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DRAFT TECHNICAL SPECIFICATION OF SUPPLY OF LT AERIAL BUNCHED CABLES OF SIZES 3CX70, 3CX95 & 3X120 SQ.MM

Sr. No	Technical Specification No./Revision	Date of revision
1.	GUVNL/GPRD/TS/LTABC/RP242/R0	07.03.2025
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4.		
5.		

1. SCOPE:

This specification covers the design, manufacture, testing, inspection, packing, transportation, and delivery of Cross-linked polyethylene (XLPE) insulated Aluminium Cables twisted over a central aluminum alloy messenger wire for use on 3-phase 4-wire LT overhead distribution feeders. The cable should be suitable for use on a three-phase AC (Earthed) system for rated voltage up to and including 1100 Volts and UV protection. The sizes are,

- I. 3CX70 (Ph) + 1CX 70 (N)+ 1CX50 (M)
- II. 3CX95 (Ph) + 1CX 95 (N)+ 1CX70 (M)
- III. 3CX120 (Ph) + 1CX 120 (N)+ 1CX70 (M)
- IV. 3CX70 (Ph) + 1CX 70 (N)+ 1CX50 (M)+1CX16 (SL)
- V. 3CX95 (Ph) + 1CX 95 (N)+ 1CX70 (M)+1CX16 (SL)
- VI. 3CX120 (Ph) + 1CX 120 (N)+ 1CX70 (M)+1CX16 (SL)

2. SERVICE AND CLIMATIC CONDITIONS:

The climatic conditions will be as under.

Maximum Ambient Air Temperature	50° C
Minimum Ambient Air Temperature	5° C
Maximum daily average ambient air temperature	40°C
Maximum humidity	95%
Altitude above M.S.L. (maximum)	1000Mtr
Average annual rainfall (mm)	750/800
Max. wind pressure(Kg/sqm)	150
Seismic level (Horizontal accn.)	0.3 g
Iso-ceraunic level(Days per Year)	50
The average number of Rainy days/year	120
Terrain	Coastal saline, desert chemically polluted, heavily/moderate, polluted and normal atmosphere
Note: The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.	

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3. NETWORK DETAILS: The normal system parameters of the distribution network are as below.

Nominal system voltage (rms) (U)	0.433KV
Highest system voltage (rms) (Um)	1.1 KV
Number of Phases	3
Network	3 phase 4 wire
Frequency	50Hz
Variation in Frequency	+/- 3%
Type of Earthing	Solidly Earthed

4. INSTALLATIONS:

- 4.1. These cables are required to be laid overhead, hung, and exposed to the Atmosphere in climatic conditions as mentioned above. These are also to be used for giving power supply to LT motive power consumers and other uses as per field requirements.

5. APPLICABLE STANDARDS: The cables shall be designed, manufactured, and tested in accordance with the following Indian/ IEC standards.

IS-398(Part IV):1994	Aluminum conductor for overhead transmission purposes- Part IV: Aluminum alloy stranded conductor- For Messenger Conductor
IS14255:1995	Aerial Bunched conductors for working voltages up to and including 1100 volts
IS-5831:1984	Specification for PVC insulation and sheath of electric cables
IS-7098(Part I):1988	Specification for Cross-linked polyethylene insulated PVC sheathed cables- Part I for working voltage up to and including 1100 volts
IS-8130:1984	Specification for Conductor for insulated electric cables & flexible cords
IS-10418:1982	Specification for drums for electric cables
IS 10810 (1984)	Method of test for cables
IEC 60502-1:2021	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 1: Cables for rated voltages of 1 kV (Um = 1,2 kV) and 3 kV (Um = 3,6 kV)
ASTM G-154	UV testing of XLPE insulation
NFC 33-209	Aerial Bundle Cable (ABC) 1kV
IS-5216	Guide for safety procedures and practices in electric works

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6 DEFINITIONS

- 6.1. An LT Aerial Bunched cable shall typically, at maximum, comprise of:
Insulated phase conductors (3 numbers), Insulated neutral conductors (1 number),
Insulated street lighting conductors (1 conductor), and a bare messenger wire (1 number).

Example:

i) Designation

3 x 120 (P) + 1 x 120 (N) + 1 x 70 (M) + 1 x 16 (SL)

P = Phase Conductor

N = Neutral Conductor

M = Messenger

SL = Street Light Conductor

ii) Size

3 x 120 sq. mm = 3-phase conductors.

1 x 120 sq. mm = 1 neutral conductor

1 x 70 sq. mm = 1 messenger wire

1 x 16 sq. mm = 1 lighting conductor

- 6.2. **Messenger Wire:** "Wire or cable which has the principal function of supporting the cable in overhead systems and which may be separate or may be an integral part of the cable which it supports." Messenger wire shall be a bare conductor.

7. TECHNICAL PARTICULARS:

- 7.1. **Conductor:** The Aluminum conductor shall be of circular cross-section, stranded, and compacted. They shall be of H4 EC grade aluminium grade shall conform to flexibility class-2 complying with IS: 8130:1984.

- 7.1.1. The tensile strength of the Aluminium wires used in the conductors shall not be less than 150 N/mm².

- 7.1.2. The size of the street lighting conductor shall be 16 sq.mm.

- 7.1.3. The standard size and technical characteristics of the phase, Neutral, and street lighting conductors shall be as shown in the following table,

Table 1: Technical Parameters of Conductor

Sr.No	Particular	Size of Conductor (Sq.mm)			
		16 (SL)	70 (Phase & Neutral)	95 (Phase & Neutral)	120 (Phase & Neutral)
1	Nominal Sectional Area (sq.mm)				

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2	Diameter of compacted conductor (mm)	4.4	9.6	11.3	12.9
3	Max. DC resistance at 20 Deg. (ohm/km)	1.91	0.443	0.32	0.253
4	Insulation thickness (mm)	1.2	1.5	1.5	1.6
5	Approx. Mass (kg/km)	42	184	254	315
6	Minimum No. of Strands	6	12	15	15
7	Material	EC grade aluminum of H4 grade to IS: 8130:1984			
8	Shape of conductor	Stranded compacted circular			
9	Maximum conductor temperature during continuous operation	90 °C			
10	Maximum conductor temperature during short circuit	250 °C			

NOTE:-

(A) The resistance values in the above table are the max. Permissible.

(B) Tolerance of + 5 % is allowable on Conductor diameters

7.2. Messenger Wire

7.2.1. The messenger wire shall be stranded, circular, aluminum–magnesium–silicon alloy type. They shall have a minimum of 7 strands.

7.2.2. They shall comply with IS 398 (Part 4). Specific attention is made to Tables – 1, 2 & 3 of IS 398.

7.2.3. There shall be no joints in any wire of the stranded messenger conductor except those made in the base rod of wires before the final drawing.

7.2.4. The sizes and other technical characteristics of the messenger wire shall be as given in Table No.2

7.2.5. Table No.2

Nominal Sectional Area (sq.mm.)	Nos of strands (min.)	Diameter of Compacted Conductor (mm)	Approx Mass (kg/km)	Max. DC Resistance at 20°C (ohm/km)	Minimum Tensile Strength (kN)
50	7	6.68	130	0.689	14.0
70	7	7.98	190	0.492	19.7

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7.3. Conductor Insulation:

- 7.3.1. The cross-linked polyethylene (XLPE) insulating shall be black in color and shall be stabilized against deterioration caused by exposure to direct sunlight and ultraviolet radiation, conforming to the requirements specified in Table – 1 of IS: 14255 – 1995 or IEC 60502. XLPE insulation shall be pressure extruded.
- 7.3.2. The nominal value of the carbon black content of the sheath (insulation) shall be 2.5 with a tolerance of $\pm 0.5\%$ (Table 20 of IEC: 60502-1, 2004).
- 7.3.3. The average thickness of insulation shall comply with Table 4 of IS: 14255 – 1995. For nominal area conductors above 95 sq. mm., the average thickness of insulation shall not be less than the nominal value mentioned in above table-A:
- 7.3.4. It shall be free from any foreign material or porosity visible to the unaided eye. The insulation shall be so applied that it fits closely to the conductor and it shall be possible to remove insulation without damaging the conductor. The XLPE insulation shall be ultraviolet-protected for operation in direct sunlight.
- 7.3.5. The insulating material shall have excellent electrical properties with regard to resistivity, dielectric constant, and loss factor and shall have high tensile strength and resistance to abrasion. This shall not deteriorate at elevated temperatures or when immersed in water. The insulation shall be preferably fire-resistant and resistant to chemicals like acids, alkalis, oils, and ozone.

7.4. Phase Identification: The following shall be embossed on the one side of the core: **RIDGES REQUIRED** for Phase identification:

- 7.4.1. Phase core identification to be provided by Red, Yellow Blue colored strips coextruded in XLPE insulation as a single layer.
 - a) Width of colored strip – 3 to 5 mm
 - b) Depth of colored strip – 0.2 mm (max)

Additionally, Ridges shall be provided over phase & and neutral core also as per IS 14255 for phase identification.

7.5. Embossing on Cable: All the cables shall have the following embossing on the insulated Phase conductors for identification in intervals not more than 1 meter. Font size of letters to be min. 5 mm.

- I. Name or trademark of a manufacturer
- II. Voltage grade
- III. Type of cable, i.e., LT ABC
- IV. Size of phase conductor, i.e., 120 sq.mm.
- V. Successive Length
- VI. Year and month of manufacturing.
- VII. Type of insulation, i.e., XLPE
- VIII. Property of ____ (Name of DISCOM)
- IX. P.O. Number
- X. ISI Mark [on Applicable Size]

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8 Packing and Marking: The cables shall be wound non-returnable wooden drums conforming to IS : 10418 - 1982 or the latest version thereof (specification for Drums for electric cables). The drum shall be marked with the following.

- a) Manufacturer's name.
- b) Trade mark, if any.
- c) Drum number or identification number.
- d) Cable Code as per technical specifications
 - i. For ex. 3CX95 (Ph) + 1CX 95 (N)+ 1CX70 (M)+1CX16 (SL)
- a) Size of conductors.
- b) Size of messenger
- c) Voltage grade.
- d) Number and lengths of pieces of cable in each drum.
- e) Direction of rotation
- f) Gross mass of the packing.
- g) Net mass of cable.
- h) Manufacturing Year
- i) P.O.(A/T) No. and Date
- j) ISI mark.
- k) Details of the consignee (on wooden drums only)
- l) Property of _____(DISCOM Name)

9. Type test: The cable offered shall have successfully passed all types of tests relevant to IS/IEC (amended up to date). The Type Test Certificate shall be submitted along with the offer OR within the commencement period. All the Type Tests shall be carried out from Laboratories that are accredited by the Govt. Approved National Accreditation Board for Testing and Calibration Laboratories (NABL) such as ERDA/CPRI. Type tests shall not be more than 7 years old at the time of bid submission. The following type tests shall be furnished invariably with the offer:

9.1.1. Tests on phase/street light conductor

- a) Tensile Test (IS-8130)
- b) Wrapping Test (IS-8130)
- c) Resistance Test (IS-8130)

9.1.2. Tests on messenger conductor

- a) Breaking Load (to be made on finished conductor as per IS-398-IV: 1994 with latest revision)
- b) Elongation Test (IS-398-IV: 1994)
- c) Resistance Test (IS-398-IV: 1994)

9.1.3. Physical test for XLPE Insulation (IS-14255:1995 latest):

- a) Tensile strength and elongation at break
- b) Ageing in an Air oven
- c) Shrinkage test
- d) Hot set test

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- e) Water absorption (Gravimetric)
- f) Carbon black:
 - content
 - dispersion
- g) Test for thickness of insulation
- h) Insulation resistance (volume resistivity)
- i) High voltage test
- j) Bending test on complete cable
- k) UV radiation test as per ASTM G154 standard.(sample shall meet min. 80% retention after exposure of 21 days as per ASTM standard)

9.2. Further, the purchaser shall reserve the right to pick up cable at random from the lots offered/supplied and get the cable tested for some or all the Type Tests in the presence of the purchaser's representative at third-party NABL lab at the sole discretion of the purchaser.

10. Acceptance Test: The following acceptance tests shall be conducted on samples taken at random from a lot as per relevant standards in the presence of the purchaser's representative.

- a) Conductor Resistance Test of Phase/Street Lighting conductor
- b) Conductor Resistance Test of Messenger conductor
- c) Breaking Load test of messenger conductor
- d) Elongation test of messenger conductor
- e) Test for Thickness of insulation
- f) Tensile Strength & Elongation at break of insulation
- g) Hot set test of insulation
- h) Volume Resistivity Test of insulation
- i) High Voltage Test
- j) Lay the length of the Complete cable [Not applicable for audit test in case of cable sampling from drum]
- k) Conductor Dimensional test as per technical particulars/GPTs
- l) Chemical Composition test [Audit test only]

11. Routine Test: The following routine tests shall be conducted on cable as per the sampling plan of QAP/Relevant standard by the manufacturer at their works as per relevant standards.

- a) Conductor resistance test for phase/Neutral/streetlight and Messenger wire.
- b) High voltage test at room temperature

12. INSPECTION AND TESTING:

12.1. Testing will be carried out at the works of Manufacturers in the presence of the Company's Engineers at the firm's cost according to relevant IS/IEC with the latest amendment /revision if any and in force on the date of the inviting tender. Materials shall not be dispatched by the supplier without having been inspected and the test certificate approved by the Company's Inspector and obtaining specific dispatch instructions in writing.

12.2. The supplier shall present the latest Calibration Certificate(s) of testing

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instruments/equipment to be used for the testing of the material covered in the Purchase Order to the authorized inspecting officer / inspecting agency of the purchaser. The testing instruments/meters/apparatus etc. should be got calibrated by the supplier from time to time from an independent testing laboratory/house having valid accreditation from National Accreditation Board for testing and calibrating laboratories for the testing equipment or from original manufacturers having traceability to NABL / NPL. The calibration certificate(s) should not in any case be older than one year at the time of presenting the same to the inspecting officer / inspecting agency of the purchaser. The testing instruments/equipment should be duly sealed by the Calibrating Agency and mention thereof shall be indicated in the calibration certificate(s).

- 12.3. At least 5% of the total number of drums subject to a minimum of 2 in each lot put up for inspection shall be selected at random to ascertain the length/workmanship of cable by the following method:

12.3.1. At the work of the manufacturer, the cable shall be transferred from one drum to another for checking any manufacturing defects in the cable drum selected for conducting acceptance tests, at the same time measuring its length with the help of a pulley & cyclometer graduated in the presence of an inspector.

- 12.4. The Company reserves the right to select sample from any offered/inspected lot against the A/T to be issued which will be get type tested at any NABL-accredited Laboratory as decided by the Company. The results of this type-tested sample shall be applicable for the entire quantity of the particular lot offered or supplied by the supplier. The Company shall bear the testing charges if the sample passes all the tests and if the sample fails in any one of the tests, the supplier shall have to bear testing charges, same are recoverable from the supplier's pending bill, security deposit, Bank Guarantee or by any suitable means, whichever deem fit by the Company. In case of the sample failing in aforesaid type tests, the supplier shall have to replace the whole lot materials, which should pass through the type tests, and the re-testing charges will have to be paid by the supplier. If any quantity against the particular lot is consumed by the Company, the supplier will agree to any penalty/deduction in price as decided by the competent authority of the Company. The decision of competent authority in case of any dispute will be final and binding to the supplier.

13. Documentation:

- 13.1. All documents/drawings shall be provided in soft copy only via mail or in returnable Pen drives.
- 13.2. The language of the documents shall be English only
- 13.3. Deficient/ improper or incomplete document/ drawing submission shall be liable for rejection
- 13.4. Any document not included in the below table but necessary for detailed engineering shall be deemed to be included in the bidder's scope.

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Sr No.	Detail of Document	Bid submission	Approval	Pre Dispatch (During inspection)
1	Guaranteed Technical Particulars (GTP)	Required	Required	
2	Deviation Sheet, if any	Required	Required	
3	Detailed cross-sectional drawing of cable	Required	Required	
4	Dimensional drawing of cable drum	Required	Required	
4	Type test reports of the offered type and rating of the cable	Required	Required	
5	BIS License for IS 14255:1995	Required	Required	
6	Complete cable catalogue	Required		
7	Make of Raw Materials	Required		
8	Cable de-rating factors	Required		
10	Acceptance test reports and Routine Test Certificates carried out in the manufacturer's works			Required
11	Calibration test reports of instruments/meters/apparatus			Required

13.5. In the absence of a valid ISI License, Guaranteed Technical Particulars, and a copy of the type test certificate attested by an authorized person, the offer is liable to be ignored without any further correspondence.

14. Packing and Marking : The Cable shall be wound on non-returnable wooden drums conforming to IS: 10418 /1982 with latest amendment thereof. The ends of the cable shall be sealed by means of nonhygroscopic sealing materials.

14.1. The wooden drums shall be as per IS: 10418/1982. The outer surface of the drums shall be painted with white Aluminum paint. Similarly, the inside surface of the drums shall have a protective layer of varnish/paint to protect it from white ants.

14.2. The ends of the cable shall be sealed by means of non-hygroscopic sealing materials.

14.3. Cable drums shall be so constructed as to have required mechanical strength so that the drum flanges and other components do not break during transportation or in storage.

14.4. The ferrous part of the wooden drum shall be treated with suitable rust preventive paint/coating to minimize rusting during storage.

14.5. Both the ends of cable are to be provided with lead seals with seal wire.

14.6. The drums shall be of such construction as to assure delivery of conductor in the field free from displacement and damaged and should be able to withstand all stresses due to handling and the stringing operation so that cable surface is not dented, scratched or damaged in any way during transport and erection. The cable shall be properly lagged on the drums. The cable drum shall be suitable for wheel mounting.

14.7. The min. drum length of cable shall be 500 mtrs.

14.8. Tolerance in drum length shall be $\pm 5\%$

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14.9. Total Order quantity tolerance shall be $\pm 2\%$

14.10. Nonstandard length shall not be less than 250 meters in one continuous length.

14.11. One drum's non-standard length to be acceptable.

- 14.12. **Quality Control :** The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections

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Annexure 1

(Technical information and guaranteed technical particulars (GTP) to be filled by Supplier

Sl. No.	Particulars	Bidders Response		
		70 Sq.mm	95 Sq.mm	120 Sq.mm
1	Name of manufacturer.			
2	Applicable standard/specification.			
3	Type of Cable (construction to be described)			
4	Size of Cable.			
5	Voltage Grade			
6	Phase/Neutral Conductor Alu Portion			
	i) Material of conductor			
	ii) Applicable standard			
	iii) No. of strands			
	iv) Nominal diameter of strand (mm)			
	v) Max. diameter of bare conductor (mm)			
	vi) Nominal area of cross-section of bare conductor (Sq.mm)			
	vii) Lay ratio			
	viii) Elongation at break (%)			
	ix) Tensile strength (min)/breaking load (KN)			
6.1	Phase/Neutral conductor Insulation portion			
	i) Material of insulation			
	ii) Insulation thickness (mm)			
	iii) Diameter of insulated conductor (mm)			
	iv) Whether the insulation conforms to the standards specified in the technical specification			
	v) Volume Resistivity at 27°C & 70 °C (Ohm-CM)			
	vi) Insulation Color			
7	Street Light Conductor - Alu. Portion			
	i) Material of conductor			
	ii) Applicable standard			
	iii) No. of strands			

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	iv) Nominal diameter of the strand (mm)			
	v) Max. Diameter of bare conductor			
7.1	Street Light Conductor - Insulation Portion			
	i) Material of insulation			
	ii) Insulation thickness (mm)			
	iii) Diameter of insulated conductor (mm)			
	iv) Whether the insulation conforms to the standards specified in the technical specification			
8	Messenger conductor - AAA portion			
	i) Material of conductor			
	ii) Applicable standard			
	iii) Number of strands			
	iv) Nominal diameter of strand (mm)			
	v) Max. diameter of bare conductor (mm)			
	vi) Nominal area of cross-section of bare conductor (Sq.mm)			
	vii) Lay ratio			
	viii) Elongation (%)			
	ix) Tensile strength (min)/breaking load (KN)			
9	Complete AB Cable			
	i) Overall diameter (mm)			
	ii) Total weight (kg/km)			
	iii) Standard drum length offered (mtrs) and tolerance			
	iv) Gross weight of the cable drum			
	v) Code or method of cable identification			
10	Electrical Data			
	i) Max. DC resistance of the phase conductor at 20 °C			
	ii) Max. DC resistance of the neutral conductor at 20 °C			
	iii) AC resistance at 90°C phase conductor (ohms/km)			

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	iv) AC resistance at 90 °C messenger conductor (ohms/km)			
	v) Max. DC resistance of the street light conductor at 20 °C			
	vi) AC resistance at 90°C street light			
	vii) Approx. inductive reactance at 50 Hz. Phase conductor/Neutral (ohms/km)			
	viii) Approx. inductive reactance at 50 Hz. Messenger conductor (ohms/km)			
	ix) Approx. zero sequence reactance at 50 Hz. Per phase (ohms/km)			
	x) Short circuit current for 1 Sec. Max (KA)			
	xi) Current carrying capacity (amps) at various ambient temp. deg. of 10°C, 20°C, 30°C, 40°C & 50°C			
11	Specification of climatic conditions to which AB Cable is manufactured			
	a) Max. solar radiation (w/sq.mm)			
	b) Min. wind velocity (m/sec)			
12	Embossing Details			
13	Phase/Neutral Identification Method			
14	Material of Drum			
15	Carbon Content (%)			
16	Standard Length of Drum			
17	Approximate weight of 1000 metres length of LT 3 C X AB Cable (weight in Kgs.)			
17.1	Aluminium			
17.2	Aluminium Alloy			
17.3	XLPE			
17.4	Total Weight (Kg.)			

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Annexure-2

Bidder has to enclose following documents and has to confirm the same:

Sr. No.	Particulars	Confirmation
1.	ISI License (attested copy)	Yes.
2.	Proof if applied for renewal	Yes of ISI License
3.	Type Test Certificate from Govt. of India's laboratory (for all cores/rating)	Yes approved

Description	Size of Cable		
	70mm ²	95mm ²	120mm ²
a) Name of Laboratory/ City/State)			
b) Test Report No.			
c) Test Report Date			

- | | | |
|----|--|------|
| 4. | List of plant and machinery | Yes. |
| 5. | List of testing facility available | Yes. |
| 6. | List of orders pending/executed: | |
| | a. With GUVNL (formerly GEB)/
MGVCL/DGVCL/UGVCL/PGVCL | Yes. |
| | b. With agencies other than 6(a) above | Yes. |

Annexure-3

Bidders have to mention below deviation if any, Quoting relevant clause of specification.

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