

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.



MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

11/22/33 KV XLPE POWER CABLE
FOR DISTRIBUTION NETWORK IN MAHARASHTRA

SPECIFICATION NO.

CE/T & QC /MSC-I/11/22/33KV XLPE POWER CABLE/2019,
DATE: 15.06.2019

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Guaranteed Technical Particular

1.00 SCOPE

The specification covers design, manufacture, shop testing, stage inspection at works, testing before dispatch, supply and delivery of ISI marked 11, 22 & 33 kV, multi core, cross linked polyethylene insulated power cables to the designated Store Centers in the State of Maharashtra. These cables shall be suitable for the AC Three Phase 50 Hz system with the nominal voltage of 11 / 22 / 33 kV which may reach maximum of 12 / 24 / 36 kV respectively. These cables shall primarily be designed for effectively earthed neutral 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 the specification and / or the commercial order or not.

2.00 SERVICE CONDITIONS

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

2.01 Maximum ambient temperature	50 ⁰ C
2.02 Maximum temperature in shade	45 ⁰ C
2.03 Minimum temperature of Air in Shade	3.5 ⁰ C
2.04 Relative Humidity	10 to 100 %
2.05 Maximum annual rain fall	1450 mm
2.06 Maximum wind pressure	150 Kg/mm ²
2.07 Maximum altitude above mean sea level	1,000 Metres
2.08 Isoceraunic level	50 days/year
2.09 Seismic level (Horizontal Acceleration)	0.3 g

2.10 Moderately hot and humid tropical climate Conducive to rust and fungus growth

3.00 STANDARDS TO WHICH CABLE SHALL CONFORM

Unless otherwise specified elsewhere in this specification, the rating as well as performance and testing of the HT XLPE power cables shall conform to the latest revisions available at the time of placement of order of all the relevant standards as listed in, but not limited to following.

IS: 8130 / 1984 – Specification for Conductors for insulated electric cables and flexible cords.

IS: 7098 (Part 2) / 1985 - Specification for crosslinked polyethylene insulated PVC sheathed cables for working voltages from 3.3 kV upto and including 33 kV.

IS: 5831 / 1984 - Specification for PVC insulation and sheath of electric cables.

IS: 3975 / 1988 – Low carbon galvanized steel wires, Formed wires and tapes for Armouring of cables - Specification

IS: 10462 (Part I) / 1983 – Fictitious calculation method for determination of dimensions of protective coverings of cables.

4.00 GENERAL TECHNICAL REQUIREMENTS

4.01 6.35/11 kV, 12.7/22 kV, 19/33 kV earthed, multi core power cables shall normally be with stranded compacted H2/H4 grade aluminium conductor as per IS: 8130 /1984 provided with conductor screening (of extruded semi-conducting cross link material) and shall be insulated with Nitrogen Dry cure and Dry cool technology XLPE of natural colour. Identification of cores shall be by colour, as per provision of clause 13.1 of IS: 7098 (Part 2) / 1985. The insulation (XLPE) screening shall be provided consisting of extruded semi- conducting cross link material in combination with a metallic layer of copper tape. Three such screened cores shall be laid up together with fillers and/or binder tapes where necessary and provided with extruded inner sheathing of heat resistant PVC conforming to type ST2 of IS: 5831 / 1984. The maximum continuous operating temperature shall be 90°C under normal operation and 250°C under short circuit condition.

Armouring shall be provided consisting of galvanized round steel wires conforming to IS: 3975 / 1988 (amended upto date) and over the armouring a tough outer sheath of PVC compound shall be extruded.

The PVC compound for the outer sheath shall conform to type ST2 of IS: 5831 - 1984 (amended upto date). The colour of the outer sheath shall be black. The cable shall be manufactured strictly conforming to IS: 7098 (Part 2) - 1985 amended upto date and shall bear ISI mark.

4.02 SEQUENTIAL MARKING ON LENGTH ON CABLE

Non erasable Sequential Marking of length shall be provided by embossing on outer sheath of the cable for each meter length.

The quality of insulation shall be good and insulation shall not be deteriorated when exposed to the climatic conditions.

4.02.1 DISCHARGE FREE CONSTRUCTION

Inner conductor shielding, XLPE insulation and outer core shielding shall be extruded in one operation by special process (viz. Triple Extrusion Process) to ensure that the insulation is free from contamination and voids and perfect bonding of inner and outer shielding with insulation is achieved. The bidders are requested to elaborate the manufacturing technique adopted by their manufacturers to achieve this motive.

The Company will order the verification of triple extrusion process at manufacturer's works as a pre qualification if it is technically accepting the bid. During verification if it is found that the firm is not manufacturing the cable with triple extrusion process the offer shall be rejected.

4.03 CONTINUOUS AC CURRENT CAPACITY

Continuous AC current capacity shall be as per Table given below.

11,22 & 33 KV Three CORE AL COND,XLPE INSULATED , ARMOURED CABLE IS 3961 (part 7) Table 10 & 12						
Cross-sectional area (Sq MM)	Normal Current Rating in Amps					
	11kV Aluminums Conductor			22kV,33kV Aluminums Conductor		
	Ground	Duct	Air	Ground	Duct	Air
3X70	161	139	184	159	142	189
3X95	190	165	222	189	169	227
3X120	216	188	256	215	192	262
3X150	242	209	288	239	214	294
3X185	273	240	330	270	245	336
3X240	315	278	387	312	282	393
3X300	354	312	441	351	317	448
3X400	404	356	512	400	361	519
3X500	457	403	590	454	408	598

4.04 SHORT CIRCUIT CURRENT

Short circuit current of 11, 22 & 33 kV XLPE cable shall be as per Table given below.

Duration of Short Circuit in sec	Area of Al. Conductor	Short circuit current in kA
t	A	$I=0.094 \times A/\text{sq.rt} (t)$
1	70 mm ²	6.58
1	95 mm ²	8.93
1	120 mm ²	11.28
1	150 mm ²	14.10
1	185 mm ²	17.39
1	240 mm ²	22.56
1	300 mm ²	28.20
1	400 mm ²	37.60
1	500 mm ²	47.00
1	630 mm ²	59.20

5.00 TESTS

5.01 TYPE TESTS

The cable offered shall have successfully passed all type tests described in the IS: 7098 (Part- 2) / 1985 (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: 7098 (Part- 2) -1985, (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 reserves 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. 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.

5.02 ROUTINE TESTS

All the Routine tests as per IS: 7098 (Part 2) / 1985 amended upto date shall be carried out on each and every delivery length of cable. The results shall be given in test report. Partial discharge test must be carried out in a fully screened test cell. It is, therefore, absolutely

essential that the manufacturer shall have the appropriate type of facility to conduct this test which is routine test.

The details of facility available in the manufacturer's works in this connection shall be given in the bid.

5.03 ACCEPTANCE TESTS

All Acceptance tests as per IS: 7098 (Part 2) / 1985 as modified upto date including the optional test as per clause no 18.4 and Flammability Test shall be carried out on sample taken from the delivery lot.

5.04 SHORT CIRCUIT TEST

5.04.1 The bidder / supplier shall also undertake to arrange for the short circuit test as a type test on each size & each voltage grade shielded XLPE cables ordered at the 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. at the cost of the supplier.

If facilities for carrying out short circuit tests are available at the works of the supplier, and provided the certification procedure is approved by the Purchaser, testing at the supplier's works will be acceptable. Short Circuit test shall be witnessed by the purchaser's representative.

The short circuit test shall be preceded and followed by the following tests so as to ensure that the characteristics of the cable remain within the permissible limits even after it is subjected to the required short circuit rating.

- a) Partial Discharge Test.
- b) Conductor Resistance Test.
- c) High Voltage Test as a Routine Test.

5.04.3 The manufactured cable will be acceptable only after such a sample test is successfully carried out at NABL Labs as above or at suppliers works and approved by the Purchaser.

6.00 TESTING FACILITIES

The supplier / tenderer shall clearly state as to what testing facilities are available in the works of manufacturer and whether the facilities are adequate to carry out type, routine and acceptance tests mentioned in specified IS. The facilities shall be provided by the bidder to purchaser's

representative for witnessing the tests in the manufacturer's works. If any test cannot be carried out at manufacturer's works reason shall be clearly stated in the tender.

7.00 PRE DESPATCH INSPECTIONS

All the type tests in accordance with IS: 7098 (Part 2) / 1985 (amended upto date) and acceptance tests 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.

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: 7098 (Part 2) / 1985 (amended upto date) and acceptance tests and additional acceptance test as per this specification and issue test certificate approval to the manufacturer and give clearance for dispatch.

8.00 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.

9.00 PACKING AND MARKING

9.01 IDENTIFICATION MARKS ON CABLE

The following particulars shall be properly legible embossed on the cable sheath at the intervals of not exceeding one meter through out the length of the cable. The cables with poor and illegible embossing shall be liable for rejection.

(a) Manufactures name and / or Trade name.

(b) Voltage grade.

(c) Year of manufacture.

(d) M.S.E.D.C.L.

(e) Successive Length.

(f) Size of cable

(g) ISI mark

9.02 The cable shall be supplied in continuous standard length of 250 running meters with plus minus 5% tolerance wound on non returnable wooden drum of good quality and non-standard lengths not less than 100 meters upto 5% of the ordered quantity shall be accepted. Alternately cable can be supplied wound on non-returnable steel drum without any extra cost to the purchaser. The ends of the cable shall be sealed by means of non-hygroscopic sealing material.

9.03 Packing and marking shall be as per clause No. 21 of IS: 7098 (Part 2) / 1985 amended up to date.

The following additional information shall be furnished on with the consignment.

- Name of the consignee, i.e. MSEDCL.
- Destination
- Company's Supply order no. and date

9.04 Supplier shall provide statistical data regarding cables of all sizes viz.-

(a) Weight of one meter of finished product of cable of various sizes and ratings.

(b) Weight of one meter of bare conductor used for cables of various sizes and ratings.

10.00 QUALITY CONTROL

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

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

10.03 The cable supplied shall give service for a long period with out drifting from the original calibration & performance must be near to zero percent failure.

11.00 QUALITY ASSURANCE PLAN

A detailed list of bought out items which got into the manufacture of cables shall 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.

12.00 SCHEDULES

12.01 The tenderer shall fill in the following schedule which forms part of the offer.

Schedule 'C' - Tenderer's Experience.

12.02 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.

SCHEDULE - C

SCHEDULE OF TENDERER'S EXPERIENCE

Tenderer shall furnish here a list of similar orders executed/under execution by him to whom a reference may be made by purchaser in case he considers such a reference necessary.

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

NAME OF FIRM _____

NAME & SIGNATURE OF TENDERER _____

DESIGNATION _____

DATE _____

Guarantee Technical Particular

Sr.no	DESCRIPTION	Reference Documents	To be filled by Bidder
1	Name of Manufacturer & Address		
2	Cable Type		
2.1	Description		
3	Applicable Standards (IS)		
4	No of cores (Nos)		
5	Cable Size (sq.mm)		
6	Voltage Grade (kV)		
7	Permissible Voltage & Frequency variations for satisfactory operation		
8	Maximum conductor temperature under normal operating conditions		
9	Maximum conductor temperature at the termination of short circuit		
10	Continuous Current carrying capacity in air (Amp) 40 Deg C		
11	Continuous Current carrying capacity in ground (Amp) 30 Deg C		
12	<u>Conductor</u>		
(i)	Material		
(ii)	Shape		
(iii)	Nominal Cross-sectional Area (Sq. mm)		
(iv)	No of Wire (mm)	IS:8130:2013-Table 2	
(v)	Dia of Individual wire (mm)		
(iv)	Nominal Conductor Diameter	mm	
13	<u>Conductor Screen</u>	IS 7098 (Part2)/2011	
(i)	Material		
(ii)	Nominal Thickness (mm)		
14	<u>Insulation</u>		
(i)	Material		
(ii)	Nominal Thickness (mm)		
15	<u>Insulation Screening</u>		
(i)	Material	IS 7098 (Part2)/2011 as per Clause 6.1	
(ii)	Nominal Thickness (mm)		
16	<u>Core Identification</u>	IS 7098 (Part2)/2011 as per Clause 14.1	
17	Calculated Laid up dia (mm)		

TECHNICAL SPECIFICATION OF 11/22/33 KV XLPE POWER CABLE FOR DISTRIBUTION NETWORK

18	<u>Inner Sheath</u>		
(i)	Material	IS 7098 (Part2)/2011 as per Clause 7.1	
(ii)	Extruded or wrapped		
(iii)	Min. Thickness (in mm)	IS 7098 (Part2)/2011 as per Table 5	
(iv)	Calculated Dia over I/Sh (mm)		
	Filler material		
19	<u>Armour</u>		
(i)	Material	IS 3975	
(ii)	<u>Types of Armouring</u>		
(iii)	Nominal size of wire (mm)	IS 7098 (Part2)/2011	
(iv)	Calculated Dia over Armour (mm)		
20	<u>OUTER SHEATH</u>		
(i)	Material	IS 7098 (Part2)/2011	
(ii)	Minimum Thickness (mm)	IS 7098 (Part2)/2011	
(iii)	Colour		
21	Approximate Overall Diameter. (mm)		
22	Approximate Weight of cable. (Kg/Km.)		
23	Drum Material		
24	Standard Drum Length (mtr)		
25	Minimum Bending Radius		
26	Safe pulling Force	As IS 1255	
27	Short Current Rating Of Conductor -Duration of 1 Sec in (KA)	IEC:60949	
28	Maximum DC resistance of conductor at 20°C (Ohm/km)	As IS 8130:2013	
29	Approx. AC resistance 90°C (Ohm/km)		
30	Approx. Reactance of cable at 50 HZ (Ohm/km)		
31	Approx. capacitance (Micro F/Km)		
32	Marking Detail (by embossing)		
33	Sequential marking of length		