MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.

MATERIAL SPECIFICATIONS CELL

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TECHNICAL SPECIFICATION

L. T. AERIAL BUNCHED CABLES
FOR DISTRIBUTION NETWORK IN MAHARASHTRA

SPECIFICATION NO.

CE/T & QC /MSC-I/ A.B CABLE/2019, DATE: 15.07.2019

I N D E X

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1.0 SCOPE:

The specification given here under covers the manufacturing, testing, stage inspection at works, testing before dispatch, supply and delivery of designated stores of ISI marked XLPE insulated Aluminium cables twisted over a central bare Aluminium alloy messenger wire for use on L.T. overhead lines in rural electrification system.

The cable shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to purchaser, who will interpret the meaning of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in these specifications and / or the commercial order or not.

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2.0 SERVICE CONDITIONS:

Equipment to be supplied against the specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

2.1	Maximum ambient temperature (Degree C).....	50
2.2	Maximum temperature in shade (Degree C).....	45
2.3	Minimum temperature of Air in Shade (Degree C)..	3.5
2.4	Relative Humidity (Percent)	10 to 100
2.5	Maximum annual rain fall (mm)	1450
2.6	Maximum wind pressure (Kg/sq.mm.)	150
2.7	Maximum altitude above mean sea level (Meter)	1000
2.8	Isoceranic level (day per year)	50
2.9	Seismic level (Horizontal Acceleration)	0.3 g

Moderately hot and humid tropical climate conducive to rust and fungus growth.

3.0 STANDARDS:

Unless otherwise specified elsewhere in this specification the rating as well as performance and testing of the L.T.A.B.cables shall conform to the IS: 14255 /1995 or the latest revision available at the time of placement of order suitable for voltages upto 1100 volts A.C and bearing ISI mark. The conductors shall conform to IS 8130 - 2013 modified upto date in all respect with regard to electrical and mechanical properties. Aluminium alloy

conductors conforming to IS 398 (Part-IV)–1994 & XLPE Insulation properties asperEN50397-1-2006.

4.0 GENERAL TECHNICAL REQUIREMENT:

The insulated phase conductors (with additional street lighting conductor, if provided) shall be twisted around the bare aluminium alloy messenger wire, which shall take all the mechanical stress. The messenger wire shall also serve as the earth cum neutral wire.

5.0 PHASE CONDUCTORS:

5.1 The phase conductors and street lighting conductors shall be made of H2/H4 EC grade aluminium complying with requirements of IS 8130-1984 & shall be stranded in construction. The stranded conductor shall be longitudinally water tight and shall be insulated with black UV Resistant, Non Tracking & Erosion Resistant XLPE suitable for 1100 Volts insulation. The insulated conductors shall conform to the standards quoted in clause 3 above.

5.2 The phase conductors shall be suitably compacted. The outer diameter shall be within the limit as specified in 5.5 below :

5.3 The phase conductors shall be provided with one, two and three ridges for quick identification.

5.4 The tensile strength of the aluminium wires used in the conductors shall not be less than 90 N/ sq.mm.

5.5 The standard size and technical characteristics of the phase and street lighting conductors shall be as shown in the following table :

Table : 1

Nominal Sectional Area (sq.mm)	Diameter of compacted conductor (mm)	Max.DC resistance at 20 Deg. (0hm/km)	Insulation thickness (mm)	Approx. mass (kg/km)	Minimum No. of Strands
(1)	(2)	(3)	(4)	(5)	(6)
16	4.4	1.91	1.2	42	6
25	5.5	1.20	1.2	65	6
35	6.8	0.868	1.2	95	6
50	7.9	0.641	1.5	127	6
70	9.6	0.443	1.5	184	12
95	11.0	0.320	1.5	254	15

NOTE :-

(A) The resistance values given in col.3 are the max. permissible.
(B) Tolerance of + 5 % is allowable on diameters shown in Col. 2.

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6.0 FILLING (WATER BLOCKING):

The Stranded Conductor shall be longitudinally water tight by means of a water blocking material incorporated during the extrusion process. The use of grease /water swellable tape / water swellable powder etc is not permitted. The water blocking material shall be stable at maximum operating conductor temperature of 90 Deg. Cent.

The water blocking compound shall be compatible with the conductor material.

7.0 MESSENGER (NEUTRAL CONDUCTOR) :

7.1 The messenger conductor shall be of heat treated aluminium – magnesium - silicon alloy wires conforming to IS - 398 (part - IV) – 1994 or the latest version thereof composed of 7 strands and shall be suitably stranded to have smooth round surface to avoid damage to the XLPE insulation of the phase conductors twisted around the messenger.

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

7.3 The sizes and other technical characteristics of the messenger wire shall be as given in the following table :

Table : 2

Nominal Sectional Area (sq.mm.)	Diameter of circular conductor (mm)	Approx Mass (kg/km)	Max.DC resistance at 20 Deg. (0hm/km)	Minimum Tensile Strength. (KN)
(1)	(2)	(3)	(4)	(5)
25	6.4	65	1.38	7.0
35	7.6	95	0.986	9.8
50	9.0	130	0.689	14.0
70	10.7	185	0.492	19.7

NOTE :-

(A) The resistance values given in col.4 & Tensile Strength values given in col.5 are mandatory.

(B) Tolerance of + 5 % is allowable on diameters shown in Col. 2.

8.0 XLPE INSULATION:

The XLPE insulation shall conform to IS: 14255 / 1995 & EN – 50397 -1-2006 or the latest version thereof. The following properties shall be guaranteed by the supplier.

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Table - 3

XLPE Insulation with UV Resistant, Non Tracking & Erosion Resistant			
Sr.No	**Test**	**Unit**	**PROPERTIES OF XLPE INSULATION**
1	Operating Temperature	°C	90
	Mechanical Properties		
2	**Properties before Ageing**		
2.1	Min. Tensile strength	N/Sq.mm	12.5
2.2	Min. Elongation at break	%	200
3	**Properties after Ageing in air oven on sample**		
3.1	Aging Conditions		
	--Temperature	°C	135 ± 3
	--Duration of treatment	Days	7
3.2	Tensile strength		
	--Variation (Max)	%	± 25
3.3	Elongation at break		
	--Variation (Max)	%	± 25
4	**Properties after Ageing in air oven on complete cable as per EN 50397-1**		
4.1	Aging Conditions		
	--Temperature	°C	100 ± 2
	--Duration of treatment	Days	7
4.2	Tensile strength		
	--Variation (Max)	%	± 25
4.3	Elongation at break		
	--Variation (Max)	%	± 25

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5	**Hot set test**		
	Temperature	°C	200 ± 3
	Duration of treatment	Minutes	15
	Mechanical Stress	N/cm^2	20
	Maximum elongation under load	%	175
	Maximum permanent set after cooling	%	15
6	**Shrinkage test**		
	Temperature	°C	130 ± 3
	Duration of treatment	Hours	1
	Maximum Shrinkage	%	4
7	**Water absorption test**		
	Temperature	°C	85 ± 2
	Duration of treatment	Days	14
	Maximum water absorbed	mg/cm^2	1
8	**Tracking Resistance test**		Annexure - C of EN-50397-1
8	**Min. Volume Resistivity**		
	- At 27 ^{0}C	Ohm-cm	1 X 10^{13}
	- At 90 ^{0}C	Ohm-cm	1 X 10^{11}

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9.0 COMPOSITION AND DESIGNATION OF FINISHED CABLES:

The composition and designation of finished cables are given in the flowing tables:

Table-4

Sr.No.	Designation	Complete Bunched Cables	
		Overall dia approx	Total mass approx
		(mm)	(kg/km.)
1.	3x16+16+25	19	310
2.	3x25+16+25	22	390
3.	3x35+16+25	24	490
4.	3x50+16+35	32	640

5.	3x70+16+50	34	890
6.	3x95+16+70	39	1180

Note : -

The first part of the designation refers to the number and size of the phase conductor, the middle to the street lighting conductor (where provided) and the last to the bare messenger wire. The sizes shown are the nominal sectional areas.

10.0 Tests:

10.1 Type Test:

The cable offered shall have successfully passed all type tests described in the IS-14255-1995 & EN – 50397-1-2006 (amended upto date).

The Type Test Certificate shall clearly indicate the constructional features of the type-tested cable. The Type Test Certificate of the cable shall be same as the cable offered. Separate Type Test Certificate for each offered size of cable shall be submitted.

All the Type Tests shall be carried out from Laboratories which are accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI, ERDA, ERTL, etc. to prove that the cable meets the requirements of specification.

Type Test conducted in manufacturers own laboratory and certified by testing institute shall not be acceptable.

The Type Test Certificate as per IS-14255 & EN-50397-1 (amended upto date) shall be submitted along with the offer. The Type Test Certificate carried out during last five years shall be valid.

Further 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 presence of purchasers' representative at third party NABL lab at the sole discretion of the purchaser.

For this purpose, the tenderer shall quote unit rates for carrying out each Type Test. However, such unit rates will not be considered for evaluation of the offer.

The supplier shall have no right to contest the test results of the third party lab for additional tests.

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In case the cable fails in the type tests, the complete supply shall be rejected. The supplier has to replace / take corrective action at the cost of the supplier.

It shall be the responsibility of the supplier to arrange such tests and purchaser shall be informed of the date and time of conduction of tests well in advance to enable him to witness such tests. Test charges of the testing authority, for such successful repeat type tests, shall be reimbursed at actual by the Purchaser.

The following type/Acceptance/Routine/Optional tests should be carried out as below table :

Table - 5

TESTS			
Sr. No	**Test**	**Requirements**	**Test Methods (Ref to part No. of IS : 10810)**
	Type Tests		
(1)			
a)	Tests on phase/street light conductor		
	i) Tensile Test	See IS : 8130-2013	2
	ii) Wrapping Test	See IS : 8130-2013	3
	iii) Resistance Test	See IS : 8130-2013	5
b)	Tests on messenger conductor		
	i) Breaking load	See Table -2	2
	ii) Elongation Test	See Clause - 11.3 of IS : 14255	11.3 of IS : 14255
	iii) Resistance Test	See Table -2	5
c)	Physical test for XLPE Insulation		
	i) Tensile Strength & Elongation at break	See Table -3	7
	ii) Ageing in air oven	See Table -3	11
	iii) Hot set test	See Table -3	30
	iv) Shrinkage test	See Table -3	12
	v) Water absorption (Gravimetric)	See Table -3	33
	vi) Tracking Resistance	See Annexure -C of EN-50397-1	Annexure - C of EN-50397-1

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	vii) Resistance to UV Rays	After Exposure Min. Retention 50 % of Tensile Strength & Elongation at break	As per ASTM G 154 & IS : 10810 (Part-7)
d)	Test for Thickness of insulation	See Table -1	6
e)	Volume Resistivity Test	See Table -3	43
f)	High Voltage Test	See Clause - 11.2 of IS : 14255	45
g)	Test of the longitudinal water tightness of Phase/Street Lighting Conductor on 3 Mtrs sample	No Leakage	Annexure - D of IS : 7098 (Part-3) 1993 or Annexure - F OF IEC : 60502 (Pt-2) 2014
	Acceptance Test		
a)	Conductor Resistance Test of Phase/Street Lighting conductor	See IS : 8130-2013	5
b)	Conductor Resistance Test of Messenger conductor	See Table -2	5
c)	Breaking Load test of messenger conductor	See Table -2	2
d)	Elongation test of messenger conductor	See Clause - 11.3 of IS : 14255	11.3 of IS : 14255
e)	Test for Thickness of insulation	See Table -1	6
f)	Tensile Strength & Elongation at break of insulation	See Table -3	7
g)	Hot set test of insulation	See Table -3	30
h)	Volume Resistivity Test of insulation	See Table -3	43
i)	High Voltage Test	See Clause - 11.2 of IS : 14255	45
j)	Test of the longitudinal water tightness of Phase/Street Lighting Conductor on 1 Mtrs sample	No Leakage	Annexure - D of IS : 7098 (Part-3) 1993 or Annexure - F OF IEC : 60502 (Pt-2) 2014
k)	Tracking Resistance	See Annexure -C of EN-50397-1	Annexure - C of EN-50397-1
	Routine Test		
a)	Conductor Resistance Test of Phase/Street Lighting conductor	See IS : 8130-2013	5
b)	Conductor Resistance Test of Messenger conductor	See Table -2	5
c)	High Voltage Test	See Clause - 11.2 of IS : 14255	45

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	Optional Test		
a)	Bending test on completed cable	No Cracks	See Clause - 11.4 of IS : 14255

11 Packing and Marking:

11.0 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) Size of conductors.

e) Size of messenger

f) Voltage grade.

g) Number and lengths of pieces of cable in each drum.

h) Gross mass of the packing .

i) Net mass of cable.

j) ISI mark.

11.02 The drums shall be of such construction as to ensure delivery of conductor in the field free from displacement and damage 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 covered on the drum.

11.03 The cable drum should be suitable for wheel mounting.

11.04 The mass of finished cable in a drum (without mass of drum) of various designations shall not exceed by more than 10 % of the following values.

DESIGNATION NO. (CLAUSE- 8)	GROSS MASS (kg)
1	350
2 to 4	500
5 to 7	750

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11.05 The AB cable shall be supplied in continuous standard length of 1000 metres with plus / minus 5 % tolerance wound on non-returnable wooden drums of good quality and non –standard lengths not less than 100 meters up to 5% of the ordered quantity shall be accepted. Alternately AB cable can be supplied wound on non-returnable steel drum without any extra cost to the purchaser. The ends of the AB cable shall be sealed by means of non hygroscopic sealing material.

11.06 In addition to the requirement as per IS, the following particulars shall be properly legibly embossed on one of the core of AB cable at the intervals of not exceeding one meter throughout the length of the AB cable. The AB cables with poor and illegible embossing shall be liable for rejection.

a) Manufactures name.
b) Voltage grade.
c) Year of manufacture.
d) Name of purchaser: M.S.E.D.C.L.
e) Successive Length.
f) Size of cable
g) Cable Identification: Electric
h) ISI mark

12.0 INSPECTION:

All tests and inspection shall be made at the place of manufacture unless otherwise especially agreed upon by the manufacture and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charge, to satisfy him that the material is being furnished in accordance with this specification.

13.0 PRE DESPATCH INSPECTIONS

All the type tests in accordance with IS:14255 – 1995 & EN : 50397-1-2006 (amended upto date) and additional acceptance test as per specification shall be performed on a sample of each size of cable ordered from the first lot of supply at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and purchaser at the time of purchase.

The sample for type tests of each size of cable ordered from the first lot of supply shall be drawn by purchaser representative.

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The manufacturer shall offer to the inspector representing the purchaser, all the reasonable facilities, free of charge, for inspection and testing, to satisfy him that the material is being supplied in accordance with this specification.

The MSEDCL's representative / Engineer attending the above testing will carry out testing in accordance with IS:14255 – 1995 & EN : 50397-1-2006 (amended upto date) and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch.

14.0 PERFORMANCE GUARANTEE:

The cable offered shall be guaranteed for satisfactory performance for a period of 30 months from the date of receipt of complete cable at site in good condition, or 24 months from the date of satisfactory commissioning, whichever is earlier. In case of failure within this period, the supplier shall make good the faulty cable at no extra cost to the purchaser.

15 QUALITY CONTROL

15.0 The purchaser shall send a team of experienced engineers for assessing the capability of the firm for manufacturing of cable as per this specification.

15.1 The team shall be given all assistance and co-operation for inspection and testing at the bidder's works.

15.2 The cable supplied shall give service for a long period without drifting from the original calibration & performance must be near to zero percent failure.

16.0 QUALITY ASSURANCE PLAN

A detailed list of bought out items which got into the manufacture of cables should be furnished indicating the name of the firms from whom these items are procured. The bidder shall enclose the quality assurance plan invariably along with offer followed by him in respect of the bought out items, items manufactured by him & raw materials in process as well as final inspection, packing & marking. The Company may at its option order the verification of these plans at manufacturer's works as a pre qualification for technically accepting the bid. During verification if it is found that the firm is not meeting with the quality assurance plan submitted by the firm, the offer shall be liable for rejection.

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17 SCHEDULES:

17.01 The tenderer shall fill in the following schedule which form part of the offer. Schedule `C' - Tenderer's Experience.

17.02 The tenderer shall submit the list of orders for similar type of equipments, executed or under execution during the last three years, with full details in the schedule of Tenderer's experience (Schedule `C') to enable the purchaser to evaluate the tender.

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SCHEDULE - C

SCHEDULE OF TENDERER'S EXPERIENCE

The tenderer shall submit the list of orders for similar type of orders executed or under execution during the last three years, with full details in the schedule to whom a reference may be made by purchaser in case he considers such a reference necessary to enable the purchaser to evaluate the tender.

Sr. No.	Name of client and description	Value Of order	Period of supply and commissioning	Name and address to whom reference may be made
1	2	3	4	5

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NAME OF FIRM _____

NAME & SIGNATURE OF TENDERER _____

DESIGNATION _____

DATE _____

GURANTEED TECHNICAL PARTICULARS 3CX...(Ph)+1X....(bare messenger cum neutral)+1X...(Insulated Street Lighting)SQ.MM.			
SR. NO	PARTICULARS	UNIT	
	Name of Manufacturer		
	Place of Manufacture		
	Cables Details		
	Cable Description		
	Size of Cable		
	Applicable Standards		
	Voltage Grade	KV	
1	**Phase Conductors**		
1.1	Material & Grade		
1.2	Type of Conductor		
1.3	Nominal Cross Sectional Area	SQMM	
1.4	Minimum no. of wires	NOS.	
1.5	Maximum dc resistance of conductor at 200 c	OHM/KM (MAX.)	
2	**Insulation**		
2.1	Insulation Material		
2.3	Minimum Thickness	MM	
2.4	Colour		
3	**Street Light Conductor**		
3.1	Material & Grade		
3.2	Type of Conductor		
3.3	Nominal Cross Sectional Area	SQMM	
3.4	Minimum no. of Wires	NOS.	
3.5	Maximum dc resistance of Conductor at 200 c	OHM/KM (MAX.)	
4	**Insulation**		
4.1	Insulation Material		
4.2	Nominal Thickness	MM	
5	Messenger Conductor		
5.1	Material & Grade		
5.2	Type of Conductor		
5.3	Nominal Cross Sectional Area	SQMM	
5.4	Minimum no.of wires	NOS.	

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5.5	Maximum dc resistance of conductor at 200 c	OHM/KM (MAX.)	
6	**Properties of Insulation**		
6.1	Tensile Strength	N/MM2	
6.2	Elongation at Break	%	
6.3	Volume Resistivity		
	at 27^0 c	OHM-CM	
	at 70^0 c	OHM-CM	
7	**Physical Details of cable**		
7.1	Embossing / Printing		
7.2	Lay Ratio	MM	
7.3	Direction of Lay		
7.4	Standard Length	MTRS	
7.5	No. of Standard Lengths	No.	
7.6	Material of Drum		

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