be utilized on item to item requirement under renovation/augmentation of 11 kV line also.

Following ACSR Conductors are envisaged for new 11 kV lines:

- a) 6/4.09 + 1/4.09 mm (80 mm<sup>2</sup> Al. Area) - Raccoon

Project Manager shall decide size of conductor on proposed 11 KV line.

Care should be taken while drawing conductor from the drum. Proper roller should be used while handling conductors during erection. Jointing sleeves, binding materials, PG clamps, wedge connectors, helically formed Ties for ACSR Raccoon bi- metallic conductor shall be used for conductor jointing, insulators fixing, jumpering and termination at equipment respectively. There must not be uneven sag between conductor/spans.

3% sag shall be considered for stringing. While tensioning, care should be taken to avoid tension

on pin insulator. Therefore, proper alignment of line to be ensured.

At terminal location, care should be taken while connecting two sections to avoid bird faults. Therefore, pin insulator is to be used to handle the conductor on DC cross channel

#### **14. HT Reconductoring works using Covered Conductor**

**Covered Conductor Used :- ACSR 99 sqmm conforming to EN 50397-1:2020**

**1.00** The constructional standards except stringing of conductors shall be as below:-

- Make sure not to damage the conductor when lifting the drums. Make sure the ground is hard and flat before placing the drums standing on their flanges to avoid damaging the conductor.
- Minimum bending radius shall be considered during spooling.
- Typical dimension on rollers shall be 30 x conductor diameter.
- Avoid conductors dragging on the ground during stringing. If dragging can't be avoided, place a smooth material on the ground to avoid scratches on the conductor's surface.
- Keep the tension on the drum to a minimum. This is to avoid the conductor slicing through to lower layers on the drum as this can cause conductor to lock on the drum.
- Minimum ROW to be ensured before stringing the 11 KV Covered Conductor.
- To ensure 11 KV Covered Conductor is taken directly from the drum to the 1-sided pulley to be mounted on the cross arms.
- To ensure mid span joints are insulated properly.
- To ensure tension applied on the conductor to be within limits as specified in the technical particulars.
- Lightning arrestor shall be installed every 1 KM and pipe earthed using GI strip of sizes 25x3mm.
- Helical UV plastic ties as per standard shall be used for binding covered conductor with polymeric Pin Insulators.
- Rollers and pulleys shall be used for stringing the conductors.
- Removal of conductor insulation is not allowed in any caseat cut points and other locations.
- IPCs shall be used for branching.
- Sag shall be considered for stringing - 5%.

**2.00** List of recommended special tools while carrying out works.

1. Nylon Rollers
2. Braided Nylon Rope
3. Chinese Fingers of proper sizes
4. Crimping Tool
5. Heat Gun/Gas Torch
6. Spanner Set
7. Insulation Peeling Tool/ Heavy duty knife.

**3.00** Earthing :

All HT poles (Metallic Parts like V-Cross arm, F-clamp etc) shall be Coil Earthed. **The Lightning Arrester ( station class of rating, 9 KV 10 KA) installed** at every 1 KM shall be Pipe Earthed using 25x 3 MM GI strip.

## **15. HT Reconductoring using HT ABC of sizes.**

11 KV line shall form following areal bunched XLPE cables:

- |      |   |
|------|---|
| 8.01 | Aerial Bunched Cable HT 3x150 + 1x120 sq.mm (Insulated Messenger) as per specification. |
| 8.02 | Aerial Bunched Cable HT 3x120 + 1x95 sq.mm (Insulated Messenger) as per specification.  |

## **1.00 Survey**

Mapping of routes of proposed 11 KV lines shall be done by GPS survey. While surveying, existing electrical infrastructure, existing agriculture private tube well (PTW) locations, capacity and load details shall be mapped during survey.

Upon completion of the survey the Contractor shall provide a survey report with the following information;

- Single line diagram of the route survey and proposed line alignment details mapped and provided in a standard mapping software. This should also include information such as existing electrical infrastructure and PTW information.
- Road and railway crossing points of the proposed 11 kV line shall be marked on the single line diagram.
- Line sections proposed for 11 kV AB (Ariel Bunched) cables due to vegetation, safety and forest clearance issues (if applicable) shall be marked on the single line diagram. Lengths of proposed AB cable line sections shall be indicated.
- On the survey drawings Line to line crossing (HT/LT, LT/LT, HT/HT/Railways Crossing) details to be marked with available clearances.
- Efforts shall be taken to avoid long zig-zag lines and too many line-to-line crossing while surveying and finalizing route maps/SLD.

## **2.00 Statutory Clearances**

All statutory clearances shall be ensured for ground clearance, line-to-line clearance, road crossing clearance, horizontal and vertical clearances from buildings/objects etc. All road crossings and line crossings shall be guarded as per specifications. Conductor joint should not be provided in mid span length. Instead, it should be nearer to the support.

## **3.00 Stringing of conductors / AB cables**

Upon approval from the Project Manager the Contractor shall carry out construction work in full compliance with the technical instructions, specifications and drawings provided in this Volume.

Minimum safety clearances shall be maintained in the 11 kV line. Sag tension charts for installing AB cables shall be developed by the Contractor taking into consideration of cable characteristics, maximum / minimum temperatures and design wind pressure as per service conditions. 10% sag shall be considered for stringing ABC.

Based on this, clear guidelines shall be provided to linesmen to ensure bare neutral messenger (for AB cables) are pulled at appropriate tension so that;

- (a) Required ground clearances are maintained and
- (b) Conductor tension is maintained well below its breaking load at all temperatures.

Dynamometer method or sag method may be used to ensure appropriate tensioning of AB cables during installation. Over tensioning of conductors should be avoided to ensure its tension does not exceed permissible loading limits at low temperatures. Loose spans of conductors should be avoided to maintain permissible maximum sag at high temperatures. Loose spans may only be allowed for short spans in special cases. This applies when there are practical difficulties to install necessary stays or struts as required at a t-off point. A short loose span may be used in this case to transfer the stay / strut support point upstream or downstream of the line.

Stringing of AB cable shall be done using proper equipment as recommended by the manufacturer to avoid any damage to the cable during installation. **Temporary stays, strut poles and other materials shall be employed as necessary during stringing operation to ensure safety of personnel and equipment and after completion of work temporary equipment's/materials used shall be taken back by TKCs. Station class LA s shall be used in every 1 KM and should be Pipe Earthed using GI strip of size 25X 3 mm.**

#### **4.00 Earthing Standards**

##### **Metallic Screen Earthing (Copper screen Earthing)**

To avoid the continuous circulating current, the losses and the issues of external earth fault current passing through the screen, earthing on the metallic screen shall be done only at one point. In single point earthing, the voltage at the unearthed point increases with the length of the metallic screen involved in the stretch wire whereas the fault current gets reduced with increase in length of the screen. Hence copper screen shall be kept discontinuous at the end of every 2 KM and single point earthing (Pipe Earthing) shall be given at farther end from the source. The unearthed point of the screen shall be properly insulated. In case of shorter length of execution, copper screen shall be earthed (single point earthing) at farther end. For screen earthing pre-insulated bi-metallic lugs with copper bolts and nuts shall be used at ABC end and AB cable bits shall be used for connecting to the pipe earth.

All metallic parts excluding cable accessories mounted on HT pole shall be coil earthed.

##### **Messenger Earthing**

The messenger shall be pipe earthed at both ends and at the end of every Drum limited to a maximum interval of 500 m. The messenger shall be continuous even if the metallic screen is kept discontinuous at a joint. At Drum-Drum joints both side insulated messengers shall be brought down and connected to the Pipe Earth. GI wires are not recommended for messenger earthing.

## **16. Disaster Resilient Works: New UG Cable works**

### **1.00 Survey**

The detailed survey shall be carried out for the approved feeders/spur lines by the Contractor and submitted for Employer's approval. The Successful Tenderer shall carry out radar survey of the route using Ground penetrating Radar and determine route profile of any other utility cables, pipes etc along the route. The route survey and drilling profile shall be got approved and finalized by the Engineer-in-Charge prior to commencement of the drilling, HDPE pipe insertion and cable insertion.

### **2.00 Scope**

1. Supply, installation, testing and commissioning of 11kV XLPE UG cables. All the materials, equipment and tools and plant such as sand, cable covering slabs, G.I./ /HDPE pipes, cable route markers, cable joints/termination, etc., required for installation of the UG cable, whether specifically mentioned in these specifications or not, are deemed to be in the scope of works.
2. Detailed surveying of cable route, making trail pits at 50m/100m interval, preparation of drawings and schedules before trenching for approval etc.
3. Earth work excavation in all classes of soil for a depth of 1.2m and adequate width as per site conditions without damaging the existing cable, pipeline and other installations, and spreading the bottom of trench with 10cm sand/ sieved excavated earth (2mm sieve). The UG cable are to be buried to a depth such that the top of the cable is 1m (100cm) below the normal ground level.
4. Providing barricades and observing safety precautions, shoring of pits and dewatering the trench wherever necessary.
5. Handling, uncoiling and paving of 11kV XLPE UG cable in the trench already formed/ permanent cable duct drawing through HDD duct/ Railway crossing pipe already laid, GI/HDPE pipes laid at road crossings, culverts, bridges etc taking to the transformer yard/ RMU side/ cable rising pole, using standard cable laying/ pulling equipment as per IS specifications, after observing all safety precautions and without damaging the existing installations.
6. Supplying straight joint and out door termination kits and carrying out straight joints and outdoor end terminations, providing loop as per standard.
7. Erection of 9m PSC pole for cable connection to OH and providing cut points where ever necessary.
8. Painting route name on the cable neatly and legibly at every 5m interval with polyurethane paint(yellow colour) and suitable additive such as flexible sealer.

9. Identifying existing cables, excavating trenches and jointing newly laid cables with existing cables/ RMUs, wherever required.
10. Supply laying HDPE pipe/ B class GI pipe as per specifications, at road crossings and culverts and at locations where sufficient depth could not be achieved due to other obstructions.
11. Providing station class lightning arrestors in the cable rising DP and giving bolted jumper connections with socket, providing suitable earthing as per specifications.
12. Providing cable route markers at 100m interval and at deviations and straight joint markers as per approved drawings.
13. Testing and commissioning and submission of final as fitted cable route drawings.

### **3.00 General condition for Laying Cable.**

- i. The quoted rates should be inclusive of taking trial pit, deviating the route if there is any obstructions, any other extra work like cutting the roots of tree, shifting the other utility cable etc.
- ii. Where ever any damages caused to other utilities like pipe/ cable shall be repaired by the contractor.
- iii. The contractor is liable to rectify the defects caused other utility before handing over the cable.
- iv. The cable trench should be excavated in such a manner that there is minimum obstruction to the public.
- v. Necessary supports, protection, clamping materials etc are also considered for laying of the cables at bridges/ culverts.
- vi. All the cables are to be supported at the terminations. The rates are inclusive cost of supports.
- vii. The depth of the cable shall be 1M from the ground level (From the top of the cable).
- viii. The depth for road crossing locations shall be 1M (From the top of the cable)
- ix. Minimum width of the trench shall be 0.35m.
- x. If more than one cable is to be laid through a single trench the width of the trench should be made accordingly.
- xi. Clearance of 30cm (min.) shall be maintained in between power cable.
- xii. The cable bending radii shall be 15D.
- xiii. All road crossing shall be provided with HDPE / GI pipe.
- xiv. The diameter of the pipe shall be 1.5 times the diameter of the cable.
- xv. The bridge / culvert / hard rock / areas cable shall be laid through GI pipe. Exposed GI pipes is to be covered with concrete PCC of ratio 1:3:6 of thickness 20 cm.
- xvi. Sufficient clearance of 0.3M is to be maintained in between cable and communication cable / water / gas line.
- xvii. Sieved earth / sand shall be used at a thickness of 10cm in between cable and slab.

- xxviii. The cable trench should not be kept open more than two days.
- xix. Barricading should be provided when cable trench is open.
- xx. The interval of vertical rigid supports shall be not more than 5M and one horizontal support for barricading.
- xxi. After laying the cable the trench should be back filled and consolidated.
- xxii. After laying the cable route marker shall be provided at interval not more than 100M, all bends and joints.
- xxiii. Cable identification details should be painted on the cable at an interval of 5M.
- xxiv. Cable identification tag using Aluminium strip should be provided at an interval of 2M, if more than one cable is laid in the same trench.
- xxv. Tracing and handling the existing cables if required, should be done.
- xxvi. Connecting new cable to the existing cable, if required, should be done.
- xxvii. Providing cable supports for all cables at termination end and transformers are to be done.
- xxviii. Cable end terminations shall be connected using brass bolts and nuts.
- xxix. Necessary alternative arrangements may be arranged for diverting traffic through the excavated areas, if required.
- xxx. Signaling and traffic control should be provided on the both ends of the road which is going to be excavated.
- xxxi. The straight through joints to be used at joints shall be of Shear Bolt Type as per IS 13573 Part II 2011 with dual wall and single triple extruded hybrid tubing with shear bolt connector as per IEC 61238 of rating 300/400 A.

#### **4.00 Clearance**

The following clearance should be maintained as per clause 6.3.3 of IS 1255

- |    |                                     |       |
|----|-------------------------------------|-------|
| 1. | Power cable to control Cables:      | 0.2 M |
| 2. | Power cable to Communication cable: | 0.3 M |
| 3. | Power cable to gas/water main:      | 0.3 M |

#### **5.00 Laying cable through open trench**

The excavated cable trench shall be drained of all water and the bed surface shall be smooth, uniform and fairly hard before paying out the cable. The cable shall be rolled in the trench on cable rollers, spaced out at uniform intervals. The paving out process must be smooth and steady without subjecting the cable to abnormal tension.

The cable on being paid out shall be smoothly and evenly transferred to the ground after providing the sand cushion.

The cables shall never be dropped. All snake bends shall be straightened. Suitable size cable stocking pulling eye shall be used for pulling the cable. While pulling the cable by winches or machines, the tension loading shall be by tension indicator and shall not exceed the permissible value for the cable. The cable laying shall be performed continuously at a speed not exceeding 600 to 1000 meter per hour.

The cable end seals shall be checked after laying and, if found damaged, shall immediately be resealed. Sufficient number of heat shrinkable cable end sealing caps shall be stocked at site stores for testing and jointing work. The integrity of the outer sheath shall be checked after the cable is laid in position.

### **BACK FILLING:**

Normally back filling shall consist of the material earlier excavated. However, bigger stones, pieces of rock, metal/glass pieces, plastic bottles and any such Non Bio-degradable materials also should be removed. The disposal should be separately done for bio-degradable and non bio-degradable materials.

### **PREVENTION OF DAMAGE DUE TO SHARP EDGES:**

After the cables have been laid in the trench and until the cables are covered with protective covering, no sharp metal tool shall be used in the trench or placed in such a position that may fall into the trench. Straight and curved rollers used shall have no sharp projecting parts liable to damage the cable. While pulling through pipes and ducts, the cable shall be protected to avoid damage due to sharp edges. The cables shall never be bent, beyond the specified bending radius.

### **Placing of pre cast RCC slabs:**

After laying of cables it is covered by a consolidated layer of soft earth ( sand /sieved earth) and lightly tamped. Over this layer, a pre cast RCC slabs as per approved design and drawing is placed as a warning layer and also as a mechanical protection as the electrical cables are vulnerable to damages due to excavation by other agency.

## **6.00 Horizontal Direction Drilling**

- a. HDD or Horizontal Directional Drilling is a trenchless boring method for installing underground cables, pipes, and conduits in a shallow curve along a prescribed bore path with the use of a surface-launched rig / machine, which minimizes the disruption of the surrounding area, for example, roads and driveways.
- b. The laying of U/G cables shall normally be done direct in ground through trenchless boring by using HDPE pipes. However in exceptional circumstances the cables may have to be laid in covered trenches or in racks fixed to the walls or supported from the ceilings.
- c. The scope shall cover supply of all the material as per the BOQ, erection equipments, labor and all the other items required for the laying of the power cables.
- d. The cable route markers, at a maximum distance of 100 mtrs, and danger boards shall be provided for the information of all concerned and for their safety. Any additional requirement in terms of safety perspective shall be provided by the Contractor without any extra cost.
- e. It is the responsibility of the Contractor to maintain the required statutory clearances from other utility services. Any damage caused to any utility services/ human life / public property etc shall be

the sole responsibility of the Contractor.

- f. The Horizontal drilling shall be for a distance of not less than 90 mtrs at each stretch except road crossing and in hard soil and subsequently thereafter. Temporary road restoration for HDD pits shall be under the scope of the contractor. The reinstatement of road dug up for drilling shall be incorporated in the price for Horizontal Directional Drilling.
- g. Disposal of extra excavated material such as mud, slurry, stones etc shall be also included in the rate per meter of horizontal drilling and shall not be charged extra.
- h. The trenchless technology shall be used with HDPE casing for the portion of the cable route such as road, railway, nullah crossing and without HDPE casing for major portion of the cable route. The outer diameter of the HDPE pipe shall be suitable for insertion in an 8” diameter horizontally drilled bore. The HDPE pipe shall be of PE 80 grade with pressure rating PN6 conforming to IS 4984/1995 and shall have wall thickness of 6.20 to 7.10 mm. The HDPE pipes shall be joined by using Butt welding
- i. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pull back the pipe/cable, a drilling fluid mixing, delivery, and recovery system of sufficient capacity to successfully complete the installation, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused (if required), a magnetic guidance system or walk over system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, and trained and competent personnel to operate the system. All equipment shall be in good, safe condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.
- j. The directional drilling machine shall consist of a hydraulically powered system to rotate and push hollow drilling pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations.
- k. There shall be a system to detect electrical current from the drill string and an audible alarm which automatically sounds when an electrical current is detected.
- l. The drill head shall be steerable by changing its rotation and shall provide necessary cutting surfaces and drilling fluid jets.
- m. Mud motors shall be of adequate power to turn the required drilling tools.
- n. Drill Pipe shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.
- o. Temporary road restoration for HDD pits and normal cable trenches along NH with CC 1:3:6 shall be under the scope of the Contractor.

## **7.00 Accessories**

- i. This being a Turnkey contract, successful installation, commissioning & integration with existing system, of those equipment/accessories/material not specifically mentioned in the specifications, shall be the responsibility of Contractor. No extra payment shall be made for these inherent works.
- ii. He shall also supply all other associated equipment/ material/accessories not specifically mentioned in this tender specification but are required for successful and trouble free operation of the executed work as a whole. For that no extra payment shall be made to the Contractor.

## **8.00 CABLE TERMINATIONS:**

The cable terminations used are to be of Indoor and outdoor type.

The preparation of the cable end for installing the terminations and the precautions to be taken before fixing the terminations shall be followed as in the case of the cable jointing procedures.

The instructions furnished by the termination manufacturer shall be strictly followed.

At cable terminating end, the following provisions for supply and erection are to be included.

- i. A terminating structure should be provided where necessary for supporting the cable to be terminated (except at the ring main unit ends)
- ii. A sufficient length of spare cable (5 Meter) shall be left in the ground, for future needs which shall be paid to the contractor under supply. The contractor shall include the cost of erection of spare cable in their bid.
- iii. The rise / take off of the cable immediately from the ground shall be enclosed in 150 mm Dia. GI pipe/ HDPE to protect against direct exposure to the sun.
- iv. The cable shall be properly fastened to the support using non-metallic clamps.
- v. Appropriate labels shall be fixed identifying the phase circuit, voltage and date of commissioning etc., on the cable supporting structure.
- vi. The sealing end shall be mounted on insulators to isolate them from their supporting steel work.
- vii. Protection from contact with the exposed metal work at the termination shall be provided by resin bonded glass fibre shroud.
- viii. Providing earth stations with all required materials, like leads, connectors etc for earthing of armour and screen.

## **9.00 Technical Standards**

- i. The electrical equipment's and materials required during erection should be of high standard. Technical features of these equipment's and materials must conform to the technical specification given in this bidding document. Wherever the same is not specified, it must conform to the relevant I.S for that material.
- ii. Materials conforming to other international standards, which ensure equal or higher quality than the standards mentioned above, shall also be acceptable. In case the bidders who wish to offer materials conforming to other standards, salient points of difference between standards adopted and specific standards shall be clearly brought out in the respective schedule. Four copies of such standards with

an authentic English version shall be furnished along with the offer.

- iii. Whenever a material or an article is specified or described by the name of a particular brand, manufacturer or trade mark, the specific item shall be understood as establishing type, function and quality desired. Products of other manufacturers may also be considered, provided sufficient information is furnished, so as to enable the Employer to determine that the products are equivalent to those mentioned.
- iv. Materials supplied/used shall conform in all respects to the relevant Indian Standard Specification with latest amendments there to.

Title	IS No.
1. Cement	IS 269
2. Steel	IS 6003/1970
3. Fasteners	IS 6639/1972
4. Concrete mix	IS 1343
5. RCC	IS 456
6. Cable laying and jointing	IS 1255

Installation work pertaining to equipment, cable laying etc should be in accordance with the applicable standards, safety codes etc.

#### **10.00 Site Storage/ Transportation**

- a. It shall be the responsibility of the Contractor to store, move/transport from stores/storage yard etc., relevant items and accessories to the place of installation wherever necessary he will assemble all parts of equipment. In accordance with the specific installation instructions as directed by Site Engineer.
- b. The stores should be dismantled and site cleared after the work is completed

#### **11.00 Erection, Testing and Commissioning**

- i. All the works covered under the scope of the tender shall be done in accordance with the norms defined by the Employer, unless the same is not specifically defined in the specification or with the provisions of Indian Electricity Rules/Acts/Other Government Rules/Regulations as prevalent at the time of execution of the job/work.
- ii. Installation shall be carried out strictly in accordance with the approved drawings Modifications, if any, required to suit site conditions, shall be carried out only with the prior approval of the Site Engineer. All such changes shall be incorporated in “As built” drawings to be furnished by the Contractor.
- iii. Responsibility for successful installation of other equipment accessories, purchased but not mentioned specifically above, and their commissioning shall be on Contractor. For all such items the

Contractor shall be supplying all material and equipment required to accomplish the job complete in all respect.

- iv. Installation work pertaining to equipment, cable laying etc should be in accordance with the applicable standards, safety codes etc.
- v. The Contractors shall themselves be responsible for timely arrangement/ procurement of all the raw materials required for the manufacture of all tendered items by them/ their and / or by their vendors.
- vi. While Repairing & Replacing the equipment, if any other equipment gets damaged due to negligent handling of the Contractor the same shall be replaced by the Contractor at his cost to the Employer satisfaction.
- vii. He shall be responsible for dismantling of defective equipment's, there proper handling and shifting.
- viii. Also he shall hand over the old & dismantled equipment's/ material to the purchaser's local stores or other sites as per instructions of the purchaser for which no extra payment shall be made.
- ix. All charges on account of damages/losses/claims/thefts etc. involved under the conditions laid down above shall be borne by the Contractor. It's cost shall be recovered from his bills /security deposits /other assets.
- x. In order to avoid hazards to personnel moving around, the equipment such as Transformer, Capacitor Banks, Switchgears etc. if required to be kept charged after installation till their commissioning, shall be cordoned off by suitable barriers to prevent accidental injury to personnel moving around.
- xi. Where the equipments/ assemblies are supplied in more than one part, the Contractor shall make all necessary mechanical and electrical connections between the sections. The Contractor shall also do necessary adjustment in the alignments required for its proper operation.
- xii. Care shall be taken in handling instruments relays and other delicate devices where instruments and relays are supplied separately they shall be mounted only after the associated switch gear/control panels are erected and aligned.
- xiii. **Precaution:** The Contractor shall exercise all possible care to avoid damage to public utilities e.g. water/ sewage pipes telephone and power lines/cable already existing. In case of any accidental damage during the work, the Contractor shall be responsible to repair/replace the same at his own cost, and shall ensure that the purchaser is not put to any loss.
- xiv. The Contractor shall have to provide proper lighting, barricading, signboards etc. at the work site as a necessary precautionary arrangement to avoid accident/ damage/ losses to the public/utilities/properties.
- xv. **Site Solution:** It may be possible due to some reasons or others that it would not be possible to work

as per the procedure. In such case/cases, the solution to the problem shall be achieved by the purchaser with the consultation of Contractor, and the Contractor shall work as per procedure proposed by the purchaser. Such cases shall in variably be informed to the engineer of the contract for which no extra payments shall be made.

- xvi. **Space Constraints:** While executing the job it is quite possible that some of the specified work may not be carried out due to space/land/ other technical constraints etc. In such case the concerned Employer, if required, may divert this work at some other site or cancel the left over portions of work.
- xvii. The Contractor shall ensure that the equipment under erection as well as the work area and the site are kept clean to the satisfaction of the Engineer. In case, the Engineer is not satisfied about the cleanliness he will have the right to carry out the cleaning operations and expenditure incurred in this regard will be to Contractor's account. Packing cases and packing materials shall be promptly cleared from sites

## **12.00 11 kV line for underground railway crossing**

Detail survey of location of railway crossing shall be carried out by the Contractor to avoid multi-crossing at nearby location. Prior approval from railway authorities for execution of this work shall be obtained by the Contractor through the Project Manager. Contractor should ensure timely completion of work during block period allocated by the railway authority by mobilizing adequate resources.

2 Nos. separate cables shall be laid in separate HDPE pipe enclosures per crossing. One cable to be kept as a spare. Horizontal Direct Drilling (HDD) shall be used for installation of cables below the railway tracks.

- a) 3Cx300 sqmm XLPE armored cable (approx. length is 0.3 km each) – 2 sets
- b) 160mm dia HDPE pipe shall be of PE 80 grade with pressure rating PN6 conforming to IS 4984/1995 and shall have wall thickness of 6.20 to 7.10 mm of (red color painted on edges) for cable protection in underground laying – 2 sets
- c) 150mm dia GI pipe of B class (blue color painted on edges) for cable support at DP structure – 2 sets
- d) Outdoor heat shrinkable cable jointing kits for main cable and jumpering cable – 4 Nos for main cable and 8 Nos for jumpering cables.
- e) 11 kV lightening arrestor station class 10kA (6 nos.),
- f) 4 Nos GI 2.5-meters long pipe earthing,
- g) 6 SWG GI wires with GI nuts, bolts & washers,
- h) Cable markers

Line crossing shall be performed using underground cabling. Block on railway traffic shall be arranged by Project Manager. Contractor should ensure timely completion of work during block period by mobilizing requisite man, materials and machine at crossing locations.

Horizontal drilling machine shall be used for horizontal bore below railway tracks.

## **17. Augmentation of Distribution Transformer Substations**

### **1.00 Survey of Distribution Transformer Substations:**

Detailed survey of overloaded Distribution Transformer substation shall be performed. Existing electrical connected loading and habitation shall be surveyed and a presentable document showing population residing in the un-electrified area/existing electrified area of habitation shall be performed. Based on survey, best option for augmentation of distribution transformer substation and the capacity of new transformer shall be decided. The capacity of augmented DTR shall be governed by following technical aspects:

- a) Optimistic lengths of LT lines needed to feed the existing consumers, existing un-connected consumers and future growth in electrical loading,
- b) Space available for installation of support/transformers,
- c) Probable load expected to come on the transformer due to existing BPL beneficiaries /others connected /un-connected probable beneficiaries in the locality taking care of their expected load growth in next 5 years.
- d) Distribution Transformers of capacity 160 KVA to 500 KVA (three phase) shall be decided as per standard rating of distribution transformer as depicted in IS specifications. Nonstandard ratings of DTR shall not be installed.

Based on survey report, Project Manager shall decide type, capacity and location of Distribution Transformer sub-station for augmentation/R&M works.

2.00 Following types of works are envisaged for Distribution Transformer sub-station for augmentation/R&M works:

- a. Replacement of defective materials of DTR substations
- b. Re-erection/re-concreting of substation supports
- c. Dismantling of defective/worn-out steel structure materials, 11 kV/LT equipment like Lightning Arrester, DO Fuse, Distribution Box/SMC Distribution Box, LT cable, jumpering conductor, terminal clamps, insulators etc as required. Shifting of dismantled material to Employer's store within reasonable period of time.

- d. Installation of stay set for strengthening of DTR substation structure.
- e. Topping up of new and filtered transformer oil wherever required.
- f. De-moisturizing of silica gel, filling of transformer oil in silica gel breather.
- g. Providing new DTR substation equipment like steel structure materials, 11 kV/LT equipment like Lightning Arrester, DO Fuse, Distribution Box/SMC Distribution Box, LT cable, jumpering conductor, terminal clamps, insulators etc
- h. Renovation of DTR substation earthing by providing new earth pits, inter connection of earth pits and their connection to various equipment
- i. Cleaning of metallic structure items by rubbing through emery paper and re-painting using two coats of red oxide paint and two coats of aluminum oxide paints of reputed type and make as approved by Project Manager using painting brush.

### 3.00 Fabricated steel items:

Fabricated steel items like DC cross arm (100x50x6 mm), back clamps (65x8 mm), pole clamp (65x8 mm), DO mounting channel (100x50x6 mm), transformer mounting channel (100x50x6 mm), transformer clamping set (50x50x6 mm), transformer belting set (50x50x6 mm), V cross arm, top clamp, DC cross arm, bracket, clamps, cross bracings, bracings, strain plate, back clamp, transformer mounting structure etc shall be made of MS Channels, MS angle, MS flats as per approved drawings.

While fabricating, good quality electric cutting tools and drill machine shall be used to ensure no sharp edges and perfect holes as per approved drawings. Gas cutting set should not be used for fabrication of MS steel items. Weld material shall be distributed equally between the two materials that were joined. The weld shall be free of waste materials such as slag. The weld surface should not have any irregularities or any porous holes (called porosity). The joint shall be tight. Most welds need to demonstrate the required strength. One way to ensure proper strength is to start with a filler metal and electrode rating that is higher than your strength requirement.

The fabricated steel structures materials shall be hot-dip galvanized thoroughly internally and externally according to IS: 2629 and IS: 2633 (with latest amendments). Galvanizing shall be checked and tested in accordance with IS: 2633.

Fabricated steel structure items shall be galvanized both inside and out. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the smelter bath that could have a detrimental effect on the durability of the zinc coating. Before pickling, all welding, drilling, cutting and grinding shall be completed and all grease, paint, varnish, oil and welding slag shall be completely removed.

All protuberances which could affect the life of galvanizing shall also be removed. To avoid the formation of white rust all galvanized material shall be packaged in such a way to ensure adequate ventilation between parts during shipping and storage.

Testing of galvanizing shall be performed for Uniformity of thickness as per IS 2633/1986, Mass

of coating as per IS 6745/1972 and quantity of zinc, water quenching & centrifuging as per IS 2629/1985. Part -2 : Employer's Requirements 115

#### 4.00 Hardware:

MS Nuts, bolts and washers (Galvanized) – 16 mm dia nuts, bolts & washers shall be used for tying of overhead structure items like cross arms, top clamps, brackets, clamps, bracing, strain plates etc.

While erecting, proper dimensions of nut-bolts and washers must be ensured. 2 to 3 threads only be visible of the bolt after full tightening of nut on requisite torque. The hardware shall be hot dip galvanized. The minimum coating of the zinc shall comply with IS: 2629 and IS: 2633. Galvanizing shall be checked and tested in accordance with IS: 2633. Before shifting them to site for erection, they shall be offered for inspection and approval by Project Manager.

#### 5.00 Stay Set:

Galvanized Stay Set with 50x8 mm stay clamp, guy insulator (2Nos.), anchor plate (200x200x6mm) , nut-bolts, 2 Nos turn-buckles, 1.8 m long, 16 mm diameter solid GS stay rod & 7/3.15 mm dia GI stranded wire complete.

Stay set shall be used at all sub-station location to nullify the tension of conductor/cable/transformer on the supports. 0.2 cmt cement concreting in mixture 1 part cement, 3 part coarse sand and 6 part 40mm size aggregate stone chips (1:3:6) shall be provided in the foundation of the stay set. 2 Nos. guy insulator shall be provided in 7/3.15 mm dia stranded GI wire at middle locations between two turn buckles.

#### **6.00 Distribution Transformer:**

Following type and sizes of Energy efficiency Level 1 rated DT as per IS 1980 (Part-1) 2014 with Amendments 1, 2, 3, & 4. , distribution transformers are standardized in the project for augmentation

- a) 160 KVA 3 phase Aluminum / Copper wound DTR
- b) 250 KVA 3 phase Aluminum / Copper wound DTR
- c) 315 KVA 3 phase Aluminum / Copper wound DTR
- d) 500 KVA 3 phase Aluminum / copper wound DTR

Or any other rating as per latest Indian Standard Specification .3ph Distribution Transformers shall be 11/0.4 KV non-sealed type, type BEE specified minimum 3 Star Distribution Transformers. The transformers shall be double wound, three phase, CRGO or amorphous core type having energy efficiency level 1 as specified in latest IS:1980 (Part-1) 2014 with Amendments 1,2 3 &4.

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. Project Manager shall select samples from the core laminations and get the same tested in NABL Accredited laboratory to prove the quality of the core material.

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 within five years from date of Letter of Intent 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 and (ii) performance certificates from the users, specifically from Central Govt./State Govt. or their undertakings.

The losses in Distribution Transformer should be as per Energy Efficiency Level 1 as specified in IS 1180 (Part-1):2014 and amendment 1,2,3 &4 for all kVA ratings of distribution transformers  
Bimetallic connectors of suitable capacities are to be provided on LT side and on HT side of the transformer.

T-Clamps should be provided on each jumper on bus bars. Line jumpers should be provided with adequate size of PG Clamps (Two numbers PG Clamps at each end of jumper). Clamp should be made of aluminum grade T-1F as per IS-8309 having good electrical quality aluminum material and should not be brittle in nature.

Transformers should be tested for pre-commissioning checks which includes Insulation Resistance Test, ratio test and oil breakdown voltage test. Before formal energization, 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. 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.

ACSR / AAAC Conductor:

ACSR racoon conductor (or equivalent AAAC conductor) is to be used for connection between overhead lines to transformer studs/bushing.

### **8.00 Distribution Box/SMC Distribution Box and Power Cabling:**

Distribution Box/SMC 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.

All CT terminals are to be ring type and other terminals are fork type. 2.5 sqmm copper multi stands wiring 1.1 KV grade, ISI marked, IS 694 shall be used for control wiring. A terminal block be provided between CT and Meter keeping 20% spare terminals.

The Distribution Box/SMC 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/SMC Distribution Box 16 KVA should also house three phase tri-vector energy meter / single phase meter depending on capacity and type of distribution transformer as per specifications.

For higher capacity transformers where CT operated meters are to be installed, separate LTCT cum Meter Box at eye height shall be installed for housing of meter, CTs, terminal block and wiring.

The single core un-armored power cables shall be used for connection from Distribution Transformer to Distribution Box/SMC Distribution Box and Distribution Box/SMC Distribution Box to Outgoing LT lines. Cable should not be used in underground laying arrangement. Cables should be dressed & tied properly using clamps /cable ties at 1 meter intervals and tied with substation structure/poles. At-least 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:

No	TYPE OF DISTRIBUTOR	INCOMER		OUTGOING	CABLE	
		MCB/Isolator	HRCF use	MCCB	1	2
1	160 KVA 3 Ph	200A TPN Isolator	300 A	6x90A MCCB SP	1Cx70/120 sq mm UA	1Cx150 sq mm UA
2	200 KV	400 A TPN Isolator	315 A	9x120A MCCB SP	1Cx150 sq mm	1Cx300 sq mm

	A 3 Ph					UA	UA
3	315 KVA 3 Ph	600 A TPN Isolator	500 A	12X120A MCCB	SP	1CX 150 sq mm UA	1CX 300 sq mm UA
4	50 0 K V A 3 Ph	800 A TPN Isolator	700 A	12X120A MCCB	SP	1CX 150 sq mm UA	1CX 300 sq mm UA

1.1 KV XLPE Aluminum Conductor, Stranded, un-armored cable be used for connection of transformer LV bushing to Distribution Box/SMC Distribution Box and Distribution Box/SMC Distribution Box to overhead line.

### 9.00 Earthing:

Distribution Transformer Earthing 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. Project Manager shall decide the type of earthing.

25x3mm GI Flat and 8 SWG GI shall be used for making earthing connection to various sub-station equipment as per given details. GI Flat and GI wire shall be properly dressed, bunched and clamped with the support at 2 feet intervals. An overlapping of 35mm shall be used at the place of flat to flat joint. Two sets of GI nuts, bolts and washers shall be used for flat-to-flat joints. 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 / mesh and corresponding drawing of existing earthing arrangement shall be recorded and submitted to Project Manager.

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
Laying of earth mat	Below ground 0.5 meter

Standard requirements of earthing shall be as under:

- Earth Pit – 1 for Transformer Neutral,
- Earth pit - 2 for Lightning Arrester,
- Earth pit – 3 for Equipment body earthing.

Following arrangement is envisaged for various equipment of distribution transformer substation:

- a) Transformer Neutral (Two distinct connections) : GS Flat 25X3mm
- b) Transformer Body: GS Flat 25X3mm
- c) Lightning Arrester: GS Flat 25X3mm
- d) Fencing (Wherever required): GI wire 8 SWG
- e) LT Distribution Box/SMC Distribution Box (Two distinct connections): GI wire 8 SWG
- f) AB Switch handle: GI wire 8 SWG
- g) Steel structure of substation: GI wire 8 SWG
- h) Line meters: GS wire 8 SWG

The location of earth pits should be at-least 3m apart, so that they their earth conductive areas do not overlap. In rocky soil where getting required earth resistance is a challenge, chemical rod earthing shall be used in place of normal GI pipe type earthing. Project Manager shall decide type of earthing pits.

#### **10.00 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.

The individual insulator shall be checked for insulation resistance before overhead line installation. Insulator should properly be cleaned before installation. No damage/crack insulator should be used.

#### **11.00 Substation numbering:**

Each Substation should be numbered properly labelled using yellow base and black indication marks (number or digits). 40/50 mm height digits/words should be used for this purpose. Base shall be made using 2 or more coats of yellow enamel paint till good surface finish. Base preparation shall be completed before shifting of poles to site for erection. Base painting and marking of digits should be performed by a skilled and trained painter using branded enamel paint, Project Manager shall approve type and brand of enamel paint.

#### **12.00 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.

#### **13.00 Danger board:**

Each support should be provided with a danger board with pole clamps as per approved drawing. Danger board should be in bi-lingual languages (local language and English). Clamp for danger board, nut-bolts and washers shall be painted with two or more coats of red-oxide and aluminum paints respectively till smooth surface before installation.

#### **14.00 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 PCC Pole, steel tubular poles, WPB Poles and H-Beam support foundation.

While erecting supports (poles), shuttering must be used for concreting so that proper quantity of cement concrete mixture be used and assessed during inspection. During concreting proper compaction by means of mobile vibrator be provided. While starting work of support erection, gang wise shuttering and mobile vibrator shall be offered for inspection to Project Manager. While erecting support, mercury level gauge must be used to ensure vertical erection of support.

250mm dia X 12" inch size muffing shall be provided on steel tubular, WPB poles and H-Beam poles to prevent direct entry of rain water along the poles. Cement Concrete of 1:2:4 (1 part Cement, 2 parts coarse sand and 4 parts 20mm aggregate stones chips) shall be used for individual poles. Steel plate shall be used in steel tubular poles and WPB poles and cement concrete reinforced plate shall be used as base plate for PCC poles.

#### **15.00 11 KV AB Switch:**

11 kV, 3-ph, 200 A, 3 Pin type, Horizontal/Vertical Mounting type, Gang Operated, AB Switch shall be installed on 100 KVA and more capacity distribution transformer substation only. B Class GI pipe shall be used (without any joints) for operation of switch. AB Switch structure and handle must be earthed using 8 SWG GI wire.

#### **16.00 11 KV Drop Out Fuses:**

11 kV, 3-ph, Drop Out fuse units (set of 3 units) along with Support Insulators, Base Channel, fuse barrel etc. shall be used for all capacity Distribution Transformer Substations. DO Fuse structure shall be earthed using 8 SWG GI wire.

#### **17.00 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.

### **18. Re-conductoring /Augmentation of LT line Using Bare OH**

#### **1.00 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) on political map with fair correctness, be prepared. SLD and foot survey report shall be approved by Project Manager 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 Project Manager. This details shall be used as reference documents by Quality & Quantity Inspecting officials to execute inspection works.

**Conductor used : ACSR Rabbit as per specification**

#### **2.00 Support for LT overhead Line:**

- a) 8 M/200 kgs PSC Poles as per drawing and Specifications
- b) 9M/200 Kgs PSC Poles as per drawing and Specifications.

### **3.00 Fabricated steel items:**

Fabricated steel items like A Pole, clamps, stay clamp, etc shall be made of MS Channels, MS angle, MS flats as per approved drawings.

While fabricating, good quality electrical cutting tools and drill machine shall be used to ensure no sharp edges and perfect holes as per approved drawings. Gas cutting set should not be used for fabrication of MS steel items. Weld material shall be distributed equally between the two materials that were joined. The weld shall be free of waste materials such as slag. The weld surface should not have any irregularities or any porous holes (called porosity). The joint shall be tight. Most welds need to demonstrate the required strength. One way to ensure proper strength is to start with a filler metal and electrode rating that is higher than your strength requirement.

The fabricated steel structures materials shall be hot-dip galvanized thoroughly internally and externally according to IS: 2629 and IS: 2633 (with latest amendments). Galvanizing shall be checked and tested in accordance with IS: 2633.

Fabricated steel structure items shall be galvanized both inside and out. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the smelter bath that could have a detrimental effect on the durability of the zinc coating. Before pickling, all welding, drilling, cutting and grinding shall be completed and all grease, paint, varnish, oil and welding slag shall be completely removed.

All protuberances which could affect the life of galvanizing shall also be removed. To avoid the formation of white rust all galvanized material shall be packaged in such a way to ensure adequate ventilation between parts during shipping and storage.

Testing of galvanizing shall be performed for Uniformity of thickness as per IS 2633/1986, Mass of coating as per IS 6745/1972 and quantity of zinc, water quenching & centrifuging as per IS 2629/1985.

### **4.00 Hardware:**

MS Nuts, bolts and washers (Galvanized) – of various sizes shall be used for tying of overhead structure wherever required.

While erecting, proper dimensions of nut-bolts and washers must be ensured. 2 to 3 threads only be visible of the bolt after full tightening of nut on requisite torque. The hardware shall be hot dip

galvanized. The minimum coating of the zinc shall comply with IS: 2629 and IS: 2633. Galvanizing shall be checked and tested in accordance with IS: 2633. Before shifting them to site for erection, they shall be offered for inspection and approval by Project Manager.

#### **5.00 Stay set shall include the following items**

GI Stay Set includes

1. Stay Insulator Porcelain 11 k V - 1 Nos
2. Anchor Plate 200 x 200 x 6 mm GI (LT Stay Plate GI)
3. STAY TIGHTNER LT
4. Stay Wire 7/8 (7/3.15mm) GI (HT Stay Wire)
5. Stay Rod (Anchor Rod) GI 16 mm dia (LT Stay Rod)
6. Helically formed Guy-Grip LT
7. Thimble GI 75 mm x 22 mm x 40 mm ,1.5 mm Thickness (For HT and LT)
8. Stay clamp (GI ) etc as required as per technical specification, approved drawings and scope of work.

Stay set shall be used at all turning locations, cable dead end locations to nullify the tension of the cable. Erection of storm guys at suitable location in straight line may also be provided. Erection of storm guys at suitable location in straight line may also be provided.

0.2 cmt cement concreting in mixture 1 part cement, 3 part coarse sand, 6 part 40mm size aggregate stone chips (1:3:6). 2 Nos. guy insulator shall be provided in stranded GI wire at middle location between two turn buckles.

#### **6.00 LT ABC earthing arrangements :**

40 mm dia., 2500 mm long GI pipe earth electrode with test link, RCC pit, RCC cover plate on GI frame, bentonite powder and other accessories complete (For ABC)

At starting and end points, neutral cum messenger shall be pipe earthed using stranded insulated conductor( Abc conductor bits can be used). Wherever branching comes, at such points , Pipe earthing is to be done using IPC and stranded insulated conductor.

Earth Knob shall be used for coil earthing wherever necessary for neutral .Every fifth LT pole shall be coil earthed with 8 SWG GI wire. Overhead steel items shall be connected to GI Earth Coil earthed using 8 SWG GI wire.

In rocky soil where getting required earth resistance is a challenge, chemical rod earthing shall be used. Overhead line structure shall be connected to chemical earth electrode using 8SWG GI wire.

## 19. Re-conductoring /Augmentation of LT line Using ABC

### 1.00 Survey

The Contractor shall carry out a GPS based survey of existing bare conductor LT distribution lines in the habitation. The Survey should cover Pole by pole survey of all the bare conductor lines to identify the location of poles and phase configuration, pole condition, Existing stays / struts, Existing street lamp connections, Location and capacity of the connected distribution transformer (DTR) to each LT line, Connection points of any existing ABC lines connected to the bare conductor lines should be identified. The length of such ABC lines and total service connections provided through this line should be indicated on the map at this point, Load readings for each LT feeder. Upon completion of the survey the Contractor is required to develop the Single Line Diagram (SLD-A) indicating the survey Information and Schedule of network survey information (Schedule – A).

### 2.00 Load Readings

Load readings of each LT feeder shall be taken before and after proposed ABC conversions. This is required to monitor actual demand reductions achieved following ABC conversions. Load currents on each phase and the neutral in respective LT feeder shall be taken on four different occasions per day before and after completion of ABC conversion work. The load current measurements shall be decided by Engineer in Charge. Load reading before ABC conversions shall be taken when carrying out the survey and recorded in Schedule-A. Load readings after ABC conversions shall be provided to the Project Manager/Engineer in charge within one week from completion of works.

3.00 Reconductoring of LT line using additional supports with all fittings matching with length and type of existing support is envisaged on following type of supports:

- a) 8 m/200 kgs PSC Poles as per drawings and specifications
- b) 9m/200 kgs PSC poles as per drawings and specifications

4.00 Reconductoring of existing LT line of bare conductor with following type of new ABC cable LT line as required are envisaged under this work-

4.01	3X95+1X70+1X16 sqmm (insulated messenger)
4.02	3X70+1X50+1X16 sqmm (insulated messenger)
4.03	3X50+1X35+1X16 sqmm (insulated messenger)
4.04	2X50 sqmm (insulated messenger)

While executing this work, mid span pole with all fittings may be provided matching with existing poles of the line or wherever the sag is high and need so arise.

5.00 Following works shall also be executed by Contractor under this head –

- a) Straightening of tilted supports by providing additional foundation or by providing boulders etc as required.
- b) Revamping of pole earthings and replacement of GI earth wire.
- c) Labeling, providing danger board, providing anti climbing device and painting of all the step poles shall be in the scope of work
- d) Providing of stay set wherever required
- e) Removal of old bare conductor and depositing in Employer's store

Item-wise scope of works of LT line is detailed out under scope of new LT line. It shall be utilized on item to item requirement under renovation/augmentation of LT line also.

#### **LT ABC earthing Arrangement:**

At starting and end points, neutral cum messenger shall be pipe earthed using stranded insulated conductor (ABC conductor bits can be used). Wherever branching comes, at such points, Pipe earthing is to be done using IPC and stranded insulated conductor.

40 mm dia., 2500 mm long GI pipe earth electrode with test link, RCC pit, RCC cover plate , bentonite powder and other accessories complete shall be used.

### **6.00 Service connections from LT ABC**

6.1. Installation of LT Distribution Box/SMC Distribution Boxes for ABC service connections.

The following types of LT Distribution Box/SMC Distribution Boxes (according to number of consumers to be connected) shall be selected:

- Distribution Box as per Technical specification and GTP shall be supplied and erected

6.2. **Mounting Arrangement**

Distribution Box/SMC Distribution Box (DB) shall be mounted on LT pole with galvanized MS clamp of 40x3 mm size/ using stainless steel strap with buckles

6.3. **Connection to AB Cable**

1Cx25 sqmm Stranded cables shall be used to connect AB cable with single phase and three phase Distribution Box/SMC Distribution Box respectively.

6.4. **Satellite Connectors and IPCs for service connections:**

1. Main- 16 – 95 Sq.mm , Tapping – 2.5 sqmm to 35 sqmm (4 way)
2. IPCs of Sizes Main 16-95 Sq.mm. & Tap 4- 35 sqmm can be used for high end service connections.
3. IPCs of Sizes Main 16-95 Sq.mm & Tap 1.5 to 10 sqmm can be used for Single phase Service Connections & Street light Connections

#### 6.5. Connection of Consumer Service Cables

All existing consumer service cables shall be re-connected to the Distribution Box/SMC Distribution Box/IPC's /Satellite Connectors by the Contractor. In case existing consumer service connections are to be replaced with armored service cables in each habitation as determined by the Project Manager, new armored cable shall be connected to the Distribution Box/SMC Distribution Box. The service connections to consumers can also be given with IPCs or satellite connectors as determined by the project Manager

### 7.00 Replacement of Existing Consumer Service Connections

#### 7.1. Service Connection Types

The applicable service connection types are as follows;

SC Type	Connected Load No of Phases / Contract Dmd	Service Cable Size (cores / sqmm)
SP-1	Single Phase / upto 5 kW	2 x 4 mm <sup>2</sup>
TP-1	Three Phase above 5 kW up to 10 KW	4 x 6 mm <sup>2</sup>
TP-2	Three Phase / above 10 kW	4 x 25 mm <sup>2</sup> or higher sizes

#### 7.2. Service Cable Types

**1.1 KV grade PVC insulated, Aluminium single/multi core PVC sheathed weather proof.**

#### 7.3. Service Cable Span

Permissible maximum span for service cable shall be 35 m. In isolated cases this limit may be extended with the approval of Project Manager provided that required ground clearance is maintained with additional supports where necessary.

Existing service cables shall be replaced with new one if required and joints in any manner shall not be permitted and the specification of new cables shall be provided by Project Manager.

No service cable replacements shall be carried out without the approval of Project Manager.

Existing un- armored service cables shall be removed and returned to Employer warehouse. Any non-standard supports used as supports for existing service cables shall also be removed.

New service cables shall be drawn from the LT Distribution Box/SMC Distribution Box upto the meter board as per approved drawings. The service wire is to be hanged on supportive GI wire between pole support and the house. 9/8 SWG GI wires shall be used for single phase and three phase services respectively.

Before installing service wires and GI wire, GI pipe / MS Angle on the consumer premises is to be erected using clamps/ nails/proper binding etc. In case of hut or poor structure at consumer premises, GI pipe is to clamp on wooden planks/wooden structure existing in the house. The GI pipe should be supported for neutralizing tension by means of GI tie wire support. In pukka/brickwork/cement concrete foundations, house, GI support pipe is to be clamped by means of MS clips.

New service cable shall be connected to existing consumer meter terminals or incoming fuse / MCB / MCCB terminals. Care should be taken not to damage the existing meters in the process. 20mm dia PVC conduit pipes shall be used to take down service cable from the roof to the meter box along the walls. The service cable shall be drawn inside PVC pipes from roof upto the meter board.

Terminal cover of the meter or fuses shall be sealed upon connection of new service cable as arranged with the Employer.

Earth terminal point shall be provided at meter board via bearer GI wire. This point shall be connected with the proper earthing system through GI wire.

All work required to install service cable from LT Distribution Box/SMC Distribution Box upto the meter board shall be carried out as per drawings. This includes GI wire for supporting service cables from LT Distribution Box/SMC Distribution Box upto the consumer premises, MS angle fixed at roof, clamp with bolts nuts and flat iron for fixing GI wire on pole, clamps for fixing cable to GI wire, PVC conduit pipes and accessories to draw the service cable from roof upto the meter board.

## **8.00 Installation of Poles**

### **8.1. Types of pole installation works for ABC conversions**

The following types of pole installation works applicable for ABC conversions as per site requirements specified in the table below;

<b>Sl.No</b>	<b>Type</b>	<b>Site Requirements</b>
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Sl.No	Type	Site Requirements
1	Installation of new poles	<ul style="list-style-type: none"> <li>• New pole to be used as an intermediate pole in the existing line to address excessive spans or other requirements.</li> <li>• New Poles to be inserted to maintain span length 20-25m while drawing ABC When there is a need to do minor extensions to the existing line in order to minimize excessive service cable lengths to existing consumers.</li> <li>• To shift existing lines due to safety/ clearance issues.</li> </ul>
2	Replacement of existing (unusable) poles	<ul style="list-style-type: none"> <li>• To replace existing poles which are damaged / corroded and cannot be re-used.</li> <li>• To replace of existing non-standard line supports such as temporary structures including supports embedded in buildings.</li> </ul>
3	Re-location of existing poles	<ul style="list-style-type: none"> <li>• To shift existing poles</li> <li>• To shift existing lines due to safety/ clearance issues</li> </ul>
4	Re-alignment of existing poles	<ul style="list-style-type: none"> <li>• To straighten the poles that are inclined in a particular direction but in re-usable Condition</li> </ul>

## 8.2. Types of poles

For works relating to new poles and replacement of poles, poles according to Employer specification shall be used.

For works relating to re-location or realignment of existing poles the available existing pole (any type) may be re-used provided that it is in re-usable condition.

## 9.00 Erection of Poles

### 9.1. Removal of existing poles for re-use or disposal

All unusable poles or non-standard line supports in the existing LT lines shall be removed and disposed. If the existing pole is removed for re-use adequate measures should be taken not to damage the pole during removal.

Existing poles shall be removed by pulling the complete pole from the ground; poles shall not be cut off at the ground line. Pole shall be cleaned and any material attached with the pole (including concrete) shall be removed. The RCC base plate may be removed and re-used if it is in re-usable condition.

Pits (of depth  $1/6^{\text{th}}$  of pole length) shall be backfilled and compacted completely with sufficient added backfill piled above grade to prevent depressions being created by natural compaction.

Contractor shall be responsible for disposal of unusable poles or non-standard line support structures after taking approval of the Project Manager/ Engineer In- Charge of the Employer.

## 9.2. Erection of new or existing poles

For 8 /9 m 200 Kg PSC poles pole pit shall be excavated ( of depth 1/6th of pole length) as per details provided in drawing. PSC pole pit shall be refilled with 200 mm average size of boulder mixed with excavated earth. Proper ramming shall be performed for better compaction. Pole shall be erected fully vertical and firmly fixed to ground and shall not wobble.

## 9.3. Erection of poles with concrete foundation

Concrete foundations shall be used to erect poles in water logged areas or for all locations as instructed by the Project Manager. Details of concrete foundation for PSC poles are provided in drawing.

## 9.4. Re-alignment of existing pole

Existing poles that are inclined in a particular direction shall be re-aligned / straightened by pulling, providing additional bouldering, concreting and re-compacting as necessary. Upon re-alignment pole shall be erected fully vertical and firmly fixed to ground and shall not wobble. If necessary pole may be completely removed and re-installed.

## 9.5. Pole Numbering

Requirements specified in section 3.9 with respect pole numbering shall also be applicable for new poles or pole replacements indicated in this section.

# 10.00 Installation of Stays and Struts

## 10.1. Installation of Stays (Guys)

Stay set shall include the following items

GI Saty Set includes

1. Stay Insulator Porcelain 11 k V - 1 Nos
2. Anchor Plate 200 x 200 x 6 mm GI (LT Stay Plate GI)
3. STAY TIGHTNER LT
4. Stay Wire 7/8 (7/3.15mm) GI (HT Stay Wire)
5. Stay Rod (Anchor Rod) GI 16 mm dia (LT Stay Rod)
6. Helically formed Guy-Grip LT
7. Thimble GI 75 mm x 22 mm x 40 mm ,1.5 mm Thickness (For HT and LT)
8. Stay clamp (GI ) etc as required as per technical specification, approved drawings and scope of work.

If there are no existing stays installed at such locations in the existing line, such poles shall be identified and included in [Schedule-B](#) for installation of new stays. In addition required stays for

proposed new and relocated poles shall also be included.

8 SWG stay wire (7/ 3.15 mm) with 16 mm stay rod shall be used for 11 kV / LT lines. Stay shall be installed in the opposite direction of resultant force due to AB cable tension in order to nullify the same.

If the stay wire proves to be hazardous, it should be protected with suitable asbestos pipe filled with concrete of about 2 m length above the ground level, painted with white and black strips so that, it may be visible at night.

In general, the stay should be applied on the pole as close as possible to the load center. The angle between stay wire and pole shall be between  $30^{\circ}$  –  $45^{\circ}$ . Where there are issues obtaining specified angle due to physical obstacles, bow (outrigger) stay arrangement may be considered with the approval of the Project Manager. In case of critical space issues, fly stays may also be considered subject to approval of the Project Manager. (Reference : REC Drawing # G4).

Concreting of stay pit shall be done as shown in drawings except for firm soil where compacting with necessary aggregates shall be done.

Stay wire shall be properly tightened after installation and allowing sufficient time for setting concrete. Contractor shall ensure all stays in the existing line are properly tightened including new and existing stays.

## 10.2. Installation of Struts

The struts may be used only in case where stays cannot be installed due to physical obstacles or limitations. Strut shall be applied in the same direction of resultant force due to AB cable tension in order to nullify the same.

Installation of strut pole shall be carried out using 8 m PSC pole and pole brackets as shown in drawing # REC/DDUGJY/GEN/10. Strut pole shall be installed with the RCC base plate. Angle between the line and strut pole shall be 45E.

## 11.00 Re-Connecting Existing Street Lamps to ABC

If there are existing street lamps connected to the bare conductor line, these street lamps shall be re-connected to ABC line through the street lighting conductor using IPC (for insulated conductor). This work scope is limited to providing connection to existing street lamps only.

## 12.00 Shutdown during execution of works:

The Contractor is required to take shutdown to execute reconductoring and all other works wherever needed. During shut down, safety of system and operating manpower shall be ensured

by Contractor.

Shut down shall be planned with concerned in-charge well in advance. This may subject to exigencies leading to cancellation of requisition if situation so desire. Contractor shall be responsible to take advance action on resource mobilization (men, materials and machine) well in advance to perform shut down works. Adequate manpower shall be mobilized to take-up the works in parallel at 11KV supports on given shut-down area.

Contractor shall deploy well educated and experience engineer to take care of shut down, end earthing of lines, check clearances on completion of works, return shut down and ensure re-energization of section/part of line. He shall be available at site for taking shut-down, during execution of works, return of shut down and re- energization of line. Safety of working crew shall be looked after by him. He must be a trained person having requisite experience of shut-down works. He must be well aware of LT/HT networks and their supply sources.

On completion of work, Contractor shall provide as built GA drawings GPS making of connected consumers and their type of connection (single/three phase), domestic/commercial/agriculture etc. and connected loads.

## **20. Re-conductoring /Augmentation of LT line Using Covered Conductor:**

Conductor Used: XLPE Insulated Covered Conductor equivalent to ACSR Rabbit (50 Sqmm.)  
While stringing LT covered conductor proper accessories like Anchoring Clamps, IPCs etc shall be used. While drawing the covered conductor removing outer insulations shall strictly be avoided. IPCs are used for coil earthing the neutral line. IPCs, satellite connectors and distribution boxes as per Spec. to be used for giving service connections to consumers. Metallic ties not to be used for binding conductor on polymeric pin insulators instead helical UV plastic ties are to be used.

## **21. Conversion of LT Line Using Bare OH (Rabbit)**

All the construction standards to be followed as mentioned for LT reconductoring works using Bare OH

## **22. Conversion of LT Line Using AB Cable**

LT AB Cable of Sizes: 3X95+1X70+1X16 sqmm (insulated messenger)  
3X70+1X50+1X16 sqmm (insulated messenger)  
3X50+1X35+1X16 sqmm (insulated messenger)

The construction standards for Conversion of LT line Using ABC of above sizes to be followed as mentioned in LT reconductoring works using ABC.

## 1.00 Rates for Conversion of bare conductor lines to ABC

It should be noted that scope of work for this item relates to AB cable installation on existing poles. It excludes any additional works required on the existing poles or installation of new poles, installation of Distribution Box/SMC Distribution Boxes, stays etc. Separate BOQ items are provided for work associated with installation of new poles and replacement, re-alignment or relocation of existing poles, installation of stays and struts and installation of Distribution Box/SMC Distribution Boxes for AB cables.

## 23. 11 KV New line

Construction of 11 KV Line Using AB Cable of sizes.

- 8.01 Aerial Bunched Cable HT 3x150 + 1x120 sq.mm (Insulated Messenger)
- 8.02 Aerial Bunched Cable HT 3x120 + 1x95 sq.mm (Insulated Messenger).

## 1.00 Survey

Mapping of routes of proposed 11 KV lines shall be done by GPS survey. While surveying, existing electrical infrastructure, existing agriculture private tube well (PTW) locations, capacity and load details shall be mapped during survey.

Upon completion of the survey the Contractor shall provide a survey report with the following information;

- Single line diagram of the route survey and proposed line alignment details mapped and provided in a standard mapping software. This should also include information such as existing electrical infrastructure and PTW information.
- Road and railway crossing points of the proposed 11 kV line shall be marked on the single line diagram.
- Line sections proposed for 11 kV AB (Ariel Bunched) cables due to vegetation, safety and forest clearance issues (if applicable) shall be marked on the single line diagram. Lengths of proposed AB cable line sections shall be indicated.
- Estimated peak demand on each feeder/s upon implementation and percentage voltage regulation at farthest point on various spur sections.
- On the survey drawings Line to line crossing (HT/LT, LT/LT, HT/HT/Railways Crossing) details to be marked with available clearances. Effort shall be taken to avoid long zig-zag lines and too many line to line crossing while surveying and finalizing route maps/SLD.

Regarding stringing, testing and commissioning of new 11 KV line using AB Cable works should be follow as per the directions mentioned above as in reconductoring of 11 KV line using AB cable and drawings , technical specification provided.

## 24. New LT Line

## **1.00 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) on political map with fair correctness, be prepared. SLD and foot survey report shall be approved by Project Manager 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 Project Manager. This details shall be used as reference documents by Quality & Quantity Inspecting officials to execute inspection works.

## **2.00 Support for LT overhead Line:**

- a) 8 M/200 Kgs PSC Poles as per drawing and Specifications
- b) 9M/200 Kgs PSC Poles as per drawing and Specifications.

## **3.00 Fabricated steel items:**

Fabricated steel items like A Pole, clamps, stay clamp, etc shall be made of MS Channels, MS angle, MS flats as per approved drawings.

While fabricating, good quality electrical cutting tools and drill machine shall be used to ensure no sharp edges and perfect holes as per approved drawings. Gas cutting set should not be used for fabrication of MS steel items. Weld material shall be distributed equally between the two materials that were joined. The weld shall be free of waste materials such as slag. The weld surface should not have any irregularities or any porous holes (called porosity). The joint shall be tight. Most welds need to demonstrate the required strength. One way to ensure proper strength is to start with a filler metal and electrode rating that is higher than your strength requirement.

The fabricated steel structures materials shall be hot-dip galvanized thoroughly internally and externally according to IS: 2629 and IS: 2633 (with latest amendments). Galvanizing shall be checked and tested in accordance with IS: 2633.

Fabricated steel structure items shall be galvanized both inside and out. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the smelter bath that could have a detrimental effect on the durability of the zinc coating. Before pickling, all welding, drilling, cutting and grinding shall be completed and all grease, paint, varnish, oil and welding slag shall be completely removed.

All protuberances which could affect the life of galvanizing shall also be removed. To avoid the formation of white rust all galvanized material shall be packaged in such a way to ensure adequate ventilation between parts during shipping and storage.

Testing of galvanizing shall be performed for Uniformity of thickness as per IS 2633/1986, Mass of coating as per IS 6745/1972 and quantity of zinc, water quenching & centrifuging as per IS 2629/1985.

#### **4.00 Hardware:**

MS Nuts, bolts and washers (Galvanized) – of various sizes shall be used for tying of overhead structures wherever required.

While erecting, proper dimensions of nut-bolts and washers must be ensured. 2 to 3 threads only be visible of the bolt after full tightening of nut on requisite torque. The hardware shall be hot dip galvanized. The minimum coating of the zinc shall comply with IS: 2629 and IS: 2633. Galvanizing shall be checked and tested in accordance with IS: 2633. Before shifting them to site for erection, they shall be offered for inspection and approval by Project Manager.

#### **5.00 Stay set shall include the following items**

GI Stay Set includes

1. Stay Insulator Porcelain 11 k V - 1 Nos
2. Anchor Plate 200 x 200 x 6 mm GI (LT Stay Plate GI)
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4. Stay Wire 7/8 (7/3.15mm) GI (HT Stay Wire)
5. Stay Rod (Anchor Rod) GI 16 mm dia (LT Stay Rod)
6. Helically formed Guy-Grip LT
7. Thimble GI 75 mm x 22 mm x 40 mm ,1.5 mm Thickness (For HT and LT)
8. Stay clamp (GI ) etc as required as per technical specification, approved drawings and scope of work.

Stay set shall be used at all turning locations, cable dead end locations to nullify the tension of the cable. Erection of storm guys at suitable location in straight line may also be provided. Erection of storm guys at suitable location in straight line may also be provided.

0.2 cmt cement concreting in mixture 1 part cement, 3 part coarse sand, 6 part 40mm size aggregate stone chips (1:3:6). 2 Nos. guy insulator shall be provided in stranded GI wire at middle location between two turn buckles.

#### **6.00 LT ABC earthing Arrangement:**

At starting and end points, neutral cum messenger shall be pipe earthed using stranded insulated conductor (ABC conductor bits can be used). Wherever branching comes, at such points, Pipe earthing is to be done using IPC and stranded insulated conductor.

40 mm dia., 2500 mm long GI pipe earth electrode with test link, RCC pit, RCC cover plate , bentonite powder and other accessories complete shall be used.

#### **7.00 LT line shall form following areal bunched XLPE cables:**

- 7.01 3x70+1x50+1x16sqmm(insulated messenger)
- 7.02 3x95+1x70+1x16 sqmm (insulated messenger)

#### **8.00 Distribution Box/SMC Distribution Box:**

Single phase or three phase Distribution Box/SMC as per specification shall be provided for extending power supply to LT consumers. Distribution Box/SMC Distribution Box (DB) shall be mounted on LT pole with galvanized MS clamp of 40x3 mm size. Stainless steel strap and buckles. DB shall be earthed using 8 SWG GI wire. Satellite connections as per specification shall also be provided wherever necessary as per BOQ and direction of Project Manager. 1C 25 sqmm PVC un armoured Al cables shall be used for ABC to DB connections using IPC Type 2.

#### **9.00 Connection from ABC cable:**

1Cx25 sqmm **stranded** cable shall be used between LT ABC line and Distribution Box/SMC Distribution Box. IPC shall be used at LT line for tapping. While tapping connection from ABC cable, highly skilled lineman/wireman shall be deployed along with sophisticated cutting plier/tool so that no damage should result in AB cable conductor.

#### **10.00 Distribution Box/SMC Distribution Box Pole numbering:**

Each support pole should be numbered properly labelled using yellow base and black indication marks (number or digits). 40/50 mm height digits/words should be used for this purpose. Base shall be made using 2 or more coats of yellow enamel paint till good surface finish. Base preparation shall be completed before shifting of poles to site for erection. Base painting and marking of digits should be performed by a skilled and trained painter using branded enamel paint, Project Manager shall approve type and brand of enamel paint.

#### **11.00 Anti-climbing device only on Step poles:**

3.5 kgs, 2.5mm dia (12 SWG) galvanized barbed wire shall be used on each LT line support. Galvanized barbed wire should be properly dressed and crimped at termination. While wrapping the wire on support, proper tension should be maintained.

#### **12.00 Danger board only on step poles:**

Each support should be provided with a danger board with pole clamps as per approved drawing. Danger board should be in bi-lingual languages (local language and English). Clamp for danger board, nut-bolts and washers shall be painted with two or more coats of red-oxide and aluminum paints respectively till smooth surface before installation.

### **13.00 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 and H-Beam LT line supports and wide parallel beam supports.

In rural areas, PSC pole pit (of length  $1/6^{\text{th}}$  of pole length) shall be refilled with 200 mm average size of bolder mixed with excavated earth. Proper ramming shall be performed for better compaction. PSC pole at cut point and PSC poles erected on water logging area shall be grouted using cement concrete mixture similar to H-Beam & Tubular poles. Prior approval of Project Manager shall be obtained for concreting of PSC poles in water logging area. While preparing route survey report, water logging areas shall be earmarked.

While erecting supports (poles), shuttering must be used for concreting so that proper quantity of cement concrete mixture be used and assessed during inspection. During concreting proper compaction by means of mobile vibrator be provided. While starting work of support erection, gang wise shuttering and mobile vibrator shall be offered for inspection to Project Manager. While erecting support, mercury level gauge must be used to ensure vertical erection of support.

250mm dia X 12" inch size muffing shall be provided on steel tubular and H-Beam poles to prevent direct entry of rain water along the poles. Cement Concrete of 1:2:4 (1 part Cement, 2 parts coarse sand and 4 parts 20mm aggregate stones chips) shall be used for individual poles.

### **Dead Span**

Wherever additional line construction is required for dead span at transformer interlinking points, it shall be executed upon considering all safety standards and as per the direction of project manager. End caps shall be used at dead ends to prevent entry of moisture.

### **14.00 Quality & Quantity inspection and compliance to the observation:**

The line works, before or after commissioning/energization, shall be inspected by Quality Inspectors and State Inspection Inspectorate. Contractor shall provide all requisite details of line like approved survey report, as built drawings and joint measurement sheet to the inspector to conduct. Contractor shall rectify defects/deficiencies and submit compliance to the observations with supporting photographs in digital form within one month from receipt of observations.

## **15.00 Tree-cutting/trimming of tree:**

The Contractor shall count, mark and put proper numbers with suitable quality of paint at his own cost on all the trees that are to be cut/trim to obtain required tree clearance. Contractor shall pay compensation for any loss or damage for tree cutting due to Contractor's work. Wherever forest clearance is envisaged for execution of work, clearance of forest department for tree cutting, if required, shall be arranged by the Project Manager and compensation shall also be paid by the Project Manager. Necessary fee if required to pay to Govt. dept. for arranging such clearances shall be paid by Project Manager. However, the Contractor would require to provide all necessary assistance for execution of this work.

## **16.00 Statutory clearances:**

During execution of LT Line works, all statutory clearances shall be ensured for ground clearance, line-to-line clearance, road crossing clearance etc.

The earthing point of distribution transformer should be extended to the single phase beneficiary premises having en-route earth connection at every 6th supports. The earth conductor is to be connected with earth point provided in the premises of single phase consumers. The bearer wire shall be earthed at every sixth pole.

Bearer wire of LT AB cable shall be anchored through eyehook or dead end (anchor) clamps.

Extra length of continuous AB cable along with messenger / bearer wire shall be properly dressed and clamped.

## **25. Installation and commissioning of RMUs**

### **1.00 Scope:**

Supply, Erection, testing and commissioning of 11KV outdoor fully motorised SCADA Compatible, front cable entry type & both side extensible type RMU and extension modules with or without FRTU, with 11KV terminal protector boots, actuators for remote operations, fixing to anchor bolts, giving power and control wiring and connections, mounting the cable end termination with suitable type of cable clamps after glanding the cable, providing RDSS sign Boards, Danger boards etc complete as required including cost of all materials. RMU shall have slanting roof for avoiding water collection at top of RMU in Kerala climate especially considering heavy rain in the State. Suitable sealing compound shall be applied at all end covers, front covers etc. Site specific foundations have to be designed in certain locations such as across the drain or along with the wall of the drain or under a transformer structure etc. due to space constraints in the city area. The Add on C' and Add on T' must be compatible with existing RMUs at site. The erection, testing and commissioning shall be done as per IS 10118 parts 1 to IV - Installation and Maintenance of Switch Gears. Design of foundation to be specified and finalized in consultation with manufacturer.

Providing LT supply from nearest LT pole to the RMU using LT 2CX 10 sqmm armoured UG Cable if required shall be done by TKCS.

Following types of RMUs as per specification and standards shall be installed at various locations as per the direction of CoPA.

- a) 11kV, 630 A, SCADA compatible Extensible RMU CCC -Load break switch 3 nos.
- b) 11kV 630 A SCADA compatible Extensible RMU CTC - Load break switch 2 nos & VCB 1 No.
- c) 11kV 630 A SCADA compatible Extensible RMU CC - Load break switches 2 nos.
- d) 11kV 630 A SCADA compatible Extensible RMU Add on T - VCB 1 nos.
- e) 11kV 630 A SCADA compatible Extensible RMU Add on C-Load break switches 1 nos.
- f) 11kV 630 A SCADA compatible Extensible RMU CCCTT - Load break switches 3 nos & VCB 2 nos.
- g) 11kV 630 A SCADA compatible Bus coupler for extensible type RMU.
- h) 11kV 630 A SCADA compatible Extensible RMU gCCg - 2 Load Break Switches.
- i) 11 KV Sectionalizer with Load Break Switch (SCADA compatible).
- j) 11kV 630 A SCADA compatible Extensible RMU- CT- Load Break Switches - 1 No & VCB - 1 No.
- k) 11kV 630 A SCADA compatible Extensible RMU - CTTC - Load Break Switches - 2 Nos & VCB - 2 Nos.
- l) 11kV 630 A SCADA compatible Extensible RMU - CTTT - Load Break Switches - 1 Nos & VCB - 3 Nos.
- m) 11kV 630 A SCADA compatible Extensible RMU - CCCT - Load Break Switches - 3 Nos & VCB - 1 Nos.
- n) 11kV 630 A SCADA compatible Extensible RMU - CCCC - Load Break Switches - 4 Nos.
- o) 11kV 630 A SCADA compatible Extensible RMU- CCCCT - Load Break Switches - 4 Nos & VCB - 1 Nos.
- p) 11kV 630 A SCADA compatible Extensible RMU - CTT - Load Break Switches - 1Nos & VCB - 2 Nos.

The RMU shall be mounted on C-Channel (2 nos) of sizes 100x50x 10mm fixed (Front & Back side) above the plinth with 16 mm foundation bolts embedded in RCC form works as per approved design and drawing. All the foundation bolts shall be seated on the C- Channel and pillar foundation shall be constructed accordingly. Foundation bolts in the pillar for fixing the C- Channel shall be 16 mm dia with 300 mm length. The RMU shall be properly aligned. A gauge to ensure that the bolting shall not induce any undue mechanical stress and should check the ends of bus- bars to joint together. The foundation hold down bolts shall be grouted in the foundation and only when they are well set, the unit shall be bolted down. The verticality of the panels shall be checked and ensure only appropriate foundation hold down bolts, nuts & check nuts shall be used and all the necessary spring & flat washer shall be provided.

## **2.00 Foundation**

Construction of suitable foundation for RMU as per approved design, fixing to anchor bolts, giving power and control wiring and connections.:

The foundation for erection of RMU shall be made of RCC cast at site. The dimension of the pits for casting the pillar foundation shall be as per approved drawing and spec. The RCC for the RMU foundation should be in the ratio 1:1.5:3 (M20). In localities which are Subjected to flooding during the rainy season, the height of the base shall be suitably raised so that the bottom of the plinth is kept well above the high flood level.

RMUs shall be mounted on C channels of dimension 100X 50X 10 mm and shall be aligned properly. The plinth shall be cast as per the approved drawings and with the use of proper form work. After the RCC work is settled and cured, the plinth shall be finished with cement mortar in proportion of 1:2:4 of 6mm thickness. The contractor shall arrange water for curing the plinth for at least 7 days to give necessary strength. The sides of the RCC formwork shall be filled with the excavated earth and rammed properly to give it necessary strength so that the plinth does not tilt and loose its verticality at a later stage. Finally the plinth above the ground level shall be painted with black oil paint.

The contractor shall develop foundation designs for the RMUs based on the information furnished by the manufacturers of the same and after assessment of the soil conditions in the field and submit the same to the COPA. Only after approval of these designs and drawings the work should commence.

The finishing of the foundation above ground level shall be made with cement mortar and shall have a neat appearance. The work of casting the foundation at each location shall be commence only after the written approval of the Engineer. The cable trench below the RMU shall be filled with good quality sand after the cables are laid and terminated at the RMU.

All the materials like coarse and fine aggregates, cement, steel, bolts and nuts etc., shall be procured by the contractor and stored at a place convenient to the works without causing inconvenience to the traffic as far as practicable.

The height of the plinth shall be such that the bottom of RMU shell should normally remain 30 cms above the normal ground level

The excavation, shoring, strutting etc., shall be done as per the prevailing prudent civil engineering practice depending upon the field conditions. The base concreting, masonry shall be strictly as per approved drawings and in case any deviations from the approved drawings are required due to site conditions, the same shall be brought to the notice of the Site Engineer and his approval obtained. The extra-excavated earth remaining unused materials etc., shall be transported and dumped far away in a suitable place and the area shall be kept clean after the works.

### **3.00 Earthing Arrangements**

Two separate Pipe Earth using GI pipe of size 40mm dia, 2.5 M length shall be done and connected to two earth points of the RMU using GI strip of size 32x 6 mm and also interconnected with both earth

electrodes. The specification of earth electrode shall not be less than twice its depth below the ground level. The earth electrodes shall be strictly as per IS 3043. RCC Earth chamber with RCC covering slab as per spec and drawing to be provided at earth points. The earth resistance shall be measured and should be below 10 ohm. Earth ground enhancing material like bentonite powder etc shall be used for improving earth resistance. If the earth resistance of the measured exceeds 10 Ohm, soil treatment shall be made as detailed below. The earth pipe while driving into the ground shall not be hammered.

#### **4.00 Soil Treatment.**

The chemicals to be used for treatment are Calcium Chloride, Sodium Carbonate and Copper Sulphate. The applications of these chemicals consist of excavating a shallow basin around the top of the earth electrode, one meter in diameter and 30cm deep, and application of these chemicals in the basin thus formed. The basin should subsequently be filled with water several times allowing each time to soak around the ground, thus carrying the artificial agent to become diffused through the greater part of the effective cylinder of earth surrounding the electrode. The resistance of the earth electrode shall be measured three days after the treatment. Even after the treatment the resistance does not come down below 10 ohms, the matter should be referred to CoPA for further guidance.

#### **5.00 Installation of Ring Main Units:**

The panels/switch gear shall be properly aligned. The bus bar extensions shall be properly connected as per the manufacturer's instructions.

#### **6.00 Yard Metalling & Fencing of RMUs:**

Cleaning and levelling of RMU yard, after clearing vegetation, spreading 40 mm broken stone in yard for a thickness of 10 cm above bed of 10 cm thick 6 mm broken stone, after constructing a plastered curb wall (plastering CM 1:6 thickness - 10mm; applying cement primer, 2 coats emulsion) of height 20cm above ground and 10cm below level including cost of all materials and charges for conveying, spreading, consolidating etc. as per specification in vol II and direction of Project Engineer and painted as per Item no.28.0 of the SBD and as per IS :5

Constructing fencing of 2M height with suitable gate using steel work in MS Angles of size 75x75x6mm or suitable size with hot dip GI chain link of size 10 SWG 50mmx50mm size, MS flats, bolts and nuts etc applying one coat of iron primer and two coats of Aluminium paint for fencing post and gate frame, and

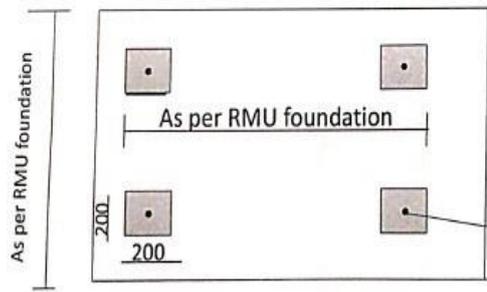
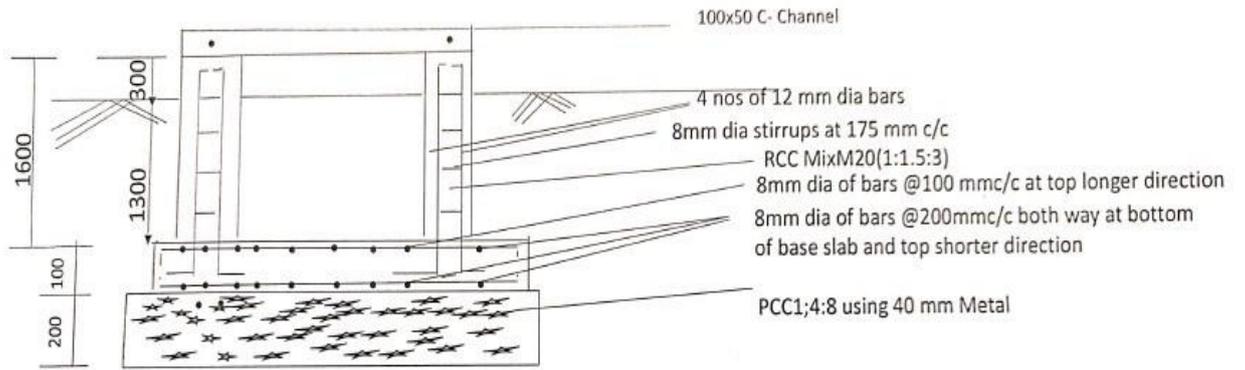
providing reflector at one side with road facing, Danger Board with letters " 11kV DANGER" (10cm height letters) along with danger symbol using reflective paint of good quality, RDSS sign board as per specification and earthing the fencing and doors with GI flat 25x6 mm to the nearest earth point (except LA)including cost of all materials and charges for labour, hire, welding, transporting, concrete muffing of MS Angles as per approved design. The curb wall should be finished and painted with 2 coats of standard specified colour.

#### **7.00 Pre-Commissioning Tests:**

The following pre-commissioning tests shall be conducted before commissioning

- i. Measurement of Insulation Resistance with the unit in closed and open positions.
- ii. Simultaneous closing and opening of circuit breakers and Load Break Switches.
- iii. Measurement of Insulation Resistance, checking of polarity and ratios of current transformers etc., by primary injection.
- iv. Checking of earth connections, short circuiting of spare current transformer cores.
- v. Checking of interlocks.
- vi. Time travel characteristics of Circuit breakers.
- vii. Contact resistance of all switches and circuit breakers.
- viii. Measurement of earth resistance.
- ix. Checking of earth leakage detectors and tripping of circuit breakers, both manually and through relays.

## RMU Foundation



*Note: As per RMU foundation all the foundation bolts shall be seated on the C-channel and pillar foundation shall be constructed accordingly.*

*Foundation bolts in the pillar for fixing the C-channel shall be 16mm dia with 300mm length.*

**12.1**

**12.2**

**12.3**

**12.4**

**12.5 Annexure-B**

General Technical Instructions

(This document is meant for the exclusive purpose of bidding against this Package and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued.)

## **Technical Instructions of RDSS**

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## **12.6 General Technical Instructions**

Following CEA regulations 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)

### **1.1. 11 KV line Support and DTR Substation support**

- 1.1.1. 9.0 meters PSC Pole or A- Poles as per prevailing practices of the state shall be used for 11 KV line. 152x152mm H-Beam (37.1kg/m) or Wide Parallel Beam 160x30.44 kg/m can also be used as support in urban/forest area and or Steel Tubular Poles/Wide parallel Beam (with expandable lengths through jointing plates) may be used in hilly area where head load shifting is the only option.

The single PSC pole supports shall be erected with Stone bolder/stone ballast mixed with excavated earth in normal soil. PSC poles in Double Pole structures, turning point structure, Distribution Transformer Substation structure shall be grouted in cement concrete mixture of 1:3:6 (1: cement, 3: coarse sand and 6 Stone ballast 40mm sizes). Single pole supports in water logging area shall also be grouted in cement concrete mixture of 1:3:6 (1: cement, 3: coarse sand and 6 Stone ballast 40mm sizes). PSC pole shall be grouted with concrete (0.6mx0.6mx1.35m) = 0.486 cmt.. In special location, wherever, Project Manager specifically decides, to enhance additional strength, concreting may be used as support foundation.

- 1.1.2. Pole earthing shall be performed through earthing coil duly connected with 8 SWG wire. The GI wires between pole structure and the earthing coil should not be used in cut length. Wherever, cut is evitable, proper nut bolt, washer and binding should be made as per REC specifications. The GI wire between support and earth coil should be placed 1 meter below the ground level.
- 1.1.3. Earth coil should be inserted 1200 mm away from pole.

### **1.2. Route And Terrain**

- 1.2.1. 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. The survey shall be approved by Project Manager. Accordingly requirements of materials shall be finalized by the turnkey contactor in association with Project Manager.

### **1.3. Detailed Survey**

1.3.1. The detailed survey shall be carried out for the approved feeders/spur lines by the Contractor and submitted for Employer approval.

#### **1.4. Profile Plotting**

1.4.1. 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.

1.4.2. Extension: An individual span shall be as near to the normal design span as possible. In case an individual span becomes too short with normal supports on account of undulation in ground profile, one or both the supports of the span may be extended by inserting standard body extension designed for the purpose according to technical specification.

1.4.3. 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. In case uplift is unavoidable, it shall be examined if the same can be overcome by adding standard body extensions to the poles failing which tension poles designed for the purpose shall be employed at such positions.

1.4.4. Horizontal Tensions on pin insulators are to be avoided by proper alignment of the line. In case where installation of DP structure is not possible to erect for turning the line, "two pins" arrangement with suitable jumpering shall be provided at all those locations where pins are subjected to horizontal tension. Bridling type V Cross arms for such installations shall be used by the agency accordingly.

#### **1.5. Road Crossing**

At all road crossings, the poles shall be fitted with horizontally aligned disc type tension insulator string(s) or bridling V-cross arm supports using double pin insulator per phase depending on the type of poles and line 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 33 KV and 11 KV lines. Also, cradle guarding is to be used at all the road crossing locations as per drawings / specifications enclosed.

#### **1.6. Railways Crossings**

Railway Crossings at pre-planned locality shall be selected in such a way that minimum feeder length shall be re-routed. The line crossing should be executed as per prevailing practices and approved drawings of railways. Railways crossing shall preferably be executed through underground cabling. Horizontal drill machine shall be used for this purpose. Required permission to block the Railways traffic and approval for railway crossing shall be arranged by the Employer at his own cost. All liaison works shall be performed by turnkey Contractor.

#### **1.7. 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 as per drawings / specifications enclosed.

### **1.8. Details En-route**

All topographical details, permanent features, such as well, trees, building etc. 75 m on either side of the alignment shall be detailed on the profile plan.

### **1.9. 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. Similarly, for the purpose of computing any horizontal clearance of an over-head line, the maximum deflection of any conductor shall be calculated on the basis of the wind pressure specified by the State Government under rule 76 (2) (a) [or may be taken as 35°, whichever is greater]. Following clearances shall be maintained by the Contractor while executing the work:

A. 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 and medium voltage lines | 5.8 meters |
| (b) For high voltage lines           | 6.1 meters |

B. No conductor of an over-head line, including service, lines, erected along any street shall at any part thereof be at a height less than

- |  |            |
|--|------------|
| (a) For low & medium, voltage lines  | 5.5 meters |
| (b) For high voltage lines   | 5.8 meters |
| (c) For Low, Medium & high voltage lines above 11,000 volts ,<br>If insulated. | 4.0 meters |

For extra-high voltage lines the clearance above ground shall not be less than 5.2 meters plus 0.3 meter for every 33,000 volts or part thereof by which the voltage of the line exceeds 33,000 volts:

Provided that the minimum clearance along or across any street shall not be less than 6.1 meters.

C. CLEARANCE FROM BUILDINGS OF LOW AND MEDIUM VOLTAGE LINES AND SERVICE LINES:

Where line is to cross over another line of the same voltage or lower voltage, pole with suitable extensions shall be used. Provisions to prevent the possibility of its coming into contact with other overhead lines shall be made in accordance with the latest CEA regulations (as amended from time to time). The Contractor will required to under cross higher voltage lines by erecting

gantries/suitable Rail Pole structures.

Where a low or medium 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 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
- b) For pitched roof
  - i. When the line passes above the building a vertical clearance of 2.5 meters immediately under the lines, and
  - ii. When the line passes adjacent to the building a horizontal clearance of 1.2 meters. The horizontal clearance shall be measured when the line is at a maximum deflection from the vertical due to wind pressure.

**D. CLEARANCE FROM BUILDINGS OF HIGH AND EXTRA-HIGH VOLTAGE LINES:**

Where a high or extra-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

	For High Voltage Lines up to and including 33,000 volts	3.7m
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**1.10. Electrical System Data**

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

Minimum corona extinction voltage for Not less than 27 kV, 50 Hz ac system under Dry condition (rms) phase to earth

Radio interference voltage at one MHz for Not exceeding 1000 micro-volts 27 kV (dry condition)

**1.11. 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 short poles can be used and will 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. Special attention should be given to the locations of poles, where the ground washes badly. Poles should not be placed along the edges of cuts at or embankment or along the banks of creeks or streams.

### **1.12. Construction**

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

- (1) Pit marking, pit digging (of depth  $1/6^{\text{th}}$  of pole length).
- (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.

### **1.13. Erection of DP Structure for Angle Locations**

Cut point to be used for angle of deviation more than 30 degree. The pit digging (of depth  $1/6^{\text{th}}$  of pole length) 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.

### **1.14. Concreting**

The concreting mixture of one cum 1:3:6 ratios would mean 1 part cement, 3 parts coarse sand and 6 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.

### **1.15. Providing Of Guys To Supports**

Guys are installed at locations where terminal poles are erected at sectional cut points. These cut points may be in same alignment or at turn points. Guys are installed to nullify tension on supports resulted due to conductors tension. In spite of careful planning and alignment of line route, certain situations arise where the conductor tries to tilt the pole from its normal position due to abnormal wind pressure and deviation of alignment, etc. When these cases of strain arise, the pole is strengthened and kept in position by guys. 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.

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 45 degree.

Before start of erection of Stay sets, required concreting materials like Cement, Sand, Stone Chips and Construction water need to be made available near the pit.

G.I. stay wires of size 7/4.00 mm (8 SWG), for 16 mm/20 mm stay rods are to be provided. 6 Kg. Stay Wire (7/ 3.15 mm) per Stay with 20 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.

After concreting, back filling and ramming must be done well and allowed 7 days to set. The free end of the guy wire/stay wire is passed through the eye of the anchor rod, bent back parallel to the main portion of the stay/guy and bound after inserting the G.I. thimble, where it bears on the anchor rod. If the guy wire proves to be hazardous, it should be protected with suitable asbestos pipe filled with concrete of about 2 m length above the ground level, painted with white and black strips so that, it may be visible at night. The turn buckle shall be mounted at the pole end as directed by Project Manager of the stay and guy wire so fixed that the turn buckle is half way in the working position, thus giving the maximum movement for tightening or loosening.

### **1.16. 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. Guy insulators are to

be used in stay wires only. All stay conductors are to be provided with guy insulators as per following specifications.

1. 11 KV line stay – Two stay insulators.

### **1.17. 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. In case, the cross-arm is to be mounted after the pole is erected, the lineman should climb the pole with necessary tools. The cross-arm is then tied to a hand line and pulled up by the ground man through a pulley, till the cross-arm reaches the line man. The ground man should station himself on one side, so that if any material drops from the top of the pole, it may not strike him. All the materials should be lifted or lowered through the hand line, and should not be dropped.

### **1.18. Insulators And Bindings**

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 (Polymeric only)
2. Disc type (Polymeric only)

The pin type Polymeric insulators will be used for straight stretch of line. The polymeric 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 Disc 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 intending 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. They shall be dipped into water for 24 hrs. and then tested for insulation resistance tests at the stores. The insulators found fit in IR testing shall be sent to site for erection. 11KV and 33 KV insulators shall be tested by at-least 1 KV megger whereas LT insulators shall be tested by 500 Volts megger.

### **1.19. 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 conductor drums to site, precautions are to be taken so that the conductor does not get damaged/injured. The drum could be mounted on cable drum support, which generally is made from crow-bar and wooden slippers for small size conductor drums. The direction of rotation of the drum has to be according to the mark in the drum so that the conductor could be drawn. While drawing the conductor, it should not rub causing damage. The conductor could be passed over poles on wooden or aluminum snatch block (pulley) mounted on the poles for this purpose.

When approaching the end of a drum length at least three coils shall be left in place when the stringing operations are stopped. These coils are to be removed carefully and if another length is required to be run out a joint shall be made as per the recommendations of the accessories manufacturer.

The mid span jointing is done through compressions or if helical fittings are used the jointing could be done manually. After completing the jointing, tensioning operation could be commenced. The conductor is pulled through come-along clamps to stringing the conductor between the tension locations.

Conductor splices shall not crack or otherwise be susceptible to damage in the stringing operation. The Contractor shall use only such equipment / methods during conductor stringing which ensures complete compliance in this regard.

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. Each part of the joint shall be cleaned by wire brush till it is free of rust or dirt, etc., and be properly greased with anti-corrosive compound. If required and as recommended by the manufacturer, before the final compression is carried out with the compressors.

All the joints or splices 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. The compression type fittings shall be of the self-centering type or care shall be taken to mark the conductors to indicate when the fitting is centered properly. During compression or splicing operation, the conductor shall be handled in such a manner as to prevent lateral or vertical bearing against the dies. After compressing the joint, the aluminum sleeve shall have all corners rounded; burrs and sharp edges removed and smoothed.

During stringing of conductor to avoid any damage to the joint, the Contractor shall use a suitable protector for mid span compression joints in case they are to be passed over pulley blocks / aerial rollers. The pulley groove size shall be such that the joint along with protection can be passed over it smoothly.

### **1.20. Tensioning and Sagging Operations**

The tensioning and sagging shall be done in accordance with the approved stringing charts or sag tables. The “initial” stringing chart shall be used for the conductor and “final” stringing chart for the earth-wire. 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, before transferring the conductors from the running blocks to the suspension clamps. The conductor shall be clamped within 36 hours of sagging in.

The sag will be checked in the first and the last section span for sections up to eight spans and in one additional intermediate span for sections with more than eight spans. The sag shall also be checked when the conductors have been drawn up and transferred from running blocks to the insulator clamps.

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.

Tensioning and sagging operations shall be carried out in calm weather when rapid changes in temperature are not likely to occur.

### **1.21. 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. Fasteners in all fittings and accessories shall be secured in position. The security clip shall be properly opened and sprung into position.

### **1.22. Fixing of Conductors and Earth wire Accessories**

Conductor and earth-wire accessories supplied by the Contractor shall be installed by the Contractor as per the design requirements and manufacturer’s instruction within 24hours of the conductor / earth-wire clamping. While installing the conductor and earth-wire accessories, proper care shall be taken to ensure that the surfaces are clean and smooth and that no damage occurs to any part of the accessories or of the conductors.

### **1.23. Replacement**

If any replacements are to be effected after stringing and tensioning or during maintenance e.g. replacement of cross arms, the conductor shall be suitably tied to the pole at tension points or transferred to suitable roller pulleys at suspension points.

Sagging of conductor has to be in accordance to the Sag Tension chart. In order to achieve it, it is preferred to pull the conductor to a tension a little above the theoretical value so that while transferring it from the snatch blocks to the pin insulators and to take care of temperature variation. Proper sag could be achieved. Sagging for 33/11 KV line is mostly done by "Sighting". A horizontal strip of wood is fixed below the cross-arm on the pole at the required sag. The lineman sees from other end and the sag is adjusted by increasing or decreasing the tension. The tension clamps could then be finally fixed and conductor be fixed on pin-insulators. All fittings, accessories like guys, cross-arms, etc., could be checked as they should not have deformities.

The maximum permissible spans for all the lines of 33/11/0.4 KV are prescribed according to the design of the supports. Sag-tension charts for these conductors are to be followed.

#### **1.24. 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 5 degree 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.

#### **1.25. Kind And Size Of Tie Wire To Be Used**

Helically formed fittings are to be used for tying the insulators, end terminal connectors etc.. The tie should always be made of soft annealed wire so that it may not be brittle and injure the line conductor. A tie wire should never be used for second time. Specifications of helically formed fittings are given in this section.

#### **1.26. Rules Of Good Tying Practice**

1. Use only helically formed fittings.
2. Use of size of tie wire which can be readily handled yet one which will provide adequate strength.
3. Use length of tie wire sufficient for making the complete tie, including an allowance for gripping with the hands. The extra length should be cut from each end if the tie is completed.
4. A good tie should

- a. Provide a secure binding between line wire insulator and tie wire.
  - b. Have positive contacts between the line wire and the tie wire so as to avoid any chattering of the contacts.
  - c. Re-enforce line wire in the vicinity of insulator.
- i. Apply without use of pliers.
  - ii. Do not use the wire which has been previously used.
  - iii. Do not use hard drawn wires for tying.

### **1.27. Conductors At Different Voltages On Same Supports**

In urban area, lines are to be erected with provision for forming lines of two different gradients as under

- a) 11 KV Line and LT Lines

Where conductors forming parts of systems at different voltages are erected on the same supports, the Contractor shall make adequate provision to guard against danger to linemen and others from the lower voltage system being charged above its normal working voltage by leakage from or contact with the higher voltage system; and the methods of construction and the clearances between the conductors of the two systems shall be as described in the specifications.

The agency shall be intimated by the Project Manager in writing about the locations where such provisions is intended by him. At all such locations, the Contractor shall make adequate provision to guard against danger to linemen and others from the lower voltage system being charged above its normal working voltage by leakage from or contact with the higher voltage system.

### **1.28. Earthing**

Earthing shall generally be carried out in accordance with as per IS 3043 and as per 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 PSC poles the metal cross-arms and insulator pins shall be bonded and earthed at every pole for HT lines.
- 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 & PSC) 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) In special locations and special structures, road crossings etc., pipe/rod Earthing should be done on either side of the construction.
- g) 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 REC standard J-1.

Following shall be the earthing requirements:

No	Description	Type of Earthing
1	Single Pole - PSC/ A Pole	1 No. Coil at each SP
2	Double pole - PSC/ A Pole	2 Nos. Pipe earthing at each DP
3	Road crossing	GI Pipe / Chemical earthing on either side one each
4	Telephone line crossing	GI Pipe / Chemical earthing on either side one each
5	DP with Isolating switch	2 Nos and GI Pipe

### 1.29. Anti-Climbing Devices on Step poles:

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. Barbed wire binding is to be adopted for this purpose at a distance of 30 to 40 cm at a height of 3 m from ground level. The barbed wire shall conform to IS – 278 (Grade A1). The barbed wire shall be given chromatin dip as per procedure laid down in IS: 1340. At-least 3.5 kgs barbed wire is to be used per Step pole for the purpose.

### 1.30. Testing And Commissioning

When the line is ready for energization, it should be thoroughly inspected in respect of the following:

- a) Poles-Proper alignment, concerting and muffing (A poles & poles at marshy & water logged areas)
- 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. At the time of testing through megger person should not climb on the pole or touch the guarding, conductor, guy wire etc.

- 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 Project Manager 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. Acknowledgement of all the workmen in writing should be taken in token of having intimated them.
- d. Wide publicity by Tom-toming 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.

### **1.31. 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 Project Manager.

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

### **1.32. Guarding**

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. Guarding is to be provided in major road crossing as per directions of Project manager CoPA.

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 generally conforming to IS: 2633/72 & suitable for 8m, 9m & A poles. 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.

### **1.33. 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.

#### **1.34. LT Lines and Service connection**

- a. The LT line shall be erected of single phase or three phase arrangements through Bare Conductor/AB Cable/Covered Conductor depending on site requirements. Every 5<sup>th</sup> pole of LT line shall be earthed with GI Coil as per specifications.
- b. In all those locations where LT AB cable is to be erected on the same support in which 11KV or 33KV line is also erected, proper isolation is to be maintained.

## Annexure-C

1. The claim for sixty percent (60%) payment (first instalment) for the supply of major materials will be admitted only for those materials supplied for execution of works that are agreed and approved by the Project Manager.
2. The materials supplied in actual for the successful completion of works like stringing/laying of conductors (ABC/UG Cable/ACSR/Covered Conductor) including sag and loop shall only be admitted for measurement and the quantity of materials supplied in excess should be taken back by the turnkey Contractor at his own cost. For labour portion, the measurement is admissible only as per circuit length mentioned in the erection part of BoQ.
3. The quantity provided in the BoQ for the subject tender is only provisional. After conducting detailed survey, the turn key contractor has to prepare Bill of Quantity based on detailed survey and got it approved by the Project Manager, before proceeding to manufacturing and delivery of materials.
4. Tree cutting comes under the scope of the bidder and compensation will be given by the CoPA Contractor is liable to pay compensation for any loss or damage for tree cutting due to Contractor's work.
5. For the supply and installation of RMU, a Service Level Agreement (SLA) will have to be executed after award of work, on mutually agreed terms & conditions for services during the warranty period of RMU.
6. The vendor and specification for minor materials shall be got approved by the Project Manager before procurement of the same.
7. The Contractor shall perform/supply any additional work, material or spare part which are not specifically mentioned in the BOQ but is required for attaining the completion of the work without any extra payment.

### Guarantee Period of Major Materials used in RDSS Works

<b>SI No</b>	<b>Material</b>	<b>Warranty Period</b>
1	RMU/ Circuit Breaker	3 years from date of commissioning
2	Aerial Bunched Cables HT & LT	3 years from date of commissioning
3	3 x 300 Sqmm XLPE UG cable	3 years from date of commissioning
4	Distribution Transformer	5 years from the date of commissioning