A. **33/11KV SUBSTATION WORK:** This includes construction of new 33/11 kV Substations, capacity augmentation of existing s/s both by adding a new transformer and by replacing the existing transformers. Addition of new 33 kV line bays in the existing 132/33 kV or 33/11 kV is also envisaged in some packages***. (Scope of respective package may kindly be referred to as mentioned in section- I of this TS.)***

The scope of works also includes the following works related to fibre optic based communication system:

- Installation, testing & commissioning of communication terminal equipment in both existing and new s/s

Details of the same are provided at Section V & VI

8.0 GENERAL

8.1 Design & engineering of substation and its associated electrical & mechanical auxiliary systems is included in the scope and includes preparation of single line diagrams and **Foundation layout,** electrical layouts, erection key diagrams, electrical clearance diagrams, design calculations for earth mat and Direct Stroke Lightning Protection (DSLP). control and protection schematics, wiring and termination schedules, civil designs and drawings, firefighting, indoor and outdoor lighting/illumination, road, drain, boundary wall, fencing and other relevant drawings & documents required for all facilities within the boundary wall of substation to be provided under this contract, are covered under the scope of the Contractor***.***

8.1.1 ACDB, DCDB including supply & erection of battery, battery charger and accessories shall be supplied, erected and commissioned by the Contractor. Rating/sizing of these distribution boards shall be such so as to take care of the load requirements of the entire substation.

8.1.2 Land selection shall be done by POWERGRID in association with concerned DISCOM. Contractor shall be responsible to develop the land including its filling keeping HFL (highest flood level) in view, leveling, and construction of drainage, fencing and boundary wall with gates.

8.1.3 Contractor shall arrange the power and water required during construction at site.

8.1.4 Contractor shall involve manufacturers' representative during erection, testing and commissioning of Circuit Breakers, Power Transformers and C&R Panel at least for one **of each type/Manufacturer**.

8.1.5 Supply and erection of the 33/11 kV Power transformers, 33 kV and 11 kV Circuit breakers, isolators, current transformers, voltage transformers, surge arresters, CT & PT etc. To carry out all civil works including equipment foundations, trenches, supply & erection of equipment structures are in contractor's scope.

8.1.6 Surge arrestors of suitable rating shall be supplied and erected on the 11kV and 33 kV line and on 33 kV and 11kVside of the 33/11 kV power transformer.

8.1.7 Complete Indication, control, relay and protection system bay wise for the sub station.

8.1.8 Fire fighting system consisting of portable fire extinguishers (DCP and CO2 type).

8.1.9 LT SWITCHGEAR (AC/DC DISTRIBUTION BOARDS)

8.1.9.1 Batteries & Battery Chargers shall be supplied erected and commissioned as per specification enclosed at relevant Section of this document.

8.1.9.2 1.1 kV grade PVC, Power & Control cables along with complete accessories and laying. Supply of the power and control cables shall be as per specification enclosed at relevant Section of this document.

8.1.9.3 Supply and erection of the galvanized structures as per specification enclosed at relevant Section of this document.

8.1.9.4 Insulator strings and hardware, clamps & connectors, bus bar, jumpers, droppers and Earthing materials, Bay marshaling box, cable supporting angles/channels, Trench cover, Junction box, cable trenches etc.

8.1.9.5 Contractor shall install the fluorescent industrial tube lights each having tube light with reflectors of Philips/Crompton/Bajaj/Havell make or equivalent reputed brand and other accessories as per specification enclosed at relevant Section of this document.

8.1.9.6 Terminal connectors of all types & rating for all the equipment (including terminal connectors for transformers).

8.1.9.7 LA on 33 KV side of Power Transformer shall be installed on separate structure but as close to the transformer as permitted by the site conditions.

8.1.9.8 In case of outdoor S/S, PT with Isolator shall be provided on each section of 33 KV &11KV bus.

8.1.9.9 CT/PT shall have square base to facilitate mounting of these equipment by rotating 90 degree, if required.

Contractor shall ensure coordination between CT ratio and Relay plug setting to facilitate operation of Power Transformer/Line at 50-110%, in steps, of rated current.

“Stud cum disconnecting type terminal blocks shall be provided for CT/PT secondary circuits. This provision shall facilitate site testing of CT/PT. For all other equipment, terminal block shall be of stud type.

8.1.10 CIVIL WORKS

8.1.10.1 Leveling of the sites shall be in the scope of the contractor as per The BOQ.

8.1.10.2 Contractor shall use ordinary soil for leveling obtained from borrow pits free from logs, stumps roots, rubbish or any other ingredients likely to deteriorate or affect the stability of site surface including the breaking the clods maximum to 60 mm. Cube, placing the earth in layers not exceeding 225 mm in loose thickness, rough dressing including cost of cutting and removing shrubs, roots falling in borrow area all complete as per approved design, (Mode of measurement sectional measurement after required compaction) the cost for royalty, if any to be paid to the local authority for fill materials from borrowed pit shall be included in BOQ against earth work.

8.1.10.3 Before proceeding with the construction work of the new substation, the Contractor shall fully familiarize himself with the site conditions and general arrangements, scheme etc. Though the owner shall endeavor to provide the information, it shall not be binding for the owner to provide the same. The contractors are advised to visit the substation site necessarily and acquaint

themselves with the topography, site land contour and profile, HFL, infrastructure required & available and also the design philosophy before submitting the offer. The contractor shall be fully responsible for arranging all equipment, materials, system and services specified or otherwise, which are required to complete the construction and successful commissioning, operation & maintenance of the substation in all respects.

a) Soil investigation at three points per new substation.
b) All concrete grades shall be M-20 in substation work.

8.1.11 EARTHING OF THE SUB STATION

8.1.11.1 Contractor shall carry out measurements of the earth and then design the earth mat such that earth resistance, in no case, exceeds 2 ohm. Contractor shall also design and construct earth pits for the transformer neutral, transformer body, LA and fencing. The supply and laying of earth mat shall be paid as per the provisions of the BPS.

8.1.11.2 The earth mat shall be constructed using **75x8mm MS flat** and the riser shall be constructed using 60x8 mm **GI flat** as per detailed Engineering Requirement. The earth mat /earthing/ pits shall be laid in new as well as the existing sub-station where new line/transformer bays are to be constructed.

8.1.11.3 Contractor shall be responsible for designing the earth mat of the switchyard in such a way that the specified value of the ground resistance (as per IS/IEEE) is achieved. Contractor shall be responsible for meeting step and touch potentials as specified in relevant IS.

Use of deep-driven ground rods/ earth electrodes as detailed in the Annexure may also be used for achieving desired soil resistivity values in case of high soil resistivity.

Treated pipe type Earthing shall be used for LA's, **Earthing spikes.** and also for neutral **& body** of power & station transformers. Rod type Earthing using **20**mm dia. 3000mm long GI rod shall be used at all other points like fencing etc. Contractor shall connect the electrode with the switchyard earth mat including supply of the required material which is not envisaged in the Supply BPS. **A suitable mix of Bentonite Clay & Black Cotton soil is permitted in place of salt & coke.**

Also, the material should generally conform to IEC 62561 Part-7 which will use for Soil treatment to lower resistivity. The material should be permanent and maintenance free. It should not dissolve or decompose or otherwise pollute the soil or local water table & environment and should not depend on the continuous presence of water or moisture in the surrounding to maintain its conductivity. The material of the earthing enhancing compound in its set form should have a resistivity of less than 0.12 ohm-m (as per IEEE 80-2000 Cl. No. 14.5(d)). It should have hygroscopic properties and should not cause burns, irritation to eyes, skin etc. Test report for the following test on Earthing enhancement compound (conducted at accredited laboratory as per IEC 62561 Part-7) shall be submitted by the contractor to the site in charge.

- **Resistivity test using soil box**
- **Leaching test**
- **Sulphur determination**
- **Corrosion test**

8.1.12 LIGHTNING PROTECTION (DSLP)

8.1.12.1 Direct stroke lightning protection (DSLP) shall be designed, supplied & installed in the switchyard by installing peaks on gantry towers to the maximum extent possible. In case, in order to design effective DSLP system, any other structure (other than the gantry tower peaks) is required, the same shall be paid for.

8.1.12.2 The lightning protection shall not be in direct contact with underground metallic service ducts and cable.

8.1.12.3 Conductor of the lightning protection system shall not be connected with the conductor of the safety earthing system above ground level

8.1.12.4 Lightning conductor shall not pass through & run inside GI conduit.

8.1.13 MISCELLANEOUS ITEMS

8.1.13.1 Construction of boundary wall with barbed wire fencing on top along substation property line along with one gate.

8.1.13.2 Construction of fencing in the switchyard area with gates.

8.1.13.3 Any other items not specifically mentioned in this specification but required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in contractor's scope unless specifically excluded.

8.1.13.4 Meteorological-Data - For design purposes, ambient temperature should be considered as upto 50 deg. C and relative Humidity as 100 %, height above mean sea level at certain locations may exceed 1000 meters. Wind speed of 55 meter/sec may be taken for design purpose. These factors will be taken into consideration while designing the equipment/structures.

8.1.13.5 Soil Data -The contractor shall be responsible for carrying out the required tests and should fully satisfy himself about the nature of soil expected to be encountered prior to the submission of bid. Any variation of soil data during detailed engineering or construction stage shall not constitute a valid reason in affecting the terms and conditions of the bid.

8.1.13.6 The cost of terminal connectors for the equipment (like transformer, CBs, Isolators, instrument transformer, LA etc.) shall not be included in the cost of the respective equipment. All the terminal connectors for all equipment and for construction of bus shall be supplied on lump sum basis separately, as provided in the BOQ. This shall supersede any provision in the equipment specification for terminal connector. **These connector are included separately under the item "Clamp & Connectors…" in supply BPS.**

8.1.13.7 The scope also include addition of new 33 kV line bays, addition of a new 33/11 kV transformer and replacement of existing transformer with a new one in existing substations. While carrying out this job the following shall be in scope of contractor's work.

8.1.13.7.1 In case of replacement of an existing transformer, to the extent possible, new equipment shall be installed on the existing structure (if required by modifying the existing structure to some extent). The existing transformer foundation shall also be modified to suit the new transformer.

8.1.13.7.2 Completing 33 kV and 11 kV side connections using ACSR wolf conductor including supply of conductor, clamps and connectors etc.

8.1.13.7.3 Extension of existing earth mat, gravel filling etc. in the bay extension area.

8.1.13.7.4 Contractor may visit the existing substation sites before bidding.

8.1.13.7.5 Wherever shutdown of the running system is required, contractor shall submit written request for the same to concerned DISCOM/Electricity Deptt. at least 7 days in advance.

8.1.13.7.6 Contractor shall have to supply and erect all clamps, connectors, hardware etc including jumpers for carrying out the augmentation of transformer capacity. Necessary T&P required during the work shall be arranged by the contractor.

8.1.13.7.7 Contractor shall have to use existing approach road for transporting **all** goods and material to substation site and **road strengthening, repair etc. wherever required, is included in contractor's scope**.

8.1.13.7.8 Necessary construction water and power shall be arranged by the contractor.

8.1.13.7.9 Bay extension works at 33/11 kV sub-stations for shall be constructed. The scope shall include the following:

8.1.13.7.10 Erection and commissioning of the bay including supply of all equipment, necessary hardware and conductor.

8.1.13.7.11 The land shall be handed over to the contractor by Concerned DISCOM/Electricity Deptt..

8.1.13.7.12 Contractor shall be responsible to supply the equipment as per Technical specification.

8.1.13.7.13 Necessary foundation drawings shall be submitted to POWERGRID for approval.

8.1.13.7.14 Earthing (new / strengthening) of all the equipment shall be in the scope of the contractor.

8.1.13.7.15 Supply shall include 33 kV VCB including its control and protection panel.

8.1.13.7.16 Contractor shall submit detailed layout and GA of the bay for comments and approval.

8.1.13.7.17 Civil works like equipment foundations, cable trenches, drains, developing the bay area, laying earth mat shall be the responsibility of the contractor.

8.1.13.7.18 Contractor shall supply erect all power and control cables necessary for safe O&M of the bay.

8.1.13.7.19 Contractor shall include the bus extension if needed and termination of the 33 kV line to the gantry on one side and 33/11 kV power transformer toward yard end.

8.1.13.7.20 Installation of 11 KV breaker panel and bus coupler panel.

8.1.13.7.21 Extension of the auxiliary supply AC from the existing ACDB shall be arranged by the contractor. In case existing ACDB does not have necessary capacity, a provision has been kept for a new ACDB.

8.1.13.7.22 Provision has been kept for a new DC system i.e. battery & battery charger.

Annexure

Technical Specification for deep boring/ drilling for installation of 40mm Dia MS Ground Rod for 33/11kV substations

1.0 GENERAL

1.1 Preamble

Wherever it may not be possible to obtain a low impedance grounding system by conventional method, use of deep-driven ground rods/ earth electrodes are envisaged to achieve safe limit for touch as well as step potential. In such a case, it is proposed to achieve the requisite resistivity by driving the earth electrode upto 50m depth from ground level.

1.2 SCOPE OF WORKS

2.0 The scope of works includes

(a) Drilling in all kinds of Soil/Boulder/Rock upto 50mtr depth below ground level at 4 nos. locations for installation of 40mm dia MS rod using any suitable method as per IS standard.

(b) Supplying of all materials, equipment, labours, tools etc for making boring of size suitable to drive 40mm dia MS ground rod (including ground rod with joints).

(c) Supplying of casing pipes as required during drilling operation. However, this casing pipes shall be withdrawn after driving the 40mm dia MS rod and same shall be taken back by the contractor.

(d) Supplying all materials, labours, equipment for lowering & removal of pipes as casing for protecting the sites/soil from falling during the process of drilling all complete including carriage to work site.

(e) Supplying all labours, equipment for lowering/driving of 40mm dia MS rod in the bore holes including jointing of MS rod through welding.

(f) Supplying of all other tools, equipment and labour not specifically mentioned but required for the successful construction of boreholes.

2.1 The contractor will be responsible for measurement of soil resistivity.

3.0 METHODOLOGY

3.1 Drilling shall be performed in accordance with applicable IS standard. Suitable drilling methods may be used depending on site/ soil condition to achieve the depth and diameter required. Drilling shall be done vertically/ straight in steps of 20m, 30m and 50m depth from ground level at 4 nos. locations simultaneously to facilitate measurement of soil resistivity. To prevent the site/ soils from falling/collapse during the process of drilling necessary casing pipes shall be lowered up to required depth.

3.2 The 40mm dia MS rod is to be lowered/ pushed vertically through the bore holes up to desired depth (initially at 20m depth) for measurement of soil resistivity. The 40mm dia rod/ electrode shall have proper contact with soil / properly penetrated into the soil during measurement of soil resistivity.

3.3 If the measured soil resistivity value is found lower or equal to the desired value, the drilling process shall be terminated. Otherwise drilling process shall be repeated to next depth till the soil requisite resistivity value is achieved.

3.4 The 40mm dia MS rod shall be joined through welding to get desired length. The welding of MS rod joints shall be done as per direction of Engineer-in-charge.

3.5 Upon termination of the drilling at each location, the casing pipes are to be slowly withdrawn out of the bore holes and same shall be taken back by the contractor.

3.6 Each bore holes shall be completed by backfilling with the existing clean soil free from foreign materials.

3.7 After completion of the work at each drilling location, the Contractor shall remove from the vicinity of each drilling location, at the Contractor's sole cost and expense, all unused materials belonging to the Contractor or used under the Contractor's direction during construction and all temporary structures, rubbish, and solid waste materials resulting from their drilling operation.

. Payment for drilling shall be paid as per actual measurement of length of bore holes in meters plus the mobilization charges as per BPS. No other claims shall be entertained.

4.0 TERMINATION OF DRILLING

4.1 The estimated depth of the borings has been considered in the BPS as 50m each at 4 locations. i.e. (50m X 4 locations = 200m). However, drilling shall be terminated at any desired depth if the desired soil resistivity value mentioned is achieved.

5.0 POWER AND WATER

5.1 The contractor shall make his own necessary arrangements of power like diesel generator sets etc at his own cost for the drilling works and POWERGRID shall in no case be responsible for any delay in works because of non-availability of power.

5.2 The contractor shall make his own arrangement for obtaining, storing, transporting & pimping of water required for drilling process at his own cost and the POWERGRID shall in no case be responsible for any delay in works because of non-availability or inadequate availability of water.

6.0 SPECIFIC REQUIREMENT

6.1 The contractor shall be responsible for safety of human and equipment during the drilling/ boring process.

6.2 The Contractor shall use suitable/ efficient equipment and engaged experienced staff for the drilling operations.