Cable Laying Methodology

CABLE LAYING

1.0. Notwithstanding anything stated in these specifications, CESU reserves the right to assess the bidder's capability to fulfill the scope of the bid, should the circumstances warrant such assessment.

2.0. DESIGN – WORKMANSHIP AND INTERPRETATION OF CLAUSES :

2.1 The design and quality of goods supplied and the workmanship shall be in accordance with the best engineering practice to ensure satisfactory performance of the system throughout the service life.

2.2 The goods and accessories offered shall be complete in all respects. Any material and / or component thought not specifically stated in this specification but is necessary for trouble free and successful operation shall be deemed to be included. All such components, accessories, etc., shall be supplied at no extra cost.

2.3 The goods supplied shall be such that components, accessories of the same type shall be interchangeable. Likewise similar or corresponding parts, components / accessories shall also be interchangeable.

2.4 Wherever and whenever a material or article is specified or described by the name of a particular brand, manufacturer, vendor, the specific item mentioned shall be understood as establishing type, function, quality and not as limiting competition. However bidders may offer other similar components / accessories provided they meet with the required standards, design, duties and performance.

2.5 Goods and accessories so offered shall conform to type test and shall also be subjected to acceptance and routine tests in accordance with the requirements stipulated in this specification. The CESU reserves the right for repeating any or all of the type tests to be conducted on the goods supplied.

3.0. STANDARDS

3.1. Except as modified by this specification all materials to be supplied shall conform to the requirements of the latest editions of the following standards:

a) IS 1255 Code of practice for Installation and maintenance of power cables up to 33kV and including 11 KV rating

b) IS 7098 (Part 2) Cross – linked Polyethylene PVC sheathed cables.

c) IEC 332 Tests on erected cables

d) IEC 1329 Allied steel, tubes, tubular and other rough iron fittings.

e) IEC 2629 Recommended practice for hot dip galvanizing of iron & steel.

f) ASTM-D : 2671 Standard method of testing heat shrinkable or push on Tapex or cold type tubing for electrical use.

g) ASTM-D 3111 Flexibility determination of hot melt adhesives by mandrel bend test method.

h) IEC 60 High Voltage test

i) IS 3043 Code of practice for Earthing

j) IS 8309 Compression type tubular terminals for aluminum conductors of insulated cable.

4.0. DEVIATION IN SPECIFICATION:

4.1. All deviations in specification shall be brought out by the bidder and detailed clause by clause in appropriate annexure form.

4.2. Deviations brought out elsewhere or in any other format will not be considered and are liable for rejection. The CESU in such an event shall also deem that the bidder has conformed to the clauses in this specification scrupulously.

4.3. Deviation in specification shall if possible be quoted with reference to standards. The bidder shall then furnish an authentic English version of such standards.

5.0. LOCAL CONDITIONS :

5.1. It will be imperative on each bidder to fully inform himself of the local conditions and factors which may have any effect on the execution of the supply and services covered under these documents and specification.

5.2. It shall be understood and agreed that such factors will have been properly investigated and considered in any bid that is submitted. The purchaser will entertain no claim for financial adjustment to the contract awarded under these specifications and documents. No change in the time schedule of the contract, or any financial adjustment arising thereof that are based on incorrect information, or its effect on the cost of the contract to the bidder shall be permitted by the Purchaser.

5.3. Bidders are advised to visit the various areas where the cables will access, road /drain / footpath crossings to enable them to make proper costing and then quote accordingly.

6.0. DETAILS OF WORK :

a) The scope of work involves Supply and laying, testing and commissioning of 11KV, 3 Core, 300 Sq. mm & 400 Sq.mm XLPE UG cable.

b) Laying of 3 core, 11 kV, 400 sq mm & 300 Sq. mm Cables by open trench method.

6.1. The contract will be on the turnkey basis and all the required materials as per specifications are to be procured by the contractor himself. The specifications for the major equipment to be procured are as follows :

a) XLPE Cables of above size as per specifications enclosed.

b) Cable jointing termination and straight through kits as per specifications enclosed.

6.2. All the other materials like coarse and fine aggregate sand, joint markers, sealing, route markers, cable support clamps, terminals and inline connectors, sealing compounds etc., whether specifically mentioned or not in these specifications are deemed to have been included in the scope of supply and installation. Similarly, the contractor has to arrange for all the tools and plants required for the works at his own cost.

7.0. SERVICE CONDITIONS :

7.1. The cables are being laid in the Cuttack district, Odisha, where temperature, humidity effect is heavily experienced.

7.2. The climatic conditions are prone to wide variations in ambient temperature, humidity etc., and the accessories offered shall be suitable for installation under the above tropical conditions, where moderately hot and humid conditions conducive to dust, rust and fungi growth, prevail at site.

8.0. CLIMATIC CONDITIONS

Climatic conditions		
Sl No	**Particulars**	**Details**
1	Location	Cuttack,Odisha
2	Altitute	Not exceed 100 M above MSL- Almost at the Sea level
3	Max. Ambient air temperature :	45º C
4	Max. Daily average air temp :	38 º C
5	Minimum ambient air temp :	10 º C (Max) 5 º C (Min)
6	Ground temperature at depth of laying assumed :	35 º C (Max)
7	Isoceraunic level :	45
8	Avg. annual rainfall :	1450 mm
9	Avg. number of rainy days per annum	60
10	Climate :	The climate in the city of

		Cuttack is Tropical moderately hot and humid. sub- soil water at certain location at depth of burial of cables may be anticipated .
11	Soil :	Normally wet

9.0. COMPLIANCE WITH REGULATIONS :

9.1. All services carried out by the bidder / sub contractor shall be as per the requirements of the I.E.Act-2003 & Indian electricity Rules – 1956, OERC and all other applicable statutory laws governing the services in the state of Odisha

9.2. Particular attention is drawn to the necessity of consulting the local authorities and the administrative heads concerned with the operation and maintenance of roads, railways, telegraph and telephone services, water supply and sewerage and other public utilities.

9.3. The CESU will assist in obtaining permission from civil authorities for boring in the Roads, cutting roads. However the necessary charges shall be paid by the bidder sufficiently in advance. CESU will also co-ordinate with the traffic police authorities for regulation of traffic during cutting of roads.

10.0. INSPECTION BY ELECTRICAL INSPECTOR

10.1. All Electrical installations and equipments are to be inspected and approved by the Chief Electrical Inspector to the Government of Odisha, before commissioning.

10.2. The Contractor will arrange for the payment of the necessary fees for inspection.

10.3. Any defects pointed out by the Electrical Inspector, shall be corrected or attended by the bidder /subcontractor at his own cost and he shall pay, for subsequent inspection charges to the Electrical Inspector, for obtaining approval.

11.0. INSTALLATION OF U.G. CABLES

11.1. Method Of Cable Laying : Laying 11 kV HT UG cables by open trench.

11.2. ROUTE PLANS: Tentative cable route plans will be furnished to the contractors, indicating the roads road crossings, findings by excavating trial holes by the contractor / sub contractor. The work should be taken upon only after CESU Engineers approve the final route. The CESU reserves the right to change, alter deviate the route on technical reasons.

11.3. TRIAL PITS : The bidder shall excavate trial pits, for alignment purpose at appropriate distance apart as warranted by the local conditions, keep a record of the findings and close the trial holes properly to avoid hindrance / accidents to pedestrian traffic. The final route / alignment of the cables shall be decided based on the finding of the trial holes.

11.4. It is the responsibility of the bidder to maintain as far as possible the required statutory clearances from other utility services.

11.5. Any damage caused, inadvertently to any utility services shall be the sole responsibility of the contractor.

12.0. STATUTORY NOTICES AND WAY LEAVES

12.1. The Contractor shall arrange the necessary way leaves from the concerned public utility authorities and CESU shall give the required assistance to the contractor in completing the project.

13.0. LAYING OF CABLES

11 kV H.T 3 core HT UG cables:

Laying 11 kV HT UG cables by open trench.

14.0.FLAKING

14.1. Wherever it is not possible to lay of the entire cable drum length, the cable should be cut and properly sealed and if it is necessary to remove the cable from the drum, it should be properly flaked. Such cable lengths should be properly stored at site.

15.0.CABLES AND OVER BRIDGES :

15.1. Wherever the cable route crosses bridges the cable shall be laid in the ducts, if provided, by removing and replacing the R.C.C. covers and filled with sand cushion.

15.2. In the absence of the cable ducts over bridges, the cable shall be laid in suitable size steel/G.I. pipes or as directed by the engineer-In-charge and the pipe covered by cement concrete if necessary to protect from direct sunrays.

16.0.CABLE CROSSING OPEN DRAINS WITH LONG SPAN

16.1. Wherever the cable to cross open drains with a long span, the cable shall be laid in suitable size G.I. pipe, properly jointed with suitable collars. The GI pipe shall be firmly supported on pillars, columns, or suitable support of R.C.C. foundation with stone masonry in cement mortar 1:4

16.2. Wherever the U.G. cable has to cross the sewerage or water supply line the U.G. cable has to be taken below them maintaining adequate clearance. Further wherever the U.G. cable runs parallel to the telephone cable a separation distance of at east 300-mm shall be maintained.

16.3. The cables shall be laid in stoneware pipe wherever the cable and trench crosses private roads, gates, etc. In order to avoid inconvenience the stoneware pipe should be laid first after excavation and excavated trench shall be back filled, compacted and surface properly redone to restore that original condition.

17.0. CABLE AND JOINT MARKERS

17.1. Permanent means of indicating the positions of joints on site should be provided. During the course of permanent reinstatement cable and joint markers, should be laid directly above the route of the cable and the position of the joint respectively.

17.2. Wherever it is not possible to place the marker directly over the cable route or joint the marker should be suitably placed near the cable route or joint on which the distance of the cable route or joint at right angles to and parallel to the marker should be clearly indicated.

17.3. The position of fixing the markers will be at the discretion of the Engineer-In-charge.

18.0. JOINTING OF CABLES

18.1. **GENERAL**: It shall be noted that the U.G. cables are of XLPE insulation and needs special care in jointing. The cable jointer and his assistant shall have experience in making joints / terminations. Jointing work should commence as soon as two or three lengths of cables have been laid. All care should be taken to protect the factory-plumbed cap/seal by laying the end solid in bitumen until such time as the jointing is commenced.

18.2. Jointing of cables in carriage ways, drives, under costly paving, under concrete or asphalt surfaces and in proximity to telephone cables and water mains, should be avoided whenever possible.

18.3. **JOINT PITS:** The joint pits should be sufficient dimensions as to allow jointers to work with as much freedom of movement and comfort as cables proposed to be jointed. The sides of the pit should be draped with tarpaulin sheet to prevent loose earth from falling on the joint during the course of making. The pit should be well shored with timber, if necessary. An overlap of about 1.0 mtr of the cables to be jointed may be kept, for allowance to adjust the position of the joint. When two or more cables are laid together the joints shall be arranged to be staggered by 2 to 2.5 mtr.

18.4. **SUMP PITS:** When jointing cables in water logged ground or under monsoon conditions, a sump pit should be excavated at one end of the joint pit in such a position so that the accumulating water can be pumped or bailed out by buckets without causing interference to the jointing operation.

18.5. TENTS: A tent should be used in all circumstances wherever jointing work is carried out in the open irrespective of the weather conditions. The tent should be so covered as to have only one entrance and the back facing the direction of the wind. The tent cover should be properly weighted or tied down on the sides.

18.6. **MEASUREMENT OF INSULATION RESISTANCE:** Before jointing is commenced the insulation resistance of both sections of the cable to be jointed should be checked by insulation resistance testing instrument. An insulation resistance – testing instrument of 2.5/5 kV shall be used. The Insulation Resistance values, between phases and phase to

earth shall be recorded. The actual jointing operation shall start only after the approval of the engineer in charge of works.

18.7. PRECAUTIONS BEFORE MAKING A JOINT OR CUTTING A CABLE.

The cable end seals should not be opened until all necessary precautions have been taken to prevent circumstances arising out of rainy/inclement weather conditions, which might become uncontrollable. The cable seals should be examined to ascertain if they are intact and also that the cable ends are not damaged, if the seals are found broken or the lead sheath punctured, the cable ends should not be jointed until after due examination and testing by the engineer-in-charge of the works.

18.8. PRECAUTIONS TO BE TAKEN ON LIVE CABLES IN SERVICE

Sometimes it becomes necessary that a H.V. cable, which is in service, be cut for making a straight joint with a new cable. In such cases work on joint should start only after the in service cable is properly identified, isolated, discharged, tested and effectively earthed. Search coils interrupters or cable-identifying instruments should be used for this purpose.

18.9. IDENTIFICATION NUMBERS / COLOURS AND PHASING : The cables should be laid and jointed number to number or colour to colour shown on the core identifying marks and prevent cross jointing. In all cases, the cables should be tested and phased out, and more particularly so when the cable terminates at Ring Main Unit / Sub-station.

18.10. **MAKING A JOINT:** The Heat shrinkable joints used shall be conforming to the specification vide Sec-iv. Alternatively push-on or Tapex or cold shrinkable type can be used with the approval of CESU. The contractor should furnish all the technical particulars of these joints and obtain approval only in case they are found superior to the heat shrinkable joints. Epoxy based joints are not permitted. Comprehensive jointing instructions obtained from the manufacturer of joint kits shall be meticulously followed. The connection of the earth wires should be done using flexible bonds connected to cable sheath using clips or soldering. Aluminum conductor strands shall be joined be joined by mechanical compression method, using suitable die and sleeve with a good quality tool. The joints shall conform to specification as per IS 13573-1992.

18.11. **TRANSITION JOINTS:** Wherever straight through joints will have to be made with existing cables under the following conditions, the contractor shall arrange such type of joints and execute them with skilled jointers.

(1) Between cables having two different types of insulation viz., paper and XLPE
(2) Between cables having two different types of conductor material, viz. copper and aluminum.
(3) Or a combination of the above

The transition joints shall conform to IS 13705 – Transition joints for cables for working voltages from 11 KV upto and including 33 KV – performance requirements and type tests.

18.12. **CABLE TERMINATIONS:** Cable terminations required are both indoor and outdoor type and invariably be of heat shrinkable type conforming to the specifications vide Sec-iv. . Alternatively push-on or Tapex or cold shrinkable type can be used with the approval of CESU with appropriate sheds for rainwater in case of outdoor terminations. All the technical particulars to establish the superiority in the performance of these joints shall be furnished while seeking approval. The terminations shall conform to specifications as per IS 13573 – 1992. The instructions furnished by the manufacturer of termination boxes/kits should strictly be followed.

18.13. Whenever a cable raised from the trench to end in termination, to be finally connected to an overhead line or transformer, the following instructions should be complied with –

(i) One coil to made and left in the ground for future needs

(ii) The rise of cable, immediately from the ground level should be enclosed in suitable diameter GI pipe to height of 2 mt.

(iii) The balance portion of the cable should be neatly curved, in 'S' shape.

(iv) The cable and pipe should be properly fastened by using appropriate clamps /support. The hardware of clamps shall be painted with red oxide and enamel paint or galvanized.

(v) The lugs on the termination shall be compressed with a suitable compression tool.

19.0. EARTHING AND BONDING

19.1. The metal sheath and Armour should be efficiently bonded and earthed at all terminals to earth electrodes provided. The cross sectional area of the bond shall be such that the resistance of each bond connection shall not exceed the combined resistance of an equal length of the metal sheath and Armour of the cable.

20.0. TESTING AFTER LAYING AND JOINTING

20.1. All cables after laying and jointing works are completed should be tested systematically and insulation and pressure tests should be made on all underground cables.

20.2. All test results should be recorded in tabular form in logbooks kept for the purpose

20.3. The cable cores should be tested for :-

(i) Continuity

(ii) Absence of cross phasing

(iii) Insulation resistance to earth; insulation resistance between conductors.

21.0.H.V. TESTS

21.1. After the laying and jointing work is completed, a high voltage test should be applied to the cable to ensure that the cable has not been damaged during or after the laying operations and there is not defect in the joining

21.2. The high voltage tests should be as per IS 1255 or as per international standards. The H.V. testing instruments shall be brought by the turn key contractor.

22.0.TESTING AND RECORD OF CABLE CONSTANTS :

22.1. When the cable is ready, just before commissioning, the cable constants viz, the resistance, capacitance and inductance of each conductor should be determined and recorded, along with frequency at which the values of capacitance and inductance are determined.

23.0.GUARANTEE

23.1. All the cable joints / termination done by the contractor shall be guaranteed for 12 months from the date of energisation of the complete cable. In the event of failure during the guarantee period, the restoration work shall be done free of cost by the contractor within 24 hours of giving notice or else the expenditure incurred by CESU to re-do the joint / termination will be recovered from the performance guarantee amount held with the CESU.

24.0.CABLE RECORDS

24.1. Accurate neat plans / sketches, drawn to suitable scale (1 cm = 10M) should be prepared and furnished by the contractor after the completion of each work.

24.2. All relevant information should be collected at site, during the progress of work and preserved for preparation of drawings.

24.3. The following essential data should be incorporated on all drawings

a) Size, type of cable or cables.
b) Location of the cable in relation to prominent land mark property, Kerb-line etc., with depths.
c) The cross section showing where cables are laid in piper or ducts, giving their sizes, type and depths.
d) Position and type of all joints
e) Location of other cables which run alongside or across the cable route.
f) Position and depths of all pipers, ducts, etc., which are met as obstruction to the cable route.
g) Accurate lengths from joint to joint
h) Manufacturers name and drum number of the cable, between sections / joint to joint.

Two transparencies and six blue print copies of the cable records prepared as above shall be given to the CESU's engineer as a part of the contract as soon as the cable is charged.