137-1:2020

CEB
SPECIFICATION

XLPE INSULATED MEDIUM VOLTAGE UNDERGROUND CABLES

CEYLON ELECTRICITY BOARD
SRI LANKA

CEB Approved Specification
25/10/2020
Chairperson Dist. Coordination Committee

Telephone: +94 11 232 8051

Fax: +94 11 232 5387

CONTENTS

SPECIFICATION FOR XLPE INSULATED MEDIUM VOLTAGE UNDERGROUND CABLES

1. SCOPE

This specification covers the general requirements of the design, manufacturing and testing of undermentioned Cross-linked Poly-ethylene (XLPE) Insulated medium voltage underground cables.

1. 11kV XLPE Insulated Single Core Cables
2. 11kV XLPE Insulated Three Core Cables
3. 33kV XLPE Insulated Single Core Cables
4. 33kV XLPE Insulated Three Core Cables

The procurement entity shall prescribe one of the above categories in price schedule indicating the cable size (cable sizes below 95mm^2 are not generally expected) and any other extra options.

2. SYSTEM PARAMETERS

(a)	Nominal voltage (U)	11 kV	33 kV
(b)	System highest voltage (U_m)	12 kV	36 kV
(c)	System frequency	50 Hz	50 Hz
(d)	Method of earthing	Resistively /Effectively earthed	Resistively /Effectively earthed
(e)	System fault current/duration applicable (for cables including and above 185mm^2)	16.4 kA /1s	17.6 kA/1s
(f)	System fault current/duration applicable (for cables below 185mm^2)	12.5 kA/1s	13 kA/1s

3. SERVICE CONDITIONS

(a)	Annual average ambient temperature	30 °C
(b)	Maximum ambient temperature	40 °C
(c)	Maximum relative humidity	90%
(d)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere

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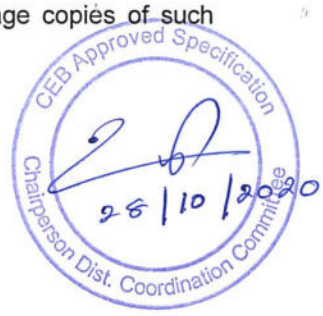
(e)	Operational altitude	From M.S.L. to 1900 m above M.S.L.
(f)	Isokeraunic (Thunder days) level	100 days
(g)	Depth of laying	1.1 m
(h)	Conditions associated with laying	Mostly direct burying occasionally laid in ducts. High water table & sustained wet conditions are generally encountered with polluted water.

4. APPLICABLE STANDARDS

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof.

(a)	BS 6622:2007	Electric cables. Armoured cables with thermosetting insulation for rated voltages from 3.8/6.6 kV to 19/33 kV. Requirements and test methods
(b)	IEC 60502-2:2014	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) – Part 2: Cables for rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV)
(c)	BS EN60228:2005 IEC 60228:2004	Conductors of insulated cables
(d)	BS EN/IEC 60811 - 201,202,203,501:2012	Electric and optical fiber cables - Test methods for non-metallic materials - Part 201: General tests - Measurement of insulation thickness, Part 202: General tests - Measurement of thickness of non-metallic sheath, Part 203: General tests - Measurement of overall dimensions, Part 501: Mechanical tests - Tests for determining the mechanical properties of insulating and sheathing compounds
(e)	BS EN/IEC 60229 : 2007	Electric cables - Tests on extruded over sheaths with a special protective function
(f)	IEC 60949:1988	Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects

Material conforming to other International Standards which are equal to or higher but not less stringent than the Standards stipulated above may be offered. When such alternative Standards are used, reference to such Standards shall be quoted and English language copies of such Standards shall be provided with the offer.



- **However, in the event of discrepancy, details given in this CEB specification supersede above standards.**

5. BASIC FEATURES

The technical requirements of the XLPE Insulated underground cables shall be in accordance with the following table.

Technical Feature	11 kV Single Core	33 kV Single Core	11 kV Three Core	33 kV Three Core
1. Design	The cable shall be designed to a maximum operating temperature of 90^0 C and a maximum short circuit temperature of 250 ^{0} C.			
2. Conductor				
(a) Type	Circular Compacted Plain Annealed Copper Conductors of Class 2 as per BS EN / IEC 60228.			
(b) Resistance of each conductor at 20°C	As per BS EN / IEC 60228.			
3. Conductor Screen				
(a) Type	Extruded Semi-conducting Compound type. The extruded layer shall be continuous and shall cover the surface of the conductor completely. The Conductor Screen shall be applied in the same operation as the insulation and shall be fully bonded to the insulation.			
(b) Volume resistivity	Shall not exceed 500 Ω.m at 90 °C when measured in accordance with Annex J of BS 6622:2007 or Annex D of IEC 60502-2:2014 as applicable.			
(c) Thickness	Shall be in accordance with BS 6622:2007 or IEC 60502-2:2014 standards.			
4. Insulation				
(a) Type	XLPE and shall be applied by extrusion and cross-linked to form a compact and homogeneous layer in accordance with the standards specified.			
(b) Nominal thickness as per BS 6622:2007	3.4 mm	8.0 mm	3.4 mm	8.0 mm

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Technical Feature	11 kV Single Core	33 kV Single Core	11 kV Three Core	33 kV Three Core
5. Insulation Screen				
(a) Type	Non-metallic semi-conducting layer having a resistivity not exceeding 500 Ω.m at 90 ^{0} C, in combination with metallic layer. The extruded layer shall be continuous and shall cover the surface of the insulation completely. The insulation screen shall be cold strippable.			
(b) Thickness	Shall be in accordance with BS 6622:2007 or IEC 60502-2:2014 standards.			
6. Metallic Screen				
(a) Type	Each Core shall be covered with Copper Wire or Tape Screen as per BS 6622:2007. If Copper Wire screen is offered, such wires shall be in contact with each other.			
(b) Fault current withstand capability	The cross-sectional area of the metallic screen shall be able to withstand the 1/3rd of System Fault current over the full duration specified.		The cross-sectional area of the metallic screen of each core shall be able to withstand the 1/3rd of System Fault current over the full duration specified.	
	Manufacturer shall prove the fault current withstand capability using adiabatic equation specified in IEC 60949.			
7. Laying Up of Cores	-		Shall be layed-up with a right-hand direction of lay.	
8. Inner Coverings and Fillers	Inner covering shall be non-hygroscopic and applied in accordance with BS 6622:2007 or IEC 60502-2:2014 standards. Inner coverings shall be extruded or lapped.		Inner covering and fillers shall be non-hygroscopic and applied in accordance with BS 6622:2007 or IEC 60502-2:2014 standards. Inner coverings shall be extruded or lapped.	
9. Longitudinal Water Barrier	Water barrier swelling tape or powder in conductor, over metallic screen, armour shall be provided to protect against longitudinal water penetration.			
10. Metallic Sheath **(Optional and shall be provided if**	Lead alloy sheath or any other suitable metallic sheath, which shall be free from defects, shall be provided over an inner covering, in accordance with IEC 60502-2:2014.			

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Technical Feature	11 kV Single Core	33 kV Single Core	11 kV Three Core	33 kV Three Core
Specified in Price Schedule)				
11. Metallic Armour	Shall be Aluminum alloy and shall consist of round wires.		Shall be Galvanized Steel and shall consist of round wires.	
	Metallic armour shall have a non-hygroscopic inner covering conforming to BS 6622:2007 or IEC 60502-2:2014 standards as applicable. The nominal diameter of the armour wires shall be in accordance with BS 6622:2007 or IEC 60502-2:2014 standards as applicable.			
12. Oversheath				
(a) Type	PVC-ST2 as per IEC 60502-2 or PVC Type 9 as per BS 6622 and shall be suitable for the maximum operating temperature of 90°C.			
(b) Colour	Black.			
(c) Thickness	Mean value of the thickness shall not be less than the specified values in BS 6622:2007 or IEC 60502-2:2014 as applicable and compliance shall be checked by carrying out tests given in the relevant standards.			
13. Coatings	A coating of Graphite shall be applied over the oversheath to carry out D.C. Voltage Test.			
14. Type tests	Type tests for the offered cable should have as per BS 6622:2007 or any other standard which is not less stringent than that are applicable.			

Note: The conductor screen, the insulation and the non-metallic insulation screen shall be extruded simultaneously in a single-head triple extrusion process, ensuring cold strippable feature for insulation screen.

6. REQUIREMENTS FOR SELECTION

6.1. Quality Assurance

The manufacturer shall possess ISO 9001:2015 or latest Quality Assurance Certification valid throughout the delivery period of this bid, for the manufacture of offered XLPE Insulated Underground Cables where manufacturing is intended. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacturer, along with the offer.

6.2. Manufacturing Experience

The manufacturer shall have minimum of ten (10) years experience in manufacturing XLPE Insulated Underground Cables. Out of this period offered XLPE Insulated Underground Cables should have been supplied successfully outside the country of the manufacturer for minimum of five (5) years for usage in utilities. The product offered has to be in same voltage range of offered item and shall have been used in service utilities over past 5 years.

If the manufacturer has supplied similar items to CEB for the last five (5) years with proven sales records; without any adverse performance records, such manufacturers will be exempted from above requirements.

6.3. Type Tests

The following Type Test Certificates conforming to the BS 6622:2007 or any other international standard which is not less stringent, issued by:

Either

(a) an accredited independent testing laboratory acceptable to the CEB or

(b) an accredited or independent testing laboratory acceptable to the CEB where the type tests have been witnessed by CEB or a reputed independent body acceptable to CEB

shall be furnished with the offer. Type Test Certificates shall clearly indicate the relevant standard, items concerned, showing the manufacturers identity, type No. /catalogue No. and basic technical parameters. In case if the submitted type tests are according to any other international standard which is not less stringent than the specified, then the copy of the used standard in English shall be submitted with offer.

Proof of accreditation and accredited scope by a national/ international authority shall be forwarded with the offer. Test certificates shall be complete including all the pages as issued by the testing authority. Type test certificates shall be in English language. Parts of test certificates shall not be acceptable.

If cables type tested for IEC standards are offered, such cables will be accepted with a condition that the tests which are not covered or less stringent than BS 6622:2007 shall be performed at pre-shipment inspection as an acceptance criteria. In case any standard other than BS 6622:2007 is followed for testing full test procedure of that standard shall be furnished with the offer.

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Electrical Type tests done on Cables subject to the following conditions will be acceptable. Type tests performed on any other cable will not be accepted.

(a) The type tested cable should have same insulation material, same form of semi-conductor screen, same manufacturing process. The conductor material will not be a limitation.

(b) Type tested cable should be of equal or higher voltage designation over the offered cable.

(c) With regard to the Cross-sectional area of the cables offered, Clause G.3 of Annex G of BS 6622:2007 shall apply.

(d) Type test done for three core cables will be accepted as type test for single core cables but type test for single core cable is acceptable only for the single core cable.

Electrical Tests

(a) Partial Discharge Test

(b) Bending Test

(c) Tan δ in Relation to Voltage

(d) Tan δ in Relation to Temperature

(e) Heating Cycle Test

(f) Impulse Voltage Test

(g) Four-hour Voltage Test

(h) Adherence of screens at short circuit temperature

(i) Resistance of the cable at 20°C

Material Tests

(a) Conductor Screen Resistivity

(b) Insulation Material

(c) Insulation Screen Resistivity

(d) Insulation Screen Cold Strippability

(e) Semi-conducting Lapped Inner covering Resistance

(f) Separation Sheath Material

(g) Tests on Armour

(h) Tests on Over Sheath Material

(i) Compatibility Test

(j) Test under Fire Conditions

7. INFORMATION TO BE FURNISHED WITH THE OFFER

The following shall be furnished with the offer.

(a) Following technical details in English clearly identifying the offered items, but not limited to:

(i) Comprehensive catalogues.
(ii) Dimensional drawings.
(iii) Schematic diagrams.
(iv) Calculations, graphs and tables.
(v) Operational literature.
(vi) Calculations to prove metallic screen can withstand specified earth fault current.

(b) Documentary evidence on following:

(i) Maximum design electrical stress (taking purity of raw materials, manufacturing conditions ad ageing of cables into account).
(ii) Purity of raw materials.
(iii) Control of extrusion process to achieve smooth extruded surfaces, homogenous extrudates and prevention of void formations.

(c) ISO 9001:2015 or latest Quality Assurance Certificate in accordance with clause 6.1.

(d) Manufacturer shall furnish a list of supplies with supplied item, purchaser (specifying address contact persons and contact details, country), year & quantity to prove his manufacturing experience and outside the country sales in accordance with Clause 6.2.

(e) Type Test Certificates in accordance with the clause 6.3.

(f) Duly filled and signed 'Annex - B: Schedule of Technical Requirements and Guaranteed Technical Particulars'.

Not furnishing above documents and details may result in offer being rejected.

8. PERFORMANCE GUARANTEES AND WARRANTY

Manufacturer should provide CEB a warranty ensuring that cables supplied meet the specification and any defected cable shall be replaced without extra cost during the first year after the final

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delivery to CEB stores.

9. SAMPLES

Two specimen samples of length 0.3 meter from offered category shall be supplied with the offer.

10. SPARES

Not Applicable.

11. PACKING AND LABELING/MARKING

11.1. Packing

The cables shall be supplied in non-returnable drums. Drums shall be made of steel and suitably protected against corrosion. A polythene lining shall be provided to prevent any damage to cable from the chemicals used for preservation of drum.

The drum shall be lagged with closely fitted battens to protect cable from damage. The ends of cables shall be sealed with heat shrinkable caps to prevent the ingress of moisture during transportation and storage. The preferred length of cable per drum shall be 500 meters subject to a maximum gross drum weight of 5 MT. The cable length per drum shall not vary more than ±2%.

The final packing requirements for the overall consignment are given in bid document.

11.2. Identification and Labeling/Marking

The word "CEB", voltage rating as U_0/U (U_m), size of the cable, standard adopted, conductor size, year of manufacture, manufacturer's name or trade mark and travel length shall be embossed at intervals as stipulated in BS 6622-2007 or IEC 60502-2-2014 as applicable, on the outside of the oversheath. The embossing shall be weatherproof and abrasion proof.

Each drum shall be labeled (with clear stencil) with the following;

(a) "PROPERTY OF CEYLON ELECTRICITY BOARD"

(b) Bid No. ..... Serial No.....

(c) Manufacturer's identification.

(d) Cable Type, Voltage Rating, Conductor Size and Number of Cores.

(e) Number and year of standard adopted.

(f) Net Weight & Gross Weight in kg.

(g) Length of cable in meter.

(h) Direction of rolling

(i) Year of Manufacture.

12. INSPECTION AND TESTING

12.1. Routine Tests

Depending on the choice of the applicable standards, the following Routine Test Certificates conforming to the BS 6622:2007 standard shall be furnished for the observation of the Engineer appointed by the purchaser at the time of inspection. In addition, the routine test certificates shall be sent with the shipment of cables.

(a) Spark Test on Oversheath

(b) Conductor Resistance

(c) Copper Wire Screen Resistance

(d) Partial Discharge Test

(e) Voltage Test on Complete Cable

(f) Cable Marking

(g) D.C. Voltage Test on Oversheath

12.2. Inspection

The Successful bidder shall make necessary arrangements for inspection by an Engineer appointed by the CEB and also to carry out in his presence necessary Acceptance tests on procured item and material without any additional cost. Acceptance test reports shall be a part of the shipping document. CEB may waive off the inspection either with the condition of witnessing the acceptance tests by an independent body acceptable to CEB or completely. In such a situation a notice of waive off will be issued in advance to the supplier.

12.3. Acceptance Tests

Depending on the choice of the applicable standards, the following Sample/Acceptance Tests conforming to the BS 6622:2007 standard shall be witnessed by the Engineer.

(a) Conductor Material and Construction

(b) Conductor Screen Application

(c) Insulation, Hot set Test

(d) Insulation, Thickness

(e) Insulation, Concentricity

(f) Circularity of Cores

(g) Insulation Tests on Screen

(h) Metallic Screen, Application

(i) Measurement of Amour Wires

(j) Oversheath Thickness

(k) Four-hour Voltage test

Additionally, verification of dimension and resistivity of metallic screen as against calculations provided in clause 7.0 (a)(vi) should be done.

13. ANNEXES

Annex – A	: Price Variation
Annex – B1	: Schedule of Technical Requirements and Guaranteed Technical Particulars (For 11kV XLPE Insulated Single Core Cables)
Annex – B2	: Schedule of Technical Requirements and Guaranteed Technical Particulars (For 11kV XLPE Insulated Three Core Cables)
Annex – B3	: Schedule of Technical Requirements and Guaranteed Technical Particulars (For 33kV XLPE Insulated Single Core Cables)
Annex – B4	: Schedule of Technical Requirements and Guaranteed Technical Particulars (For 33kV XLPE Insulated Three Core Cables)
Annex – C	: Non-Compliance Schedule

ANNEX- A: PRICE VARIATION

The Bidders shall forward their offers on the basis of the Price Variation stipulated below.

1. BASIS OF THE OFFER

(a) Bidders are required to make their offers on the basis of a Base Price plus a Fixed Price Margin.

(b) The Base Price shall be the Cash Seller's Midday Official Average Price of Copper Grade A, Aluminium Alloy, Steel Rebar and Lead, at London Metal Exchange (LME) in US Dollars on the 14th day before the closing of Bids (exclusive of the bid closing date) or the previous working day if that day is a non-working day at the LME.

(c) The Fixed Price Margin shall be quoted in the currency of choice of the Bidder.

Accordingly, FOB Price of foreign Bidders offering cables from outside the country and the ex-factory price of Local Bidders shall be computed **for the evaluation as;**

$$\{[((B \times MT) + (BA \times MTA)^{*} + (BL \times MTL)^{*} + (BS \times MTS)^{*}) \times US_0] + (FP \times CC_0)\} \times TL$$

* if applicable

Where;

B - Base Price which is the LME Official Settlement Price of Copper Grade A in USD per Metric Ton at the LME on the fixed date [Clause (1 b)]

BA - Base Price which is the LME Official Settlement Price of Aluminium Alloy in USD per Metric Ton at the LME on the fixed date [Clause (1 b)]

BL - Base Price which is the LME Official Settlement Price of Lead in USD per Metric Ton at the LME on the fixed date [Clause (1 b)]

BS - Base Price which is the 1 month closing price of Steel Rebar in USD per Metric Ton at the LME on the fixed date [Clause (1 b)]

FP - Fixed Price Margin per kilometer of cable in the currency allowed under Clause 1(c) above.

MT - Quantity of Copper Grade A required to manufacture one kilometre of cable in Metric Ton.

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MTA - Quantity of Aluminium Alloy required to manufacture one kilometre of cable in Metric Ton.

MTL - Quantity of Lead required to manufacture one kilometre of cable in Metric Ton, as applicable.

MTS - Quantity of Steel required to manufacture one kilometre of cable in Metric Ton, as applicable.

TL - Total Length in kilometers of cables offered.

CC_0 - Currency Conversion rate from the currency of choice of the Bidder to LKR prevailing on the 14th day before Bid opening.

US_0 - Currency Conversion rate from the US Dollars to LKR prevailing on the 14th day before Bid opening.

2. AWARD PRICE

(a) The FOB Award Price of foreign Bidders offering underground cables shall be computed as;

[((B1 X MT) + (B1A X MTA) * + (B1L x MTL) * + (B1S x MTS) *) x TL] in US Dollars + **[FP x TL]** in the currency of choice quoted.

(b) The Ex-factory Award Price of Local Bidders offering underground cables shall be computed as;

{[((B1 X MT) + (B1A X MTA) * + (B1L x MTL) * + (B1S x MTS) *) x US_1] + (FP x CC_1)} x TL in LKR

Where;

B1 - Base Price which is the LME Official Settlement Price of Copper Grade A, in US Dollars per Metric ton at the LME at the 3rd working day immediately after the day of award.

B1A - Base Price which is the LME Official Settlement Price of Aluminium Alloy, in US Dollars per Metric ton at the 3rd working day immediately after the day of award.

B1L - Base Price, which is the LME Official Settlement Price of Lead, in US Dollars per Metric ton at the 3rd working day immediately after the day of award.

B1S - Base Price which is the 1 month closing price of Steel Rebar, in US Dollars per Metric ton at the 3rd working day immediately after the day of award.

CC_1 - Conversion rate from the currency of choice to Sri Lankan Rupees prevailing on the 3rd working day immediately after the day of award.

US_1 - Currency Conversion rate from the US Dollars to LKR prevailing on the 3rd working day immediately after the day of award.

Intimation of the award will be faxed/ e-mailed to the successful Bidder and or to his agent in Sri Lanka on the same day of the award.

3. CONVERSION OF CURRENCY

(a) For the purpose of the evaluation the Prices **B , BA, BL** and **BS** in US Dollars and the Fixed Price Margin (FP) in the currency of choice of the Bidder will be converted to LKR at the official Selling Exchange Rate of the Central Bank of Sri Lanka prevailing on the 14th day before closing of Bids.

(b) The payment for the foreign Bidders for supply of underground cables will be made at the contract price in the currency quoted for the Fixed Price Margin (FP) .The metal base prices in US Dollars will be converted to the currency of the FP at the official Selling Exchange rate at the Central Bank of Sri Lanka prevailing at the 3rd working day immediately after the day of award.

(c) The payment for local suppliers for the supply of underground cables will be made in LKR. The Prices of Copper Grade A, Aluminium alloy, Lead and Steel Rebar, in US Dollars will be converted to LKR at the official Selling Exchange rate at the Central Bank of Sri Lanka prevailing on the 3rd working day immediately after the day of award.

4. VARIATION FIGURES

The Bidders shall furnish;

(i) Fixed Price Margin (FP) for manufacture of one kilometer of offered underground cable in the currency allowed in Clause 1(c).

(ii) Weight in metric tons of Copper Grade A (MT) required for the manufacture of one kilometer of cables offered.

(iii) Weight in metric tons of Aluminium Alloy (MTA) required for the manufacture of one kilometer of cables offered.

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(iv) Weight in metric tons of Lead (MTL) required for the manufacture of one kilometer of cables offered.

(v) Weight in metric tons of Steel (MTS) required for the manufacture of one kilometer of cables offered.

in the price schedule.

....

Signature and seal of the Manufacturer **Date**

I/We certify that the above data are true and correct

....

Signature and seal of the Bidder **Date**

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ANNEX B1: SCHEDULE OF TECHNICAL REQUIREMENTS AND GURANTEED TECHNICAL PARTICULARS (For 11kV XLPE Insulated Single Core Cables)

			CEB Requirement	Offered
1.	Name of the Manufacturer			
2.	Country of Origin			
3.	Nominal cross-sectional area mm²			
4.	No. of cores		1	
5.	Lead Metallic Sheath		As per the price schedule	
6.	Rated Voltage category		11 kV	
7.	System Highest Voltage		12 kV	
8.	Designed Fault Current and duration for conductor	(for cables including 185mm² and above)	16.4 kA, 1s	
		(for cables below 185mm²)	12.5 kA, 1s	
9.	Basic Insulation Level (minimum)		95 kV	
10.	Maximum Nominal Operating Temperature		90 °C	
11.	Maximum Design Stress		5 kV/mm	
12.	Applicable Standards		BS 6622-2007/IEC 60502-2-2014 as applicable	
13.	Conductor Particulars			
	(a) Diameter mm			
	(b) Number of strands. Nos.			
	(c) Diameter of strands. mm			
	(d) Material		Annealed Copper	
	(e) Shape		Round	
	(f) Type			
	I. Solid / Stranded		Stranded	
	II. Compact / Non compact		Compacted	
14.	Conductor Screen Particulars			
	(a) Material		Copper	
	(b) Thickness mm		As per applicable standard	
	(c) Method of Application		Extruded	
	(d) Whether applied in the same operation as insulation		Yes	
15.	Insulation Particulars			
	(a) Material		XLPE	
	(b) Extrusion process		Triple	
	I. Minimum average mm		As per applicable standard	

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	II. Minimum at a point	mm	As per applicable standard	
16.	Insulation Screen Particulars			
	(a) Type		non-metallic semi-conducting	
	I. Semi-conducting layer		Extruded	
	II. Metallic		No	
	III. Strippability		Cold	
	(b) Material		Extruded Semi-conducting Compound	
	(c) Maximum Electrical Stress		5 kV.mm	
17.	Inner covering		As per clause 5	
18.	Metallic Screen		As Per Clause 5	
19.	Fault current carrying capacity of metallic screen	kA	As Per Clause 5	
20.	Longitudinal water blocking		As per clause 5	
	(a) form of water blocking material			
21.	Metallic armour		As per clause 5	
	(a) Material		Aluminium Alloy	
	(b) Diameter of a wire	mm	As per applicable standard	
22.	Oversheath			
	(a) Type/Material		PVC-ST2 or Type 9	
	(b) Thickness			
	I. Nominal	mm	As per applicable standard	
	II. Min. at a point	mm	As per applicable standard	
	(c) Whether Graphite layer provided		As per clause 5	
	(d) Whether DC test on oversheath carried out			
23.	Overall diameter of cable	mm		
24.	Approximate weight of cable	kg/ km		
25.	Minimum bending radius	mm	As per applicable standard	
26.	Whether the cable ends are sealed before shipping		As per clause 7.2	
27.	Indicate the details of marking provided on the over sheath.			
	(a) Cable Designation		As per applicable standard	
	(b) Identification of manufacturer			
28.	Current Rating			
	(a) Laid direct			
	(b) Laid in ducts			

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	(c) Laid in air			
	(d) Whether the maximum symmetrical short circuit current rating curves for 0.2 to 3 Sec. duration Furnished		Yes	
29.	Conditions of laying where the above rating are valid.			
	(a) Standard depth of laying		1.1 m	
	(b) Ambient air temperature		30 °C	
30.	(a) Maximum conductor DC resistance at 20°C	Ω/km	As per applicable standard	
	(b) Maximum conductor reactance at 50 Hz		Ω/km	
	(c) Maximum conductor capacitance at 50Hz		μ F/km	
	(d) Coefficient of Thermal variations of the Electrical parameters			
31.	Maximum allowable conductor temperature at and duration			
	(a) Full Load conditions/ Duration			
	(b) Short Circuit conditions/ Duration			
	(c) Over load conditions/ Duration			
	(d) Allowable maximum overloading in determining the above	%/A		
32.	Drum Particulars			
	(a) Material of the drum		Steel	
	(b) Dimensions.	mm x mm		
	(c) Weight	kg		
	(d) Standard cable length		500m	
	(e) Weight of standard length with drum	kg		
33.	Whether a certified copy of ISO 9001:2015 or latest furnished with the offer?		As per clause 6.0	
34.	Whether the entire Type Test Certificates in accordance with clause 8.1 furnished with the offer?		As per clause 8.1	
35.	In case of cables which are type tested for IEC standards, whether supplier/manufacturer is agreeing to perform tests which are less stringent than BS 6622:2007 and not covered, during pre-shipment?	Agreed/Not	To be agreed	

.....
Signature of the Manufacturer and seal

.....
Date

I/We certify that the above data are true and correct

.....
Signature of the Bidder and seal

.....
Date

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ANNEX B2: SCHEDULE OF TECHNICAL REQUIREMENTS AND GURANTEED TECHNICAL PARTICULARS (For 11kV XLPE Insulated Three Core Cables)

			CEB Requirement	Offered
1.	Name of the Manufacturer			
2.	Country of Origin			
3.	Nominal cross-sectional area	mm^2		
4.	No. of cores		3	
5.	Lead Metallic Sheath		As per the price schedule	
6.	Rated Voltage category		11 kV	
7.	System Highest Voltage		12 kV	
8.	Designed Fault Current and duration for a conductor (phase)	(for cables including $185mm^2$ and above)	16.4 kA, 1s	
		(for cables below $185mm^2$)	12.5 kA, 1s	
9.	Basic Insulation Level		95 kV	
10.	Maximum Nominal Operating Temperature		90 °C	
11.	Maximum Design Stress		5 kV/mm	
12.	Applicable Standards		BS 6622-2007/IEC 60502-2-2014 as applicable	
13.	Conductor Particulars			
	(a) Diameter	mm		
	(b) Number of strands.	Nos.		
	(c) Diameter of strands.	mm		
	(d) Material		Annealed Copper	
	(e) Shape		Round	
	(f) Type			
	I. Solid / Stranded		Stranded	
	II. Compact / Non compact		Compacted	
14.	Conductor Screen Particulars			
	(a) Material		Copper	
	(b) Thickness	mm	As per applicable standard	
	(c) Method of Application		Extruded	
	(d) Whether applied in the same operation as insulation		As per clause 5.2	

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15.	Insulation Particulars			
	(a) Material		XLPE	
	(b) Extrusion process		Triple	
	I. Minimum average	mm	As per applicable standard	
	II. Minimum at a point	mm	As per applicable standard	
16.	Insulation Screen Particulars			
	(a) Type		non-metallic semi-conducting	
	I. Semi-conducting layer		Extruded	
	II. Metallic		No	
	III. Strippability		Cold	
	(b) Material		Extruded Semi-conducting Compound	
	(c) Maximum Electrical Stress		5 kV/mm	
17.	Lay Direction of cores		Right-Handed	
18.	Inner covering and fillers		As per clause 5	
19.	Metallic Screen construction		As per clause 5	
20.	Fault current carrying capacity of metallic screen	kA	As per clause 5	
21.	Longitudinal water blocking		As per clause 5	
	(a) form of water blocking material			
22.	Metallic armour		As per clause 5	
	(a) Material		Galvanized Steel	
	(b) Diameter of a wire	mm	As per applicable standard	
23.	Oversheath			
	(a) Type/Material		PVC-ST2 or Type 9	
	(b) Thickness			
	I. Nominal	mm	As per applicable standard	
	II. Min. at a point	mm	As per applicable standard	
	(c) Whether Graphite layer provided		As per clause 5	
	(d) Whether DC test on oversheath carried out			
24.	Overall diameter of cable		mm	
25.	Approximate weight of cable kg/ km			

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26.	Minimum bending radius	mm	As per applicable standard	
27.	Whether the cable ends are sealed before shipping		As per clause 7.2	
28.	Indicate the details of marking provided on the over sheath.			
	(a) Cable Designation		As per applicable standard	
	(b) Identification of manufacturer			
29.	Current Rating			
	(a) Laid direct			
	(b) Laid in ducts			
	(c) Laid in air			
	(d) Whether the maximum symmetrical short circuit current rating curves for 0.2 to 3 Sec. duration Furnished		Yes	
30.	Conditions of laying where the above rating are valid.			
	(a) Standard depth of laying		1.1 m	
	(b) Ambient air temperature		30 °C	
31.	(a) Maximum conductor DC resistance at 20°C	Ω/km	As per applicable standard	
	(b) Maximum conductor reactance at 50 Hz	Ω/km		
	(c) Maximum conductor capacitance at 50Hz	μ F/km		
	(d) Coefficient of Thermal variations of the Electrical parameters			
32.	Maximum allowable conductor temperature at and duration			
	(a) Full Load conditions/ Duration			
	(b) Short Circuit conditions/ Duration			
	(c) Over load conditions/ Duration			
	(d) Allowable maximum overloading in determining the above	%/A		
33.	Drum Particulars			
	(a) Material of the drum		Steel	
	(b) Dimensions.	mm x mm		
	(c) Weight	kg		
	(d) Standard cable length		500m	
	(e) Weight of standard length with drum	kg		
34.	Whether a certified copy of ISO 9001:2015 or latest furnished with the offer?		As per clause 6.0	
35.	Whether the entire Type Test Certificates in accordance with clause 8.1 furnished with the offer?		As per clause 8.1	

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36.	In case of cables which are type tested for IEC standards, whether supplier/manufacturer is agreeing to perform tests which are less stringent than BS 6622:2007 and not covered, during pre-shipment?	Agreed/Not	To be agreed	

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Signature of the Manufacturer and seal

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Date

I/We certify that the above data are true and correct

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Signature of the Bidder and seal

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Date

ANNEX B3: SCHEDULE OF TECHNICAL REQUIREMENTS AND GURANTEED TECHNICAL PARTICULARS (For 33kV XLPE Insulated Single Core Cables)

			CEB Requirement	Offered
1.	Name of the Manufacturer			
2.	Country of Origin			
3.	Nominal cross-sectional area	mm^2		
4.	No. of cores		1	
5.	Lead Metallic Sheath		As per the price schedule	
6.	Rated Voltage category		33kV	
7.	System Highest Voltage		36 kV	
8.	Designed Fault Current and duration for a conductor	(for cables including $185mm^2$ and above)	17.6 kA, 1s	
		(for cables below $185mm^2$)	13 kA, 1s	
9.	Basic Insulation Level		194 kV	
10.	Maximum Nominal Operating Temperature		90 °C	
11.	Maximum Design Stress		5 kV/mm	
12.	Applicable Standards		BS 6622-2007/ IEC 60502-2-2014 as applicable	
13.	Conductor Particulars			
	(a) Diameter	mm		
	(b) Number of strands.	Nos.		
	(c) Diameter of strands.	mm		
	(d) Material		Annealed Copper	
	(e) Shape		Round	
	(f) Type			
	I. Solid / Stranded		Stranded	
	II. Compact / Non compact		Compacted	
14.	Conductor Screen Particulars			
	(a) Material		Copper	
	(b) Thickness	mm	As per applicable standard	
	(c) Method of Application		Extruded	
	(d) Whether applied in the same operation as insulation		As per clause 5.2	
15.	Insulation Particulars			
	(a) Material		XLPE	

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	(b) Extrusion process		Triple	
	I. Minimum average	mm	As per applicable standard	
	II. Minimum at a point	mm	As per applicable standard	
16.	Insulation Screen Particulars			
	(a) Type		non-metallic semi-conducting	
	I. Semi-conducting layer		Extruded	
	II. Metallic		No	
	III. Strippability		Cold	
	(b) Material		Extruded Semi-conducting Compound	
	(c) Maximum Electrical Stress		As per applicable standard	
17.	Inner covering		As per clause 5	
18.	Metallic Screen		As Per Clause 5	
19.	Fault current carrying capacity of metallic screen	kA		
20.	Longitudinal water blocking		As per clause 5	
	(a) form of water blocking material			
21.	Metallic armour		As per clause 5	
	(a) Material		Aluminium Alloy	
	(b) Diameter of a wire	mm	As per applicable standard	
22.	Oversheath			
	(a) Type/Material		PVC-ST2 or Type 9	
	(b) Thickness			
	I. Nominal	mm	As per applicable standard	
	II. Min. at a point	mm	As per applicable standard	
	(c) Whether Graphite layer provided		As per clause 5	
	(d) Whether DC test on oversheath carried out			
23.	Overall diameter of cable	mm		
24.	Approximate weight of cable kg/ km			
25.	Minimum bending radius	mm	As per applicable standard	
26.	Whether the cable ends are sealed before shipping		As per clause 8	
27.	Indicate the details of marking provided on the over sheath.			
	(a) Cable Designation		As per applicable standard	
	(b) Identification of manufacturer			
28.	Current Rating			

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	(a) Laid direct			
	(b) Laid in ducts			
	(c) Laid in air			
	(d) Whether the maximum symmetrical short circuit current rating curves for 0.2 to 3 Sec. duration Furnished		Yes	
29.	Conditions of laying where the above rating are valid.			
	(a) Standard depth of laying			
	(b) Ambient air temperature		30 °C	
30.	(a) Maximum conductor DC resistance at 20°C	Ω/km	As per applicable standard	
	(b) Maximum conductor reactance at 50 Hz	Ω/km		
	(c) Maximum conductor capacitance at 50Hz	μ F/km		
	(d) Coefficient of Thermal variations of the Electrical parameters			
31.	Maximum allowable conductor temperature at and duration			
	(a) Full Load conditions/ Duration			
	(b) Short Circuit conditions/ Duration			
	(c) Over load conditions/ Duration			
	(d) Allowable maximum overloading in determining the above	%/A		
32.	Drum Particulars			
	(a) Material of the drum		Steel	
	(b) Dimensions.	mm x mm		
	(c) Weight	kg		
	(d) Standard cable length		500m	
	(e) Weight of standard length with drum	kg		
33.	Whether a certified copy of ISO 9001:2015 or latest furnished with the offer?		As per clause 7.0	
34.	Whether the entire Type Test Certificates in accordance with clause 8.1 furnished with the offer?		As per clause 8.1	
35.	In case of cables which are type tested for IEC standards, whether supplier/manufacturer is agreeing to perform tests which are less stringent than BS 6622:2007 and not covered, during pre-shipment?	Agreed /Not	To be agreed	

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Signature of the Manufacturer and seal

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Date

I/We certify that the above data are true and correct

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ANNEX B4: SCHEDULE OF TECHNICAL REQUIREMENTS AND GURANTEED TECHNICAL PARTICULARS (For 33kV XLPE Insulated Three Core Cables)

			CEB Requirement	Offered
1.	Name of the Manufacturer			
2.	Country of Origin			
3.	Nominal cross-sectional area mm²			
4.	No. of cores		3	
5.	Lead Metallic Sheath		As per the price schedule	
6.	Rated Voltage category		33kV	
7.	System Highest Voltage		36 kV	
8.	Designed Fault Current and duration for a conductor (phase)	(for cables including 185mm² and above)	17.6 kA, 1s	
		(for cables below 185mm²)	13 kA, 1s	
9.	Basic Insulation Level		194 kV	
10.	Maximum Nominal Operating Temperature		90 °C	
11.	Maximum Design Stress		5 kV/mm	
12.	Applicable Standards		BS 6622-2007/ IEC 60502-2 - 2014 as applicable	
13.	Conductor Particulars			
	(a) Diameter mm			
	(b) Number of strands. Nos.			
	(c) Diameter of strands. mm			
	(d) Material		Annealed Copper	
	(e) Shape		Round	
	(f) Type			
	I. Solid / Stranded		Stranded	
	II. Compact / Non compact		Compacted	
14.	Conductor Screen Particulars			
	(a) Material		Copper	
	(b) Thickness mm		As per applicable standard	
	(c) Method of Application		Extruded	
	(d) Whether applied in the same operation as insulation		As per clause 5	
15.	Insulation Particulars			
	(a) Material		XLPE	
	(b) Extrusion process		Triple	

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	I. Minimum average	mm	As per applicable standard	
	II. Minimum at a point	mm	As per applicable standard	
16.	Insulation Screen Particulars			
	(a) Type		non-metallic semi-conducting	
	I. Semi-conducting layer		Extruded	
	II. Metallic		No	
	III. Strippability		Cold	
	(b) Material		Extruded Semi-conducting Compound	
	(c) Maximum Electrical Stress		As per applicable standard	
17.	Lay Direction of cores		Right Handed	
18.	Inner covering and fillers		As per clause 5	
19.	Metallic Screen		As Per Clause 5	
20.	Fault current carrying capacity of metallic screen	kA	As Per Clause 5	
21.	Longitudinal water blocking		As per clause 5	
	(a) form of water blocking material			
22.	Metallic armour		As per clause 5	
	(a) Material		Galvanized Steel	
	(b) Diameter of a wire	mm	As per applicable standard	
23.	Oversheath			
	(a) Type/Material		PVC-ST2 or Type 9	
	(b) Thickness			
	I. Nominal	mm	As per applicable standard	
	II. Min. at a point	mm	As per applicable standard	
	(c) Whether Graphite layer provided		As per clause 5.12	
	(d) Whether DC test on oversheath carried out			
24.	Overall diameter of cable	mm		
25.	Approximate weight of cable kg/ km			
26.	Minimum bending radius	mm	As per applicable standard	
27.	Whether the cable ends are sealed before shipping		As per clause 8.2	
28.	Indicate the details of marking provided on the over sheath.			
	(a) Cable Designation		As per applicable standard	
	(b) Identification of manufacturer			
29.	Current Rating			

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	(a) Laid direct			
	(b) Laid in ducts			
	(c) Laid in air			
	(d) Whether the maximum symmetrical short circuit current rating curves for 0.2 to 3 Sec. duration Furnished		Yes	
30.	Conditions of laying where the above rating are valid.			
	(a) Standard depth of laying			
	(b) Ambient air temperature		30 °C	
31.	(e) Maximum conductor DC resistance at 20°C	Ω/km	As per applicable standard	
	(f) Maximum conductor reactance at 50 Hz	Ω/km		
	(g) Maximum conductor capacitance at 50Hz	μ F/km		
	(h) Coefficient of Thermal variations of the Electrical parameters			
32.	Maximum allowable conductor temperature at and duration			
	(a) Full Load conditions/ Duration			
	(b) Short Circuit conditions/ Duration			
	(c) Over load conditions/ Duration			
	(d) Allowable maximum overloading in determining the above	%/A		
33.	Drum Particulars			
	(a) Material of the drum		Steel	
	(b) Dimensions.	mm x mm		
	(c) Weight	kg		
	(d) Standard cable length		500m	
	(e) Weight of standard length with drum	kg		
34.	Whether a certified copy of ISO 9001:2015 furnished with the offer?		As per clause 6.0	
35.	Whether the entire Type Test Certificates in accordance with clause 9.1 furnished with the offer?		As per clause 8.1	
36.	In case of cables which are type tested for IEC standards, whether supplier/manufacturer is agreeing to perform tests which are less stringent than BS 6622:2007 and not covered, during pre-shipment?	Agreed/ Not	To be agreed	

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Signature of the Manufacturer and seal

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Date

ANNEX C: NON-COMPLIANCE SCHEDULE

On this schedule the bidder shall provide a list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to the relevant specification clause.

Clause No.	Non-Compliance

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Signature of the Manufacturer

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Date

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