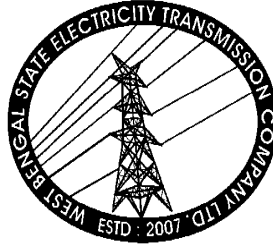


XLPE CABLE & TERMINATION



March 2015

Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED

পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড
(পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ)

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TECHNICAL SPECIFICATION OF XLPE CABLE AND TERMINATION

1.0 SCOPE

The specification covers Design, Engineering, Construction, Supply & Delivery, Erection, Laying, Testing & Commissioning including Transportation & Insurance, Storage of XLPE Cable of different ratings and their associated works.

2.0 STANDARD & CODES

The works covered by the specification shall be designed, engineered, manufactured, tested and commissioned in accordance with the Standards as specified in the table below.

Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards referred shall also be accepted. Copies of such standards shall be submitted by the bidder along with the bid.

IS 7098 : Part 3 : 1993	Cross-linked polyethylene insulated thermoplastic sheathed cables: For working voltage from 66KV up to and including 220KV.
IS 8130 : 1984	Conductors for insulated electric cables and flexible cords
IS 5831 : 1984	PVC insulation and sheath of electric cables.
IS 1255 : 1983	Code of practice for installation and maintenance of power cables upto and including 33KV rating.
IS 3975 : 1999	Mild steel wires, formed wires and tapes for armouring of cables.
IS 5831 : 1984	PVC insulation and sheath of electric cables.
IS 6380 : 1984	Elastomeric insulation and sheath of electric cables.
IS 8130 : 1984	Conductors for insulated electric cables and flexible cords.
IS10418 : 1982	Drums for electric cables
IS 3975 : 1999	Mild steel wires, formed wires and tapes for armouring of cables.
IS 5 : 1994	Colours for ready mixed paints and enamels.
IS 617 : 1994	Aluminum and aluminium alloy ingots and castings for general engineering purposes (Superseded IS 20 : 1977)
IS 3043 : 1987	Code of practice for earthing.
IS 5578 : 1984	Guide for marking of insulated conductors.
IS 11353 : 1985	Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals.
IS 5216 : Part I : 1982	Recommendations on Safety Procedures and Practices in Electrical Work.
IS 2071 : 1993	High voltage test techniques.
IEC-60540	Power cables with extruded insulation and their accessories and cords
EC 60060 : 1989	High Voltage Test Techniques
IEC-60502	Extruded solid dielectric insulated power cables for rated voltages from 1KV up to 30KV
IEC-60754 : 1991	Tests on gases evolved during combustion of electric cables

IEC-60183 : 1990	Guide to the Selection of High Voltage Cables.
IEC-60230 : 1996	Impulse tests on cables and their accessories.
IEC-60840 / IEC- 62067	Testing
IEC-60287 : 1995	Calculation of the continuous current rating of cables (100% load factor).
IEC-60304 : 1982	Standard colours for insulation for low-frequency cable and wires
IEC-60331 : 1970	Fire resisting characteristics of Electric cables.
IEC-60332 : 1992	Tests on electric cables under fire conditions.
BS-5468	Cross-linked polyethylene insulation of electric cables
IEC-60228 : 1978	Conductors of insulated cables
IEC-60332 : 1993	Test on electric cables under fire conditions
IEC-60066	Environmental Test
IEC-60117	Graphical Symbols
IEC-60270 : 2000	Partial Discharge Measurements
CSA-Z299.1-1978h	Quality Assurance Program Requirements
CSA-Z299.2-1979h	Quality Control Program Requirements
CSA-Z299.3-1979h	Quality Verification Program Requirements
CSA-Z299.4-1979h	Inspection Program Requirements
ASTMD-2863	Measuring the minimum oxygen concentration to support candle like combustion of plastics (oxygen index)

3.0 COMPLIANCE TO SPECIFICATION & DEVIATION:

Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of equipment must be mentioned in the Deviation Schedule with reasons duly supported by documentary evidence. Such deviations suggested may or may not be accepted by the purchaser.

Deviations not mentioned in Deviation schedule will not be considered.

The bidder shall also submit the GTP duly signed with date & company seal for acceptance of the Technical Bid unless which the bid may be considered as non responsive.

4.0 SYSTEM PARAMETERS

SL NO	TECHNICAL PARAMETERS	400 KV SYSTEM	220 KV SYSTEM	132 KV SYSTEM	33 KV SYSTEM
1	Rated Maximum Voltage	420 KV (rms)	245 KV (rms)	145 KV (rms)	36 KV (rms)
2	Rated Frequency	50 Hz	50 Hz	50 Hz	50 Hz
3	Grounding	Effectively Earthed	Effectively Earthed	Effectively Earthed	UE

4	Rated Power Frequency Withstand Voltage (1 min)	610 KV (rms)	460 KV (rms)	275 KV (rms)	70 KV (rms)
5	Impulse withstand BIL (1.2/50/micro Sec) Line to earth	±1425 kVp	±1050 kVp	±650 kVp	±170 kVp
6	Switching impulse voltage (250/2500 micro-sec)	±1050 kVp	X	X	X
7	Rated short time withstand current	50 kA (rms) for 1 sec	40 kA (rms) for 1 sec	31.5 kA (rms) for 1 sec	25 kA (rms) for 3 sec
8	Rated peak withstand current (1 sec)	125 KA (peak)	100 kA (peak)	80 kA (peak)	62.5 KA
9	Rated current normal (at 50 degree C design ambient temperature)	As per Price Schedule	As per Price Schedule	As per Price Schedule	As per Price Schedule
10	Seismic level	Zone- IV, as per IS-1893 Year-2002	Zone- IV, as per IS-1893 Year-2002	Zone- IV, as per IS-1893 Year-2002	Zone- IV, as per IS-1893 Year-2002

5.0 CONSTRUCTION

1. The cable shall be of applicable EHV grade as per requirement according to price schedule , single core, unarmored stranded compacted circular Copper conductor in case of cross section is less than or equals to 800 sq.mm or segmental compacted circular(Miliken) Copper conductor in case of cross section is over than 800 sq.mm, core screening by a layer of semiconducting tape followed by a layer of semiconducting compound, cross linked polyethylene (XLPE) dry cured insulation, insulation screening with semiconducting compound extruded directly over the insulation, longitudinal sealing by a layer of non woven tape with water swellable absorbent over insulation screen, followed by radial sealing of corrugated & seamless aluminum with asphalt coating& overall PE sheathed & graphite coated and conforming to the technical particulars of specification.**Cables used earlier or repaired after damaged shall not be accepted.**
2. The construction of cable shall generally conform to the description mentioned above. Bidder may offer necessary layers such as separation tape, binder tapes etc additionally as per their manufacturing practices for meeting required performance of the offered cable. The bidder shall enclose drawing showing cross section of the cable.

3. The cable shall be suitable for laying underground with uncontrolled back fill and chances of flooding by water and suitably designed by the addition of chemicals in the outer sheath to be protected against rodent and termite attack.
4. The cables shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating conditions.
5. Progressive sequential marking of the length of cable in meters at every one meter shall be provided on the outer sheath of the cable.
6. The cables shall have outer sheath of a material with an Oxygen Index of not less than 29 and a Temperature index of not less than 250°C.
7. Allowable tolerance on the overall diameter of the cables shall be plus or minus 2 mm

6.0 COMPOSITIONS OF CABLES

a) CONDUCTOR

The conductor shall consist of annealed copper stranded wires. The compacted circular conductor shall consist of segments wound up and then compacted. For the cable sizes having cross section over than 800 sq. mm the segmental compacted circular conductor having four (4) segments should be constructed for the supply under the scope of bid. When the conductor's cross-section is less than 800 sq. mm, the compacted circular is applied generally.

b) CONDUCTOR SCREEN

The conductor screen shall consist of extruded semi-conducting XLPE. Semi-conducting separator tapes may be applied between conductor and the extruded semi-conductor XLPE.

c) INSULATION

The insulation material shall be extruded cross-linked polyethylene. In order to ensure that the screen and insulation are intimately bonded together and free from all possibilities of voids between layers, the conductor screen, the insulation and the insulation screen should be extruded simultaneously in one process. The extrusion process should be carried out under strictly controlled atmospheric conditions.

The thickness of the insulation layer should be maintained as the maximum value figured out from the design of the impulse voltage and A.C. voltage. The cross-linking process by N₂ gas should be preferred instead of conventional cross-linking process by saturated steam.

d) INSULATION SCREEN

The insulation screen shall consist of extruded semi-conducting XLPE. Suitable bedding tapes shall be applied over the extruded semi-conducting XLPE.

e) **MOISTURE BARRIER**

The longitudinal water barrier shall be applied over insulation screen by a layer of non woven synthetic tape with suitable water swellable absorbent.

f) **METALLIC SCREEN:**

The metallic screen shall be of seamless or seamwelded corrugated aluminum sheet with asphalt coating. The metallic screen shall be designed to meet the requirement of the system short circuit rating.

g) **OUTER SHEATH**

The outer sheath shall consist of extruded black coloured PE having the grade ST7.

The outer sheath shall be designed for protection against termite and rodent attack and shall be coated with graphite.

7.0 RATING

The bidder shall declare current rating of cable for maximum conductor temperature of 90°C under continuous operation. A complete set of calculation made in arriving at the current rating shall be furnished for laying condition under present.

8.0 CABLE DRUMS

- a) Cables shall be supplied in wooden or steel drums of heavy construction of suitable size and packed conforming to IS 10418 or applicable internationally accepted standards. Wooden drum shall be properly seasoned sound and free from defects. Wood preservative shall be applied to the entire drum. A layer of waterproof paper shall be applied to the surface of the drums and over the outer most cable layer.
- b) Each drum shall carry the manufacturer's name, the purchaser's name, address and contract number and type, size and length of the cable, net and gross weight stenciled on both sides of drum. A tag containing the same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.
- c) Packing shall be sturdy and adequate to protect the cables, from any injury due to mishandling or other conditions encountered during transportation, handling and storage. Both cable ends shall be sealed with hermetically sealed by means of water blocking compound followed by heat shrinkable caps totally coated inside with mastic so as to prevent to cable for moisture penetration during transit, storage and laying.

- d) The bidder shall consider supply of cable on returnable drums basis. Contractor shall take back all the cable drums from site after successful laying, testing and commissioning of cables. The bidder may quote the prices accordingly.
- e) Embossing of outer sheet: the following details on the other sheet of cable at a regular interval of 1(one) meter.
 - (a) **Name of Customer i.e. WBSETCL**
 - (b) **Conductor size, type of insulation and voltage grade.**
 - (c) **Manufacturer's name.**

9.0 TESTS

All routine and acceptance tests shall be conducted as per IEC 60840/IEC 62067. All type tests conducted during last five years from the date of NIT as per IEC 60840:1999/IEC 62067:2001 including its amendments on the XLPE insulated HT cable should be submitted. The diameter of test cylinder during bending test shall be as per IS: 7098 (Part 3) or the diameter of drum barrel to be used for dispatch of cables whichever is lower. For accessories type test reports should be submitted as per Clause 11.3.2 IEC 60840:1999/ Clause 12.4.2 IEC 62067:2001 & including amendments.

TESTS AFTER INSTALLATION

All tests as prescribed in IEC-60840:1999/IEC 62067:2001 shall be performed after installation of cable.

10.0 TRENCHING

The cable trench work involves earth excavation for cable trench, back filling and removal of excess earth from site. The work site shall be left as clean as possible.

The bottom of the excavated trench should be levelled flat and free from any object which would damage the cable. Any gradient encountered shall be gradual.

11.0 PAYING OUT

The excavated cable trench shall be drained of all water and the bed surface shall be smooth, uniform and fairly hard before paying out the cable. The cable shall be rolled in the trench on cable rollers, spaced out of uniform intervals. The paying out process must be smooth and steady without subjecting the cable to abnormal tension. The cable on being paid out shall be smoothly and evenly transferred to the ground after providing the cushion. The cables shall never be dropped. All snake bends shall be straightened. Suitable size cable stocking pulling eye shall be used for pulling the cable. While pulling the cable by winches or machines, the tension loading shall be by tension indicator and shall not exceed the

permissible value for the cable. The cable laying shall be performed continuously at a speed not exceeding 600 to 1000 meters per hour.

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

12.0 LAYING OF CABLES

The installation, testing and commissioning work for laying of cable within the substation, shall mainly consist of :

- a) Formation of buried cable trenches for cables as per specification including supply and installation of warning tape, protective tiles/ bricklayer of minimum class designation 50 (50 kg./sq. cm.) cable protection covers for entire route, construction of jointing bays, backfilling of trenches and restoration as per specification.
- b) Road, rail and other crossings will be through HDPE pipe for each cable and restoration as per specification.
- c) Cable markers shall be provided all along the route and at the bendings. Also the location of underground cable shall be clearly indicated on the marker.
- d) Supply and installation of all critical installation materials like trefoil clamps, neoprene cushions, support brackets etc. as required for complete route to avoid damages of the cable. Neoprene cushion shall be provided at road crossings to avoid damage of cable due to vibrations during movement of vehicles.
- e) Termination of cables, bonding of screen/sheath to the earth station through disconnecting type link boxes and SVL (sheath voltage limiter) at cable conductor junction - point etc. Bidder shall adopt ends bonding for route under scope as per STP or as per detailed Engineering. Earthing stations/Earthing pits, earthing materials and earthing conductors wherever applicable for complete route including outdoor equipment, structure, cable terminating structure and earth link box at the locations mentioned above shall be in contractors' scope.
- f) Design, fabrication, supply and erection of galvanized steel structures (including its civil foundation) for cable end terminations (with all necessary accessories) for cables at cable-conductor junction point. At cable-conductor junction point terminal connectors offered by bidder shall be suitable to terminate with ACSR conductors.
- g) For termination at GIS substation end, necessary design construction of cable duct etc. including all supply is within the scope of this contract.
- h) Bonding, earthing etc. at GIS end.

13.0 CABLE HANDLING

The inspection of cable on receipt, handling of cables, paying out, flaking, cushioning with sand or sieved compacted soil, back-filling, reinstatement of road surface, providing and fixing joint markers, route indicators, precautions of joint holes, sump holes and all necessary precautions that are required shall be carefully planned and in general conform to IS 1255-1983 or its equivalent.

14.0 CABLE ROUTE MARKERS

Permanent means of indicating the cable route shall be fabricated supplied and erected as per approved drawings.

Markers provided shall be as per the field requirement, if the route passes through open fields, markers should be conspicuously visible above ground surface.

The marker should incorporate the relevant information-the name of the owner, voltage, circuit and distance of cable from the marker.

15.0 SAND BEDDING

The cable shall be completely surrounded by well-compacted cable sand to such a thickness and of such size that the cable is protected against damage. The thickness of the cable sand should normally be a minimum of 10 cm in all directions from the cable surface.

16.0 THERMAL BACKFILL

Based on the evaluation of soil thermal resistivity along the cable route and after approval from the Employer the contractor shall design, specify, supply, lay and monitor the installation of thermal backfill surrounding the cables.

17.0 IMMEDIATE ENVELOPE TO CABLE

The option on the use of the material that immediately envelopes the cable viz., thermal backfill or sand or sieved native soil rests with the Employer. The contractor shall seek prior approval on the use of the envelop material from the Employer before execution of the works.

18.0 BACK FILLING

Normally back filling shall consist of the material earlier excavated. However, bigger stores or pieces of rock should be removed.

19.0 WARNING TAPE

A pre-warning, Red colour plastic/PVC tape, 250 mm wide 100 microns thick, shall be laid at approx. 0.4 m above the cable specified depth, throughout the cable route. The tape shall carry the legend printed in black continuously as under CAUTION: WBSETCL xxxxxxV CABLES.

20.0 PREVENTION OF DAMAGE DUE TO SHARP EDGES

After the cables have been laid in the trench and until the cables are covered with protective covering, no sharp metal tool shall be used in the trench or placed in such a position that may fall into the trench.

Straight and curved rollers used shall have no sharp projecting parts liable to damage the cable.

While pulling through pipes and ducts, the cable shall be protected to avoid damage due to sharp edges.

The cables shall never be bent, beyond the specified bending radius.

21.0 BENDING RADIUS :

The minimum bending radius of XLPE insulated cables are as follows :

<u>Cable</u>	<u>Bending radius</u>
Single Core	25 X D
"D" means the overall diameter of the completed cable.	

22.0 CABLE END TERMINATIONS & JOINTING

a) The cable jointing accessories shall include Outdoor & Indoor the end terminating kits as per price schedule, straight through joints and also any special tools and tackles required for making these joints.

b) The straight through joints

It shall be either pre-molded type or heat shrinkable type complete with accessories. The joint shall preferably be built up from the same material as the main cable and shall have electrical and mechanical withstand capabilities same as or better than the main cable. The joints shall be suitable for tropical climatic conditions.

c) **The outdoor end termination**

- i) It shall be anti-fog, pre-fabricated type based on the EPR-based stress relief cone with an Epoxy Housing or pre-moulded type silicon based stress relief cone. The termination base plate and the cable's metallic sheath shall be electrically insulated from the supporting structure by means of self-supporting stand-off insulators or any other self-supporting means designed to withstand both mechanical and electrical stresses in services.
- ii) For OD Termination at substation (other than at composite tower), the termination shall be oil-filled type within polymeric or porcelain hollow insulator in brown or grey colour as per standard practice of manufacturing in addition upon, arcing horn and shield ring shall have to be supplied.
- iii) For OD Termination at composite Tower the termination shall be dry type polymer housed in addition upon, arcing horn and shield ring shall have to be supplied. The termination may be dry type polymer housed without mechanical / cold shrink installation technology.
- iv) The outdoor termination for 400kV shall be based on the EPR-based stress relief cone with the epoxy housing and the oil-impregnated cylindrical capacitor cone as condenser cone type to secure the uniform longitudinal voltage distribution all along the termination.
- v) The outdoor terminal should be suitable for heavily polluted atmospheric conditions with total creepage distance of 31 mm/ kV and protected creepage distance of not more than 50% of the total Creepage distance. The cable end terminals for terminating the cables shall be fully compatible with the cables to be supplied.

d) **The Indoor Termination at GIS SF6 Housing**

It shall be based on the EPR (Ethylene-Propylene Rubber)- based stress relief cone and the epoxy resin housing, Dry type without insulating oil. There shall be mechanical devices to maintain the interface pressure. Stress relief cone and mechanical devices shall be designed to fit with controlled interference over the cable insulation and shall follow the cable's diameter variations still guaranteeing under any service condition a sufficient positive pressure to control the electric field concentration. There shall be epoxy insulating plate to isolate between cable sheath and GIS chamber. The SVLs (Sheath Voltage Limiter) shall be installed to protect epoxy insulating plate from switching impulse. Plug-in type leading conductors shall be supplied though at the time of detailed engineering confirmation shall be given for selection of normal type, blind type or plug-in type. Design and scope of delivery shall be fully complying with IEC-60859, IEC-62271-209 and possibly adjusted to various needs of project. The main insulation components shall be fully examined and tested in the factory.

The bidder shall furnish the detailed description on jointing procedure during detailed engineering.

e) WORKING PROCEDURE FOR TERMINATION

- (i) At cable terminating end sufficient length of spare cable shall be left in the ground and at cable tray also at GIS, for future needs.
- (ii) The rise of the cable immediately from the ground shall be enclosed in PVC/PE pipe of suitable diameter to protect against direct exposure to the sun.
- (iii) The cable shall be properly fastened using non-metallic clamps.
- (iv) Appropriate labels shall be fixed identifying the phase circuit, voltage and date of commissioning etc., on the cable supporting structure.
- (v) The sealing end shall be mounted on pedestal insulators to isolate them from their supporting steel work.
- (vi) Protection from contact with the exposed metal work at the termination shall be provided by resin bonded glass fiber shroud.
- (vii) Providing earth stations with all required materials, like leads, connectors etc. Earth pits shall conform to IS-3043:1987 (Code of practice for earthing).

f) WORKING PROCEDURE FOR JOINTING

- (i) The cable jointing personnel and his crew shall have good experience in the type of jointing and terminations that are used. The jointing works shall commence as soon as two or three lengths of cable have been laid. All care should be taken to protect the factory-plumbed caps/seals on the cable ends and the cable end shall be sealed whenever the end is exposed for tests.
- (ii) Jointing of cables in carriage ways, drive ways under costly paving, under concrete or asphalt surfaces and in proximity to telephone cables and was mains should be avoided wherever possible.
- (iii) Sufficient over lap of cables shall be allowed for making the joints.
- (iv) The joint bay should be sufficient dimensions to allow the jointers to work with as much freedom of movement and comfort as possible. Sufficient space should be kept below the cable to be jointed.
- (v) The joints of different phases shall be staggered in the jointing bay.
- (vi) Comprehensive jointing instructions should be obtained from the manufacture of jointing kits and meticulously followed.
- (vii) The materials used in the joints like ferrules, screen/sheath continuity bonds, lugs etc. shall be of good quality and conform to standards.
- (viii) The jointing tools shall be appropriate and as per the requirement of jointing HV XLPE cables.
- (ix) SUMPHOLES

When jointing cables in water logged ground or under unforeseen rainy conditions,asumphole should be made at one end of the joint bay, in such a position

so that the accumulated water can be pumped or drained out by buckets, without causing interference to the jointing operation.

(x) TENTS/COVERS

An enclosure or suitable protection cover shall be used in all circumstances wherever jointing work is carried out in the open irrespective of the weather conditions. The joint shall be made in dust free, moisture free and clean atmosphere.

(xi) PRECAUTIONS BEFORE MAKING A JOINT

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.

If the cable end seals of cable ends are found to have suffered damage the cables should not be jointed, without tests and rectification.

(xii) MEASUREMENT OF INSULATION RESISTANCE

Before joining, the insulation resistance of both sections of cables shall be checked.

(xiii) The identification of each phase shall be clearly and properly noted. The cables shall be jointed as per the approved design. Each cable shall have identification for phase at joint bays.

23 BONDING OF SCREEN/SHEATH

The screens at both ends, shall be brought out and bonded to the earth station through disconnecting type link boxes or through SVL wherever applicable.

On the basis of the length of the cable and rise of sheath Voltage the bonding may be required as follows:

1. Single End Bonding
2. Double End Bonding
3. Cross Bonding

All accessories and consumables used in the termination should be of good quality and compatible with the cable. At the time of single end bonding parallel copper conductor along the length of the cable shall have to be provided between the two ends of the cable. Bonding cable of 6.6 KV copper shall be provided for bonding of metallic sheath/Screen.

24 CONNECTION OF RADIAL WATER BARRIER AND CABLE SCREEN

If the metallic radial water barrier is insulated from the metallic wire screen a connection suitable to carry the currents occurring during operation must be installed between metallic radial water barrier of the cable and metallic wire screen in joints and sealing ends.

25 ENGINEERING DATA AND DRAWINGS

The Bidder shall necessarily submit all the drawings/documents unless anything is waived. The Bidder shall submit 4(four) sets of drawings/design documents/data/test reports as may be required for the approval of the Employer.

All drawings submitted by the Bidder 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 and the external connections, fixing arrangement required and any other information specifically requested in the specifications.

All engineering data submitted by the Bidder 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.

26 INSTRUCTION MANUAL

- (i) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.
- (ii) If after the commissioning and initial operation, the instruction manuals require any modifications/additions/changes, the same shall be incorporated by the bidder in the final submission.
- (iii) The Bidder shall furnish to the Employer catalogues of spare parts.

27 ADITIONAL EQUIPMENTS &STRUCTURES FOR CABLE TERMINATION

- a) The terminating structure being provided should be designed as per the requirement of the cable end sealing, porcelain bushing etc.The mounting structure shall be fixed on the cement concrete foundation, the design and drawings of which shall be submitted to Employer for review and acceptance during the course of detailed engineering.

- b) After fixing the end termination, the cable shall be fixed to the support, with non-magnetic material clamps to the required height securely. The mounting structure includes the supports for cable end boxes, link boxes and any other structure required for the intent of the contract. All steel sections used shall be free from all imperfections, mill scales, slag intrusions, laminations, fillings, rust etc. that may impair their strength, durability and appearance. All materials shall be of tested quality only unless otherwise permitted by the Employer.

- c) Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the work unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment provided shall be inter-changeable with one another.

SPECIFIC TECHNICAL PARTICULARS FOR 132 KV& 220 KV XLPE CABLE

SL	ITEMS	PARTICULARS
1	Description of Cable	Stranded single core compacted copper core screening by a layer of semi conducting tape followed by a layer of semiconducting compound as conductor screen, XLPE insulation, insulation screening with semiconducting compound extruded directly over the insulation,(semiconducting conductor screen, XLPE insulation, semiconducting insulation screen-all in one triple extrusion process), longitudinal sealing by a layer of water swell able semi conducting non woven tape over insulation screen, followed by radial sealing (metal sheath of Corrugated Aluminum), and over all extruded black HDPE Sheathed (Type ST 7).
2	Highest system voltage	145KV / 245KV
3	Voltage Grade	76/132KV / 127/220KV
4	Voltage variation	+10% and -12.5%
5	Frequency	50 Hz
6	Frequency variation	±3%
7	Power frequency withstand voltage	190 KV rms for 30 minutes / 318 KV rms for 30 minutes
8	Lightning impulse withstand voltage	±650 KV peak / 1050 KV peak
10	No of phase per Ckt	3
11	Earthing system	Effectively earthed
12	Size of Cable	As per Schedule
13	Max. in Conductor Temp.	90°C at maximum continuous current.
14	Fault level	31.5 KA for 1 second / 40 KA for 1 second
15	Maximum permissible short ckt temperature.	250°C for one second.

16	CABLE DETAILS : CONDUCTORS	
i)	Conductor material	Plain un-tinned annealed copper.
ii)	Conductor Shape	Compacted circular.
iii)	Conductor Screen	Extruded, Cross-linked, semi conducting compound of suitable thickness. Semi conducting separator tapes with 50% overlap to be applied between conductor and conductor screen.
iv)	Resistivity of the semiconducting screen	Maximum 1000 ohm-meter
v)	Insulation	
	a)material	XLPE
	b)specified insulation resistance at 90°C	1x10 ¹² ohm cm
vi)	Insulation Screen : Type & Material	Extruded semi conducting compound.
vii)	Resistivity of the semiconducting compound	Max 500 Ohm-meter
viii)	Longitudinal water barrier Material	Layer of semi conducting tape with suitable water swellable absorbent with 50% overlap.
ix)	Radial moisture barrier Material	Seamless or seam welded Corrugated Aluminum sheath with anti-corrosive material.
x)	Overall sheath	Extruded black HDPE (Type ST 7) with anti termite and anti rodent treatment.
xi)	Coating of outer sheath	A hard baked layer of graphite shall be applied over the outer sheath as outer electrode for testing the sheath.
17.	Approximate Length of cable in a drum	500metres with a tolerance range of ± 5%.
18	Bending Radius	The minimum bending radius of XLPE insulated cables as follows: Cable: Bending radius Single Core: 25xD D – diameter of overall conductor.
19	TESTS - Applicable standards	IEC 60840, IEC 62067

i)	Type Test a) whether previous test reports will be sufficient b) whether sample to be Type tested against this order.	All tests as per specifications IEC Standards Yes, if done on identical cable. No, if done on identical cable.
ii)	Routine Test	All tests as per specifications IEC Standards.
iii)	Acceptance Test	All tests as per specifications IEC Standards.
iv)	Whether test will be witnessed by purchaser or his representative	Yes. Acceptance test will be witnessed.
20	INSTALLATION, TERMINATION AND JOINTS	
i)	Ambient temperature Ground temperature Thermal resistivity of soil	50 ⁰ C 35 ⁰ C 150 ⁰ C cm/Km
ii)	Laying Configuration	Trefoil formation. Ckt to Ckt distance 800mm.
iii)	Depth	1m below ground level.
iv)	Termination Type	As per tech.spec.
v)	Joints Required	No.
vi)	Earth Link Boxes Required	One at each end for each end earthing for each Ckt.
vii)	Surge Suppressor Required	No.
viii)	Type Bonding ‘	Single point bonding.