

ANNEXURE-A1

EMPLOYER'S REQUIREMENTS

Section - 6 : Employer's Requirements

Table of Contents

Section - 6 : Employer's Requirements.....	2
1. Overview of the Scope of Works	3
2. Survey.....	6
3. Project Management System.....	7
4. Quality Assurance and Evaluation Mechanism	8
5. Type and Acceptance test.....	27
6. Type Testing, Inspection, Testing & Inspection Certificate.....	27
7. Pre-Commissioning Tests.....	30
8. Commissioning Tests	30
9. GIS mapping & asset tagging.....	30
10. Documentation	31
11. Return of replaced old materials to the area stores of Employer	35
12. Miscellaneous activities	35
13. Individual work components	38
13.1. 11 KV Covered Conductor (MVCC) and its accessories	38
13.2. Renovation/Augmentation of 11 kV line.....	47
14. Other.....	67

1. Overview of the Scope of Works

The work of Site survey, designing, engineering, procurement, supply, loading, transportation, unloading, insurance, delivery at site, handling, storage, installation, testing, commissioning including documentation of all items/material required to complete works for Turnkey Based Contract for 11 KV AL-59 ACS Medium Voltage Covered Conductor (MVCC) with its accessories with Pole in feeder of Rajkot City Circle of PGVCL under SI Scheme (Package-01) 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 above said work are to be executed in the predefined phase manner work to achieve targets as per Action Plan of SI SCHEME .

The scope of works also include General Tmentical Instructions enclosed at Annexure-B :-

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

- Providing engineering data, and drawing for review, approval and records.
- Supply, testing, packing, transportation and insurance from the manufacturer's work to the site.
- Receipt, storage, insurance, preservation and conservation of equipments at the site.
- Fabrication, pre-assembly (if any), erection, testing and putting into satisfactory operation of all the equipments/ materials including successful commissioning.
- 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.
- Providing all materials, equipments 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.
- During execution of work, existing Transformers on DP structure shifted to plinth, as per the drawing attached herewith, after finalization of survey decided by Engineer-in-Charge.
- Erection of Pole shall be strictly as per design provided in this tender. However, For any specific location, if the design for pole may vary, in that condition, the revised design will be provided by PGVCL and the bidder is bound to supply & erect that updated design pole. No any extra cost shall be paid to contractor.
- During warranty period the bidder is required to provide all the services and activities mentioned in the contract.

- 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.
 - Handing over the works to the employer for taking into commercial services.
- 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 for substations & its structures 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 All the Distribution Transformers procured under SI SCHEME are procured with Standard ratings, meeting at least Energy Efficiency Level-1 as specified in IS 1180 (Part-1):2014 and its Amendment 1, 2, 3 & 4, should be manufactured by an authorised licensee and bear BIS certification standard mark.
- 1.4 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.
- 1.5 All the new assets created under SI SCHEME to be properly GIS tagged with the help of mobile App provided by the Employer.
- 1.6 The engraving of word “Developed under SI SCHEME” 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.
- 1.7 Major infrastructures like new primary substation, new Distribution Transformer, new lines etc developed under SI SCHEME needs to be clearly denoted by a signboard that should represent
- 1.7.1. About the Work
 - 1.7.2. Date of Commissioning
 - 1.7.3. Estimated cost
 - 1.7.4. Scheme
 - 1.7.5. Employer's details
 - 1.7.6. For Transformers, rating in kVA

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

- 1.8 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 SI SCHEME are:

11 KV AL-59 ACS Medium Voltage Covered Conductor (MVCC) with its accessories PSC/RSJ pole

The 11 KV AL-59 ACS Medium Voltage Covered Conductor (MVCC) with its accessories with PSC/RSJ pole shall be confirming to relevant applicable IS Specification (along with latest amendments). All the Mid span Joints, End Termination and Tapping to/from the 11 KV Medium Voltage Covered Conductor (MVCC) shall be made by using proper insulation accessories whereby ensuring that no metal part of the 11 KV Medium Voltage Covered Conductor (MVCC) at the joint is exposed to the air. The stringing of the 11 KV Medium Voltage Covered Conductor (MVCC) on the pole shall be by using proper accessories of Tension clamp/Suspension clamp etc. whereby ensuring that no mechanical stress shall be created on the cable.

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:-

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 in co-ordination with concerned Engineer-in-charge of Subdivision 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 mobilise so as to take-up the works in parallel at ll supports on given shut-down area. Contractor shall deploy well educated and experience engineer to take care of shut down, and earthing of lines, check clearances on completion of works, return shut down and ensure re-energisation 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-energisation 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.

Power Outage- Permission will be provided on the staggered holiday declared by Authority and as per mutually decided with the Executive engineer of respective Division offices/ Deputy Engineer of Sub Division Office.

Proper pole to pole span length required in the line. It should be Approx. 40 Meter SPAN length Considered.

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, 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 decending 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. Proposed route of 33 KV, 11KV and LT Line.
- b. Proposed location of 66/11 KV sub-stations along with number, capacity of power transformers and number of 11 KV feeders to be taken out.
- c. 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.
- All architectural and civil designs such as control room, foundation for equipment, transformer, isolators, VCB shall be approved by the Employer's Engineer-in-charge.
- Within substation yard, all clamps and connectors used for bus-bar will be crimped. All the clamps and connectors connecting the equipments shall be of bolted type.

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 employer 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.
- c) To actively participate in monitoring, reviewing and analysing the physical, financial and quality assurances works' progress of SI SCHEME works and also to take suitable

measures on compliance of observations being raised during monitoring/review meetings with employer.

- d) To oversee the progress and compliance of the Quality Assurance Mechanism as per SI SCHEME 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 Authorised representative of employer responsible & accountable for assuring quality in SI SCHEME 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 SI 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 SI 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 all 66/11 or 33/11 kV sub stations (New & Augmented) for quality of material as per MQP/GTP, Approved Drawings, Technical Specifications, Datasheet and erection works in the field as per FQP/approved drawings.
- c. 100% verification of feeders created under the scheme.
- d. 100% verification of materials utilised under the scheme.

4.1.1. Vendor approval: All the materials procured for SI SCHEME works shall be purchased from the authorised 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.

Vendor approval for the item is mandatory before the commencement of project. The Contractor is required to get the Manufacturer of the tendered item/s registered as an approved vendor in the DISCOMs of the GUVNL/GETCO within the commencement period, if not registered. No separate time period will be granted for the approval of the vendor.

List of existing Vendors is put up on the website of the PGVCL, MGVCL, UGVCL, DGVCL, GETCO, & GSECL. The list to approved vendors available on the website of the

concerned subsidiaries GUVNL is subjected to verification of its validity based on Official records.

- 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. Contractor.
- 4.1.3. FQP for testing & commissioning:** Employer shall prepare a comprehensive Pre-commissioning test Check-list for testing & commissioning of 33/11kV or 66/11kV substation, Distribution transformer Substation, 11KV MVCC, Pole 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.
 - Supply:

- Verification of qualifications of the subcontractor / manufacturer for supply of plant / equipment and materials. Factory inspections may be conducted if required.
 - Verification of material data, specifications, drawings and samples submitted by the subcontractor / manufacturer including GTPs.
 - Verification of type test reports including qualifications of the test laboratory, completeness and acceptance of the type test reports.
 - Witnessing acceptance tests carried out by the subcontractor/ manufacturer.
 - Carrying out pre-dispatch inspections as per relevant guidelines of this tender/ contract.
 - Inspection of storage facilities of the subcontractor/ manufacturer.
 - Works:
 - 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.
 - Issue Site Observation Reports (SOR) and follow-up with the subcontractor/ manufacturer for implementation of any remedial actions.
 - Upon completion, carry out joint inspections together with the Employer's staff and for final measurements and quality inspections.
 - 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 user department (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 procurements 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. Insulators, 5. Cables (ABC/XLPE/MVCC).
- 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/manufacture (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 from where sample is picked up.
 - d. Such picked up materials at a random shall be tested for all routine and acceptance tests feasible to conduct in the empaneled laboratory alongwith verification of type test reports (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 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) Deleted

7)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
- 8) Electrical Inspector inspection:** Electrical Inspector inspection: After successful completion of the only new Line work (excluding replacement 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 PGVCL/Nodal agencies:** In addition to the in-house quality checks and processes followed by the Employer, the PGVCL/Nodal Agency 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 PGVCL/Nodal Agency:** The PGVCL/ Nodal Agency 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 man power.

TPQMA shall also verify 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 fully completed works) is given below:

- i. 100% New Power Substations.
- ii. 100% Augmented Substations.
- iii. 100% of HT feeders (in terms of sanctioned/ awarded length of project i.e. district covering at least 100% of total sanctioned number of HT feeders) for each voltage level and / configuration (OH/AB/UG/HVDS) including bay extensions as applicables.
- iv. 5% of HT feeder re-conducotring/ replacement/ renovation work (in terms of sanctioned / awarded length of project i.e. district covering at least 5% of total sanctioned number of HT feeders) for each voltage level and configuration (OH/AB/UG)
- v. 100% of new DTR Substations (11/0.4kV), for each kVA levels.
- vi. 100% of capacity audmentation of DTR Substations (11/0.4kV), for each kVA levels.
- vii. 5% of LT lines (in terms of sanctioned /awarded length of Project i.e. District/ Circle) for each configuration (OH/AB/UG).
- viii. 5% of LT lines reconductoring/ replacement / renovation work (in terms of sanctioned /awarded length of Project i.e. District/ Circle) for each configuration (OH/AB/UG).
- ix. 5% of any other works sanctioned in DPR with sanctioned value more than 5% of sanctioned cost.
- x. IT/OT/SCADA/DMS infrastructure - primarily at system level/ field level for highlevel functional checks.
- xi. Certain % of 11 kV MVCC as may be decided.
- xii. Certain % of Pole as may be decided.

4.2.2. Field Works Quality Inspection:

The TPQMA shall carry out 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 final inspection (stage - III) for verification of rectification of defects/descrepancies / non-conformities identified in the previous stage of inspecton.

For this:

- 1) TPQMA shall submit the report after inspections to PGVCL/ Nodal Agency along with all BoQ, Photographs, SLD, etc.
- 2) 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 SI SCHEMES by turnkey contractors during project implementation).

- 3) 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.

(i) **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 PGVCL/ Nodal Agency: The PGVCL/ 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, Wedge Connectors, 11KV MVCC, Pole etc. 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 1st 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 alongwith 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 beared 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 PGVCL/ 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 Transformer Covering 5% quantity spread across two major manufacturer or supplier along with the representative of the Employer and Contractor.
- e) Material Inspection by TPQMA (deployed by PGVCL/ Nodal Agency) by sampling from field: Following materials shall be picked from site stores for testing at NABL testing laboratories empaneled by PGVCL/ Nodal Agency/ TPQMA.
 - 1. Distribution Transformer 2. Overhead Conductor 3. Pole 4. Insulators 5. Cables (ABC/XLPE/MVCC).
 - i. The equipment shall be sealed jointly in presence of TPQMA, representative of Employer, Contractor and supplier/ manufacturer (if its representative is available at site).
 - ii. At least one sample of each material shall be subjected to inspection from each Project area (District/ Package). The TPQMA / PGVCL/ Nodal Agency may devise a mechanism for randomize selection of the samples.
 - iii. The Employer shall be responsible for safe handling, packaging and transportation of sealed material up to the identified testing laboratories. All expenses related to logistics and transport shall be reimbursed to the Employer/ TPQMA, as the case may be by Nodal Agencies.
 - iv. The TPQMA shall also witness the testing at the testing laboratories.
 - v. The laboratory expenses towards inspection, testing charges etc. shall be borne by TPQMA/ PGVCL/ 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

4.3.6.1. 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 PGVCL/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) Power Transformer,
- 2) Circuit Breaker,
- 3) Insulators,
- 4) Cables / Conductors
- 5) Control & Relay Panel,
- 6) Distribution Transformer

4.3.6.2. 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. An indicative list of IS specification and tests for some of the materials are given below:

Medium Voltage Covered Conductor (MVCC)

Standards Applicable and Proposed tests for Medium Voltage Covered Conductor (MVCC) are specified in separately attached Technical Specifications.

The list of tests are as specified in Technical specifications, 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 discretion. All required tests to be carried out as per technical specifications for concerned material.

4.3.6.3. 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.

4.3.6.4. 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. 2nd 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 SI SCHEME 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) 2nd 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 SI SCHEME 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 SI SCHEME 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:

Sr. No.	No. of Material/lot rejected in a project/district	% Penalty imposed on contract price
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 penaltied 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

Annexure-A

Checklist for Quality Assurance

11 KV 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	Cross-bracing on Double poles are provided				
8	Conductors are passing through the top groove of the insulator (creepage distance compromised)				
9	More than one joint in one span				
10	Any deflecting tension on 11 KV pin insulator				
11	Proper tensioning of overhead conductor				
12	Any knot/wrapping of overhead conductor is there during erection				
13	Proper binding of insulators is done				
14	Stay plates are properly grouted in cement concrete mixture				
15	Proper tensioning is there on stay set				
16	Proper alignment of Stay wire with overhead conductor is there to nullify tension				
17	Guy insulator, anchor plate/ thimble/ hardware are provided with stay set				

S. No	Description	Status (Yes/No)	Observations	Location	Picture No.
18	Proper erection of stay clamp using 12 mm dia nuts and bolts and 50x6 mm (or more) size clamp				
19	If every 6th pole in a section of line is provided with stay sets to avoid line deflection				
20	Proper galvanization of stay wire and stay set				
21	Thimble is provided on turn buckle of stay set				
22	Proper phase to phase clearances are maintained on the line				
23	Steel overhead structure is properly earthed using 8 SWG wire				
24	Each 11 kV pole individually earthed using 8 SWG Earth wire and separate Earth pit/Earthing coil/Earth spike				
25	Quality and size of danger plates is as per scope of work				
26	Danger plate is installed at appropriate height using proper clamp as per scope of work				
27	Anti-climbing device (barbed wire/spike) are installed at appropriate height on individual support				
28	Individual pole is numbered				
29	Individual pole is imposed/painted with the name of scheme				
30	Surface of the PCC poles is finished and there are no steel wire visible				
31	No physical damages appeared on PCC pole surface				
32	Cradle guard earthing is provided on each road crossing or on each LT line crossing				
33	Proper tensioning of the cradle guard wires				

S. No	Description	Status (Yes/No)	Observations	Location	Picture No.
34	Proper Guard wires are provided in case of Road crossing as per drawing specification				
35	8 SWG G.I. wire is properly dressed with support for V-Cross arm/Channel/Top clamp earthing				
36	GI wire to GI wire jointing is provided using 12 SWG GI nut bolts and washers				
37	GI wire connection to earth pit is using 12 mm GI nut bolt and washer				
38	Earth pipe is properly inserted inside earth without pipe hammering				
39	Masonry enclosure is provided over individual pipe earth pits				
40	Funnel is provided over pipe earth pit				
41	Proper jumpering using binding practices/PG clamp				
42	If under sized conductor used				
43	Proper conductor clearances to ground is there to avoid bird fault on end sectionizer support where disc insulator are used				
44	Proper pole to pole span length in the line. It should not be less than 50 m.				
45	If Pole to pole span is less than 50 m, record the reason with pole numbers				
46	Number of poles used per kilometre of the line				
47	Record type and size of overhead conductors used in the line				
48	Shuttering is used during casting of cement concrete foundation				
49	Cement-concrete grouting foundation of end supports				
50	Measure quantum of cement concreting in any one sample support				

S. No	Description	Status (Yes/No)	Observations	Location	Picture No.
51	Measure cement concreting foundation in any one sample of stay set pit				
52	Proper painting is done on steel structure				
53	Disc Insulators are installed precariously (loose bolts/ missing cotter pins)				
54	D -shaped loop for jumpers are maintained				
55	Any broken insulator found in the line				
56	Surface finish and painting on Steel tubular pole/RSJ/H Pole/Rail pole				
57	Adequate tree cutting on either side of line done				
58	Pole to pole schedule enclosed with proforma				
59	Pole numbering with "SI SCHEME" inscription not done (properly)				
60	Engraving of poles (Name of Manufacturer, SL Nos etc.) not done				
61	Line Spacers not used				
62	Guy insulator not used in stay wire				
63	Inadequate length of barbed wire				

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.

Note:- The contractor shall require to submit the valid type test report of the Material within the commencement period. No separate time period will be granted for submission of the valid Type test report. The Type tests should have been carried out within 7 (seven) years prior to the date of opening of this tender.

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

6.1 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.

- 6.2 The reports for all type tests and additional type tests as per technical specification shall be furnished by the Contractor alongwith 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.
- 6.3 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.
- 6.4 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.
- 6.5 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.

- 6.6 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.
- 6.7 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.
- 6.8 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.
- 6.9 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.
- 6.10 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.
- 6.11 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.

- 8.1 Any special equipment, tools and tackles required for the successful completion of the Commissioning tests shall be provided by the Contractor, free of cost.
- 8.2 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.
- 8.3 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

9.1 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 SI SCHEME over the same platform. Various electrical assets i.e Power Transformers, Distribution Transformer, HT & LT lines with over head 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 is limited to updating the GIS co-ordinates and the associated mapping information of the new assets created/upgraded on the platform provided by the Employer using the **mobile app (s)**. However no additional payment shall be made to the Contractor for these works.

9.2 Key activities under the scope:

1. 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.
2. 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.
3. The vendor should create a physical marking procedure with consultation and approval of Employer and mark each assets and consumer that have been surveyed
4. Vendor will start collecting intended data from newly commissioned and / or upgraded infrastructure commissioned in SI SCHEME and submit the same with the Employer nodal / team for approval.
5. 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.
6. 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

- All 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.
- In respect of accountal 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 33 KV, 11 KV line and LT line, distribution transformers sub stations, 33/11 KV sub-station 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 33 KV & 11 KV lines, 33/11 KV sub stations, distribution transformer sub 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 equipments, 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 [1] 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.

[1] 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.

13. Individual work components

13.1. 11 KV AL-59 ACS Medium Voltage Covered Conductor (MVCC) with its accessories with PSC/RSJ pole

1. SCOPE:

1.1 Conversion of existing bare conductor by 11 KV AL-59 ACS Medium Voltage Covered Conductor (MVCC) with its accessories with PSC/RSJ pole

- 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 Aluminium Alloy (AAA) type 11 KV covered conductor and its relevant accessories 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 base conductor used to manufacture the covered conductor shall require to confirm the latest standards and its amendments thereof. The AAA Conductor shall be conforming to IS 398(Part-IV), IEC: 104-1987/IS 9997:1991 with the latest amendment and the insulation for covering shall be conforming as per the requirement given in Table-1 of the standard EN50397-1:2006 with the latest amendments. The accessories of the covered conductor shall be conforming to EN50397-2:2009 with the latest amendments.
- The AAA Covered conductor shall conform in all respects to the highest standards of Engineering, design, workmanship, the technical specifications and the latest revisions of relevant standards at the time of offer and the authorized person of DISCOM have the power to reject any work or materials, which his judgment, is not in full accordance therewith.

1.2 Conversion of existing bare conductor by 11 KV AL-59 ACS Medium Voltage Covered Conductor (MVCC) with its accessories with PSC/RSJ pole

- 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 AL59 ACS type 11 KV covered conductor and its relevant accessories 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 base conductor used to manufacture the covered conductor shall require to confirm the latest standards and its amendments thereof. The AL59 ACS Conductor shall be conforming to SS 424 08 13, SS 424 08 14 & IEC 61232:1993 with the latest amendment and the insulation for covering shall be conforming as per the requirement given in Table-1 of the standard EN50397-1:2006 with the latest amendments. The accessories of the covered conductor shall be conforming to EN50397-2:2009 with the latest amendments.
- The AL59 ACS Covered conductor shall conform in all respects to the highest standards of Engineering, design, workmanship, the technical specifications and the latest revisions of relevant standards at the time of offer and the authorized person of DISCOM have the power to reject any work or materials, which his judgment, is not in full accordance therewith.

The scope also covers the work of crediting the dismantled conductor/material to concern division store.

2. Survey

Mapping of route of proposed new 11 kV 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 Inspecting officials to execute inspection works.

In case of feeder separation, existing agriculture load shall be mapped during survey. A report to be presented indicating location wise pumps to be fed through separate feeder. Percentage voltage regulation at farthest point on various spur sections shall be examined during survey and submitted to project manager who will take a decision for feeder separation works.

3. Support (pole):

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

- a) PSC POLE 8 meter long /200 KG (PCC Pole as per state practice)

- b) 9 Mtrs. Long M.S. Beam 116 x 100 mm, 23.00 kg/mtr
- c) 11 Mtrs. Long M.S. Beam 116 x 100 mm, 23.00 kg/mtr
- d) 13 m long M.S. Beam 150 x 150 mm, 34.6 kg/mtr

<In rural area, Employers may use PCC poles are to be used. In urban area, Employer may use PCC or Galvanized H-Beam or STP or Wide Parallel Beam supports of suitable length. In hilly areas where handling of material is a challenge, tubular poles or Wide Parallel Beam GI poles expandable with jointing plates may be used. In location specific conditions like forest area, vicinity of other existing overhead lines or permanent structures etc, H- beam or tubular poles or Wide Parallel Beam supports may be used of suitable length.

Steel bottom plate shall be used in steel tubular poles/H-Beam / Wide parallel Beam and cement concrete reinforced plate shall be used as base plate for PCC poles>. Steel tubular poles shall be cleaned till good surface finish and painted with 2 or more coats of red oxide paint and 2 or more coats of aluminium paint till good finish. Steel tubular poles and H-Beams shall also be painted with 2 or more coats till good surface finish with anti-corrosive paint (in case of tubular poles shall also be painted on the inner walls) which goes in to the foundation. Project Manager shall approved brand and shade of paints.

4. Fabricated steel items:

Fabricated steel items like V cross arm, top clamp, DC cross arm, bracket, clamps, cross bracings, bracings, strain plate, guarding channels, back clamp, transformer mounting structure 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.

5. 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.

6. 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 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. 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.

7. Earthing:

Following earthing arrangements are envisaged for new 11 kV lines:

- a) 40 mm dia., 3000 mm long GI pipe earth electrode with test link, RCC pit, RCC cover plate on GI frame, bentonite powder and other accessories complete
- b) GI Earthing spike made of 20mm solid rod, Chemical rod earthing using Carbon powder/Bentonite powder / Conductive concrete powder including electrode with 2000mm long, 50 mm diameter GI pipe, GI Strip of 24x3mm minimum. 6 SWG GI wire for earthing and guarding
- c) 8 SWG GI wire for earthing and guarding
- d) Maintenance free type earthing

Each 11 kV line support shall be provided with one GI earthing spike made of 20 mm solid rod or GI Earth Coil and connected with 8 SWG GI wire. Overhead line structure shall be connected to GI earthing spike or GI Earth Coil using 8 SWG GI wire. GI nuts, bolts & washers shall be used to join two GI wires and 20 mm solid spike rod. Project Manager shall decide use of GI Earth Coil or 20mm dia GI Solid Rod for individual pole earthing.

At railway crossing, line crossing and other specific locations 40 mm dia, 3000 mm long GI pipe earth electrode with test link, RCC pit, RCC cover plate on GI frame, bentonite powder and other accessories shall be used. Overhead line structure at these locations shall be connected to GI earth pipe using 8 SWG GI wire. GI nuts, bolts & washers shall be used to join two GI wires and 40 mm GI earth pipe.

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 nuts, bolts & washers shall be used to join two GI wires and 20 mm solid spike rod.

In road crossings and line crossings, 6 SWG GI wire shall be used for cross lacing and 8 SWG wire shall be used for guard wires.

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

8. 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 & tape/helical form fitting. In road crossing and line crossing locations bridling cross arms and pin insulator shall be used.

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.

9. ACSR / AAAC Conductors:

Following ACSR Conductors (or equivalent AAAC Conductor) are envisaged for new 11 kV lines:

- a) 6/2.11 + 1/2.11 mm (20 mm² Al. Area) - Squirrel
- b) 6/2.59 + 1/2.59 mm (30 mm² Al. Area) - Weasel
- c) 6/3.35 + 1/3.35 mm (50 mm² Al. Area) - Rabbit
- d) 6/4.09 + 1/4.09 mm (80 mm² Al. Area) - Raccoon
- e) 6/4.72 mm+7/1.57 mm (100 mm² Al. Area) - Dog

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, 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.

Proper sag should be maintained using sag chart table. 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.

10. 11 KV AB Switch:

11 kV, 3-ph, 600 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.

11. 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 kV supply on same structure, at source structure, at cut points should exclusively be provided as per state practice.

12. Anti-climbing device:

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

13. Danger board:

Each support 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 aluminium paints respectively till smooth surface before installation.

14. Support foundation: The foundation detail for various strata having soil bearing capacity of 12 Ton/Cmt, 15 Ton/Cmt and 18 Ton/Cmt are attached foundation drawing. The SBC shall be checked at interval of 500 Mt throughout the length of feeder and as per actual Soil Bearing Capacity the type of foundation shall be executed as per instruction of Engineer-in-charge.

15. 11 kV line for underground railway crossing –

Two separate composite items of 11 kV line railway crossing is kept in BoQ. One is with 300 sq.mm cable & another one with 185 sq.mm cable.

2 Nos. separate cables shall be laid in separate GI pipe enclosures. At a time, one shall be used and another shall be kept idle as spare in ready to connect condition. Cable termination, cable identification, protective covering, laying of jumpering cable etc shall all be completed in this head. These composite items shall contain following sub-items:

- a) 3Cx185 (3Cx300) sqmm XLPE armored cable (approx. length is 0.3 km each) - 2 sets
- b) 150mm dia GI pipe of A class (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 3-meters long pipe earthing,
- g) 6 SWG GI wires with GI nuts, bolts & washers,
- h) Cable markers,
- i) Bi-metallic clamps,
- j) Jumpering with 11 kV Arial Bunched Cables 200 Sqmm dia (10 mtr) etc - 4 sets
- k) Maintenance free type earthing

Detail survey of location of railway crossing be performed by Contractor to avoid multi-crossing at nearby location. Prior railway permission for execution of this work shall be obtained by Project Manager for which necessary technical support shall be provided by Contractor. 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.

16. Quality & Quantity inspection and compliance to the observation:

The line works, before or after commissioning/energisation, 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.

17. 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.

18. 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.

13.2. Renovation/Augmentation of 11 kV line

- 1.00 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:
 - i. PSC POLE 8 meter long /200 KG (PCC Pole as per state practice)
 - ii. 9 Mtrs. Long M.S. Beam 116 x 100 mm, 23.00 kg/mtr
 - iii. 11 Mtrs. Long M.S. Beam 116 x 100 mm, 23.00 kg/mtr
 - iv. 13 m long M.S. Beam 150 x 150 mm, 34.6 kg/mtr
- 2.00 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. 6/3.35 + 1/3.35 mm (50 mm² Al. Area) - Rabbit by replacing existing weasel/squirrel conductor
 - b. 6/4.09 + 1/4.09 mm (80 mm² Al. Area) - Raccoon by replacing existing rabbit/weasel/squirrel conductor
 - c. 6/4.72 mm+7/1.57 mm (100 mm² Al. Area) - Dog by replacing existing raccoon/rabbit conductor
- 3.00 While executing this work, mid span pole with all fittings may be provided matching with existing poles of the line.
- 4.00 Following works shall also be executed by Contractor under this head -
 - a. Replacement of damaged insulators
 - b. Straightening of tilted supports by providing additional foundation or by providing boulders etc as required.
 - c. Revamping of pole earthing and replacement of GI earth wire.
 - d. Labelling, providing danger board, providing anti climbing device and painting of all the poles shall be in the scope of work
 - e. Replacement of damaged/bent V-cross arms & top clamps with new ones
 - f. Providing of stay set wherever required
 - g. Providing of guarding wherever required
 - h. 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.

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 SI SCHEME

1.1.	33 V Line support.....	Error! Bookmark not defined.
1.2.	11 KV line Support and DTR Substation support	51
1.3.	Route And Terrain.....	52
1.4.	Detailed Survey	52
1.5.	Profile Plotting	52
1.6.	Road Crossing	53
1.7.	Railways Crossings.....	53
1.8.	Telecommunication, LT or HT Line Crossing	53
1.9.	Details En-route	54
1.10.	Clearances - General.....	54
1.11.	Electrical System Data.....	55
1.12.	Pole Location.....	55
1.13.	Construction	55
1.14.	Erection of DP Structure for Angle Locations	56
1.15.	Concreting.....	56
1.16.	Providing Of Guys To Supports	56
1.17.	Guy Strain Insulators.....	57
1.18.	Fixing Of Cross-Arms	58
1.19.	Insulators And Bindings	58
1.20.	Conductor Erection.....	59
1.21.	Tensioning and Sagging Operations	60
1.22.	Clipping In	60
1.23.	Fixing of Conductors and Earthwire Accessories.....	61
1.24.	Replacement	61
1.25.	Tying Of Conductor On Pin Insulators	61
1.26.	Kind And Size Of Tie Wire To Be Used.....	62
1.27.	Rules Of Good Tying Practice.....	62
1.28.	Conductors At Different Voltages On Same Supports	62
1.29.	Earthing.....	63
1.30.	Anti-Climbing Devices	64
1.31.	Testing And Commissioning	64
1.32.	River Crossing	65
1.33.	Guarding	66
1.34.	Repair to conductors.....	66
1.35.	LT Lines and Service connection	Error! Bookmark not defined.

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. Connectivity Regulation - Technical Standard for connectivity to the grid (Amendment) Regulation 2013; Technical Standards for connectivity of the Distributed Generation resources, 2013; Central Electricity Authority (Grid Standard) Regulation, 2010 (as amended time to time)
- d. Metering Regulations - Central Electricity Authority (Installation and Operation of meters) Regulations, 2006; Central Electricity Authority (Installation and Operation of meters) (Amendment) Regulations, 2010 and 2015 (as amended time to time)
- e. 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. 8.0 meters or equivalent PCC Poles as per prevailing practices of the state shall be used for 11 KV line and substation support. 152x152mm H-Beam (37.1kg/m) or Wide Parralel 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 PCC pole supports shall be erected with Stone bolder/stone ballast mixed with excavated earth in normal soil. PCC 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). PCC 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.

In forest, wherever special care is to be made for elephant corridors, 13m long, 152x152mm RS Joist (37.1kg/m) / **Wide Parallel Beams 160x 30.44 kg/m** may be used for 11 KV line support.

152x152mm H-Beam (37.1kg/m)/ Steel Tubular Poles/ Wide Parallel Beams 160 x 30.44 kg/m shall be grouted in cement concrete mixture of 1:3:6 (1: cement, 3: coarse sand and 6 Stone ballast 40mm sizes) in all the formation.

1.1.2. Pole base plates as per specifications shall be used.

1.1.3. 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.

1.1.4. Earth coil should be inserted 1200 mm away from pole.

1.2. Route And Terrain

1.2.1. The scope of HT/LT length of feeder are enclosed with the tender documents. On award of the contract, Contractor shall perform foot survey to access the route, pole location and thus Single Line Diagram of the line works. The survey shall be approved by Project Manager. Accordingly requirements of materials shall be finalized by the turnkey contractor 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:

1.9.1. CLEARANCE ABOVE GROUND OF THE LOWEST CONDUCTOR: No conductor of an over-head 11KV line, including service lines, erected shall at any part thereof be at a height less than,

- (a) Across the Street - 6.5 meter
- (b) Along the Street - 5.8 meter
- (c) Elsewhere - 4.6 meter

1.9.2. 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:-

For any flat roof, open balcony, verandah roof and lean-to-roof, Building or part their of etc...

- i. When the line passes above the building a vertical clearance of 3.7 meters from the highest point; and
- ii. When he line passes adjacent to the building a horizontal clearance of 1.2 meters from the nearest point, and

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

Note:- Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023 and its amendment time-to-time must be followed.

1.10. Electrical System Data

	<u>33 KV</u>	<u>11KV</u>
Nominal voltage	33 kV	11KV
Maximum system voltage	36 kV	12KV
BIL (Impulse)	170 kVp	75KV
Power frequency withstand voltage (wet)	75 kV (rms)	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 of streams.

1.12. Construction

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

- (1) Pit marking, pit digging.
- (2) Erection of supports and concreting.

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

1.13. Erection of DP Structure for Angle Locations

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

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

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

1.14. Concreting

The concreting mixture of one cum of M-25 grade with 1:1:2 ratios would mean 1 part cement, 1 part coarse sand and 2 part 20 mm aggregate size stones. It may be noted that while preparing the concrete mixture, the proper Water-cement ratio shall be maintained to achieve concrete strength.

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.

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

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

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 7/3.15 mm (10 SWG) & 7/4.00 mm (8 SWG), for 16 mm/20 mm stay rods respectively, are to be provided. 8.5 Kg. Stay Wire (7/4.00 mm) per Stay with 20 mm Stay rod for 33 KV line and 5.5 Kg. Stay Wire (7/ 3.15 mm) per Stay with 16 mm Stay rod for 11 KV lines are to be used. For double pole structure (DP), four stays along the line, two in each direction and two stays along the bisection of the angle of deviation (or more) as required depending on the angle of deviation are to be provided. Hot dip galvanized stay sets are to be used. One stay to counter the angular deformation force shall be used.

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 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.

11 KV line stay	Type C guy insulator (1 No)
-----------------	-----------------------------

33 KV line stay

Type C guy insulators (2Nos)

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
- (2) Strain type

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

The strain insulators are intended for use at terminal locations or dead end locations and where the angle of deviation of line is more than 10°. Strain insulators are also 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 na d33 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 conductors 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 smoothened.

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 / aerail 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 Earthwire 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 24 hours 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 pit 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

- a. Use only helically formed fittings.
- b. Use of size of tie wire which can be readily handled yet one which will provide adequate strength.
- c. 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.
- d. 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.
- e. Apply without use of pliers.
- f. Do not use the wire which has been previously used.
- g. 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

b) 33 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 linesmen 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 are intended by him. At all such locations, the Contractor shall make adequate provision to guard against danger to linesmen 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 the requirements of latest CEA regulations (as amended from time to time) and the relevant regulations of the Electricity Supply Authority concerned and as indicated below:

- a) All metallic supports shall be earthed.
- b) For PCC poles the metal cross-arms and insulator pins shall be bonded and earthed at every pole for HT lines.
- c) All special structures on which switches, transformers, fuses, etc., are mounted / likely to mount should be earthed.
- d) The supports on either side of the road, railway or river crossing should be earthed.
- e) All supports (Steel & PCC) HT lines passing through inhabited areas, road crossings and along such other places, where Earthing of all poles is considered desirable from safety considerations should be earthed.
- f) 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 - PCC/RS Joist/steel tubular	1 No. Coil/Spike Earthing at each SP
2	Double pole - PCC/RS Joist/steel tubular	2 Nos. Coil/Spike Earthing at each DP
3	Substation Poles structure - PCC/RS Joist/steel tubular	GI Pipe/ Chemical Earthing 3 Nos
4	Road crossing	GI Pipe / Chemical earthing on either side one each
5	Telephone line crossing	GI Pipe / Chemical earthing on either side one each
6	DP with Isolating switch	Coil/Spike earthing 2 Nos and GI Pipe / Chemical earthing 1 No

1.29. Anti-Climbing Devices

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

1.30. Testing And Commissioning

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

- Poles-Proper alignment, concerting and muffing.
- Cross-arms - Proper alignment.
- Finishing of fabricated steel items used.
- Insulators - Proper finish, cleanliness, insulation resistance.
- Binding, clamps and jumpers - To check whether these are in reach.
- 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 in tact.
- 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 not required for crossings of 66 KV and higher voltage lines where the transmission line is protected by fast acting relay operated circuit breaker of modern design with a tripping time of the order of 0.25 sec. from occurrence of fault to its clearance. For all other crossings, guarding is essential for all telecommunication lines and major road crossing.

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 13 m 52 kgs/m rail pole & for 8.0 meters long RCC 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. A sketch showing arrangement of guarding at road crossing is enclosed with tender drawing.

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.

14. Other

“Liaisoning for Preparation of site drawing and approval / NOC of Electrical inspector &

other local utilities like telecom networking, GAS, water, drainage, road authority, Maha Nagar Palika, Nagarpalika is in scope of contractor. The stipulated fees for getting the NOC / way-leave / approval shall be paid by DISCOM, after submission and verification of adequate invoice / demand note received from respective Govt. Authority.

Liasoning with Western Railway Department and their respective competent authority. The contractor shall acquire the necessary permission from the Railway Authority for carting the cable and before handing over the cable for actual loading condition.

While working within Railway boundary any damage to the railway infrastructure, asset and / or system shall be liable to the contractor. The contractor shall have to make the payment of the damage as assessed by the Railway Authority.

The trench excavation and filling-in shall be so executed that all walls, roads, sewers, drains, pipes, cables, structures, places and things shall be reasonably secured against risk of injury and shall be carried out to the satisfaction of the authorities concerned.

However, in case, during the time of work if any damage(s) is caused by the contractor or agency to the any Govt./Non-Govt. organizations/Utilities, the contractor shall repair the affected services immediately to restore the affected services in a good services. Also, all the necessary compensation shall require to be paid by contractor, if demanded by Authority. The PGVCL will not reimburse the same.

Any accident may occur during the execution and contract period; it will be the sole responsibility of contractor or agency to pay any compensation to the victim/ legal heir of victim as per the prevailing applicable law. The PGVCL will not reimburse the same.