

TECHNICAL SPECIFICATION OF UNARMOURED 1.1 KV ALUMINIUM LT PVC INSULATED PVC SHEATHED CABLES 4 CORE 185 mm², 240 mm², 300 mm² & 400 mm².

1. SCOPE:

This specification covers Manufacturing, testing at works, supply, and delivery of unarmored **1.1 KV LT PVC insulated and sheathed round cable 4 CORE 185 mm², 240 mm², 300 mm² & 400 mm² with the sector-shaped aluminum conductor of H4 grade class-2** to any stores in Gujarat.

2. SERVICE AND CLIMATIC CONDITIONS:

The unarmored L.T. PVC insulated & sheathed with black colour outer sheath cables are required to be laid outdoors either for giving power supply to LT motive power consumers or for the LT distribution system on the transformer center.

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.	

Date:

Seal & Signature of Tenderer

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 outdoors on the transformer structures for LT power distribution i.e. from transformer L.T. bushings to LT distribution box and from LT distribution box to LT overhead lines supported on poles.

4.2. 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.

4.3. The 4 core LT PVC Cable shall be used for the Distribution Transformer up to 500 kVA.

5. APPLICABLE STANDARDS:

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

IS: 1554 (Part-I)1988	Specification for PVC insulated (heavy duty) electric cables
IS: 5831-1984	PVC insulation and sheath of electric cables
IS: 8130-1984	Conductors for insulated Electric cables and Flexible cords
IS: 10418-1982	Drums for electric cables
IS:10810-1984	Method of test for cables
IS: 10462	Fictitious calculation method for determination of dimensions of the protective covering of cables
IS: 4026-2007	Aluminium ingots, billets, and wire bars (EC grade)
ASTM G 154	Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

6. TECHNICAL PARTICULARS:

6.1. The LT PVC cables shall be unarmored PVC insulated and sheathed with shaped stranded aluminum conductors for an earthen neutral system confirming to IS: 1554 (Pt-I) 1988 with the latest amendment or revision if any. The cable shall be ISI marked

Date:

Seal & Signature of Tenderer

and shall have characteristics suitable for a voltage rating of 1100 V in standard length as mentioned in these specifications.

6.2. Conductor: The conductor of the cable shall be made from high conductivity, Electrolytic, H4 Grade and stranded Aluminium to form a sector-shaped conductor having resistance within limits as specified in IS 8130/ 1984 with the latest amendments. The Aluminium conductor shall be class-2 as per IS 8130.

6.3. Insulation: The Conductor shall be provided with PVC insulation applied by extrusion. The type of insulation shall be type A as per IS: 5831 of 1984 with the latest amendment/revision if any. The average thickness of insulation shall not be less than the nominal value as specified in IS: 1554 (Part I) with the latest amendments. Tolerance on insulation thickness shall be as per 1554 (Part I). The cable insulation shall be colour coded for proper identification in accordance with clause 10.1 of IS: 1554 (Part- I) as follows.

a) R Phase: Red, Y Phase: Yellow, B phase: Blue, Neutral: Black;

6.4. Inner sheath: The laid-up cores shall be provided with an inner sheath applied by the extrusion process. It shall be ensured that the shape is as circular as possible. It shall be applied to fit closely onto the laid-up cores and shall be possible to remove easily without causing any damage to the underlying insulated cores. The inner sheath shall be thermoplastic material or LDPE as per Cl. No. 5 & 12 of IS-1554/1988 and confirming to IS-5831/1984. The colour of the inner sheath shall be black.

6.5. Outer sheath: The outer sheath shall consist of an extruded tough outer sheath of PVC compound insulation over the inner sheath. The outer sheath shall be so applied that it fits closely over the inner sheath. It shall be possible to remove it without damage to the insulation/inner sheath. The PVC compound for the outer sheath shall conform to type ST-1 of IS: 5831-1984 (amended up to date). The color of the outer sheath shall be black. It shall be UV resistant to use in outdoor applications.

7. GENERAL TECHNICAL REQUIREMENTS:

The offered cable shall confirm following minimum technical requiremets

1.1 kV 4 Core PVC insulated & sheathed unarmored cable conforming to IS: 1554 (Part – I)						
Sr. No.	Parameter	Unit	Requirements			
	Size of Conductor	sq. mm.	185	240	300	400
1	Voltage grade	KV	1.1			
2	System Voltage	V (L-L)	433			

Date:

Seal & Signature of Tenderer

3	Conductor		Electrolytic Grade Aluminium conforming to IS 8130			
a.	Type		<u>Al.</u>	<u>Al.</u>	<u>Al.</u>	<u>Al.</u>
b.	Grade		H4	H4	H4	H4
c.	Flexibility Class		2	2	2	2
d.	No. of Cores	Nos.	4	4	4	4
e.	Maximum D.C. resistance of conductor at 20 deg C	Ohm/K m	0.164	0.125	0.100	0.0778
f.	Short circuit capacity for 1 second	KA	14.06	18.24	22.80	30.40
g.	Continuous current rating at 40 deg C (air)	A	245	291	335	390
h.	Shape of conductor		Sector shaped			
4	Insulation		PVC insulation type 'A' as per IS: 5831/1984			
a.	Nominal thickness	mm	2.0	2.2	2.4	2.6
b.	Minimum thickness(at any point of measurement)	mm	1.70	1.88	2.06	2.24
c.	Maximum Continuous operating temperature	°C	70°C	70°C	70°C	70°C
d.	Maximum Short-circuit withstand temperature	°C	160°C	160°C	160°C	160°C
5	Inner sheath	Thermoplastic material or LDPE as per Cl. No. 5 & 12 of IS-1554/1988 and confirming to IS-5831/1984				
a.	Minimum thickness(at any point of measurement)	mm	0.60	0.60	0.70	0.70
b.	Colour	Black				
6	Outer sheath	Extruded PVC Type ST1 as per IS:5831-1984				
a.	Nominal thickness	mm	2.80	3.00	3.40	3.60
b.	Minimum thickness(at any point of measurement)	mm	2.04	2.20	2.52	2.68
c.	Colour		Black			
7	Tensile strength of insulation & sheath (Min)	N/mm ²	12.5			

Date:

Seal & Signature of Tenderer

8	Cable shape		Circular
---	-------------	--	----------

8. **PACKING AND FORWARDING:**

8.1. The LT PVC cable of size 4 Core x 185 mm², 240 mm², 300 mm² and 400 mm² shall be wound on non-returnable wooden drums. The cable shall be supplied in standard drum length as per the detail below:

Size Sq.mm	Standard Length	Tolerance
4C*185 Sq.mm	250 meter	+/- 0.5 %
4C*240 Sq.mm	250 meter	+/- 0.5 %
4C*300 Sq.mm	250 meter	+/- 0.5 %
4C*400 Sq.mm	250 meter	+/- 0.5 %
Note: There shall be no negative tolerance in the overall items quantity as mentioned in A.T		

8.2. **Non-standard Length:** The non-standard length of not less than 100 Meters up to 3% of the Order quantity (for all sizes).

8.2.1. For 4 core x 25mm², 50mm², and 70 mm² cable: Length measuring 100 Meters to 497 Meters shall be considered non-standard length and is acceptable up to 3% of the ordered quantity

8.2.2. For 4core x 150sq.mm cable & above: Length measuring 100 Meters to 248 Meters shall be considered non-standard length and is acceptable up to 3% of the ordered quantity

8.3. 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.

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

8.5. 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.

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

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

8.8. The following information shall be either stenciled on both sides of the drum or contained in a label attached to it.

- IS: 1554(Pt-I)/88 or as applicable.
- Manufacturer's Name, Brand Name or Trade Mark
- Type of cable & Voltage Grade
- Number of cores
- The nominal cross-sectional area of the conductor
- Cable code

Date:

Seal & Signature of Tenderer

- g) Color of cores
- h) Length of cable on the reel, drums, or coil
- i) The direction of rotation of the drum (by means of the arrow)
- j) Approximate gross weight & Drum No.
- k) Country of Manufacture
- l) Month & Year of Manufacture
- m) P.O.(A/T) No. and Date
- n) Date of dispatch
- o) Property of DISCOM (i.e. MGVCL/DGVCL/UGVCL/PGVCL)
- p) Details of the consignee (on wooden drums only)
- q) ISI Mark

9. **MARKING/EMBOSSING**

9.1. The following words shall be duly embossed on the sheath of every meter length of cables. The embossing should be clear and visible.

- a) Name of Purchaser (i.e. MGVCL/DGVCL/UGVCL/PGVCL)
- b) Electric
- c) Voltage Grade
- d) No. of cores
- e) Size of the cable
- f) Sequential length marking at every meter distance throughout the cable length with adequate font size (Not less than 5mm) embossed on the cable in bold letters.
- g) Year of Manufacture
- h) Trade Mark of Supplier
- i) IS Number

10. **Type test:**

10.1. The cable offered shall have successfully passed all type tests described in the IS: 1554 (Part-I) 1988 (amended up to date). The Type Test Certificate as per IS: 1554 (Part-I) 1988 (amended up to date) shall be submitted along with the offer OR within the commencement period. All the Type Tests shall be carried out from Laboratories which are accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL).

10.2. A type test shall be performed on cable with similar construction and similar or higher sizes of offered cable as per amendment No. 5 of IS 1554-1. Type tests shall not be more than 7 years old at the time of bid submission. Following type tests as per IS: 1554 part-1 & purchaser requirements shall be furnished invariably with the offer:

Date:

Seal & Signature of Tenderer

Sr. No.	Test
A.	Tests on conductor i) Tensile test ii) Wrapping test iii) Resistance test iv) Chemical composition test as per IS 4026
B.	Test for thickness of insulation and sheath
C.	Physical tests for insulation and Physical Test for outer sheath: i) Tensile strength and elongation at break ii) Aging in air oven iii) Shrinkage test iv) Hot deformation v) Loss of mass in air oven vi) Heat shock test vii) Thermal stability
D.	Insulation resistance (Volume resistivity test)
E.	High voltage test (water immersion test)
F.	High voltage test at room temperature
G.	Flammability test
H.	UV stability Test as per ASTM G154 (sample shall meet minimum 70% retention in tensile strength and elongation after exposure of 14 days)

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.

- 1.1. Conductor resistance test
- 1.2. High voltage test at room temperature

12. Acceptance Test:

The following acceptance tests shall be conducted on samples taken at random from a lot as per IS: **1554 part-1/** relevant standard in the presence of the purchaser's representative

- 1.3. Tensile test,
- 1.4. Wrapping test,
- 1.5. Conductor resistance test,
- 1.6. Test for the thickness of insulation and sheath,
- 1.7. Tensile strength and elongation at break of insulation and sheath,

Date:

Seal & Signature of Tenderer

- 1.8. Insulation resistance test, and
- 1.9. High voltage test at room temperature.

13. INSPECTION AND TESTING:

- 13.1. 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 IS: 1554 (Part- I) 1988 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 Company's Inspector and obtaining specific dispatch instructions in writing.
- 13.2. The supplier shall present the latest Calibration Certificate(s) of testing 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).
- 13.3. 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:
 - 13.3.1. 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.
- 13.4. 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

Date:

Seal & Signature of Tenderer

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.

14. Documentation:

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

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 offered type and rating of the cable	Required	Required	
5	BIS Licence as relevant IS	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

- 14.5. 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.

Date:	Seal & Signature of Tenderer
--------------	---

Annexure-1

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

Sr. No.	Description	Purchaser Requirements	To be filled by Supplier for each size			
			4C* 185 Sq.mm	4C* 240 Sq.mm	4C* 300 Sq.mm	4C* 400 Sq.mm
1	Applicable IS / IEC Standard followed by vendor	IS: 1554 (P-I) 1988 (Latest)				
2	ISI License shall remain valid till Order is completed (Yes/No)	Yes				
3	Make					
4	Voltage Grade (kV)	1.1 KV				
5	Maximum Conductor temperature in degree Celsius.					
A	Continuous	70				
B	Short time	160				
6	Conductor					
A	Material and Grade	EC grade Aluminium & H4				
B	Make of Al					
C	Size (mm ²)					
D	Min no. of wires in each conductor (Nos.)					
E	Min Dia. of wires in each conductor before compaction (mm)					
F	Shape of Conductor	Sector shaped				
G	Diameter over conductor (mm)					
H	Maximum Conductor resistance at 20 ° C(Ohm/Km)	As per tech spec				
7	Insulation					
A	Insulation Material	PVC insulation type 'A' as per IS: 5831/1984				

Date:

Seal & Signature of Tenderer

	B	Nominal thickness (mm)	As per tech spec				
	C	Minimum Thickness (mm)	As per tech spec				
	D	Diameter over Insulation (mm) Approx.					
	E	Make of insulation compound					
	F	Colour of Insulation	As per tech spec				
8		Inner Sheath					
	A	Material and Type	Thermoplastic or LDPE as per IS-1554/1988				
	B	Minimum thickness (mm)	As per tech spec				
	C	Approx. dia. Over sheath (mm)					
	D	Colour	Black				
9		Outer Sheath					
	A	Material and Type	ST-1 PVC as per 5831/1984				
	B	Nominal Thickness (mm)	As per tech spec				
	C	Minimum Thickness (mm)	As per tech spec				
	D	Colour					
	E	Embossing Details					
	F	UV stabilized (Yes/No)	Yes				
10		Approx. overall dia. (mm)					
11		Overall order tolerance					
12		Cable shape	Round				
13		Cable Drum					
	A	Type of Drum	Wooden				
	B	Drum Length & tolerance	As per tech spec				
	C	Marking on Drum					

Date:

Seal & Signature of Tenderer

D	Cable drum having a ISI mark (Yes /No)	Yes				
E	wooden drums as per IS: 10418/1982 & tech spec (Yes /No)	Yes				
F	Marking on drum	As per tech spec				
14	End Cap provided ?(yes/No)	Yes				
15	Weights					
a)	Net Weight of cable (Kg/Km.) – Approx					
b)	Weight of empty drum (Kg.)					
c)	Weight of cable with drum (Kg.)					
16	Continuous current rating for standard I.S condition laid direct (A)					
a)	In ground 30° C					
b)	In duct 30° C					
c)	In Air 40° C	As per tech spec				
17	Short circuit current for 1 sec of Conductor (kAmp)	As per tech spec				
18	Electrical Parameters at Maximum operating temperature:					
A	AC Resistance (Ohm/Km)					
B	Reactance at 50 C/s Ohm/Km					
C	Impedance					
D	Capacitance (Micro farad / Km)					
19	Recommended minimum bending radius					

Date:

Seal & Signature of Tenderer

20	De-rating factor for following Ambient temperature in Air					
a)	At 30° C					
b)	At 35° C					
c)	At 40° C					
d)	At 45° C					
e)	At 50° C					
21	Core identification colour					
a)	R Phase					
b)	Y Phase					
c)	B Phase					
d)	Neutral					
22	Volume resistivity of insulation (Yes/No) a. At 27°C – 1×10^{13} ohm. Cm.(Min) b. At 70°C – 1×10^{10} ohm. Cm.(Min)	Yes				
23	Elongation break of insulation & sheath	150 % (Min)				

Date:

Seal & Signature of Tenderer

Annexure-2

GUARANTEED TECHNICAL PARTICULARS (G.T.P)

PART – B

Bidder has to furnish below details about materials for

Sr. No.	Particulars	information
1.	ISI License for IS:1554 (P-I)1988 a. Number b. Date of expiry	
2.	Approximate weight of <u>1 (one) meter length in KGs:</u> a) <u>Aluminum</u> b) <u>PVC</u> c) <u>Total</u>	

a) 185 mm²:

b) 240 mm²:

c) 300 mm²:

d) 400 mm²:

Cable manufacturing process i.e. with

i) Inner sheath by extrusion or by wrapping?

ii) Is Binder taps are provided?

iii) Outer sheath & inner sheath by separate extrusion?

iv) Inner and outer sheath in a single extrusion? If so than polyester tape is required on laid up cores.

Date:

Seal & Signature of Tenderer

Annexure-3

PART – C (Enclosures)

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) with yellow colour outer sheath....	Yes approved

Description	Rating/Size of Cable: 4 Core			
	185 mm ²	240 mm ²	300 mm ²	400 mm 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. |

Date:	Seal & Signature of Tenderer
-------	------------------------------

Annexure-4

PART – D

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

--

Date:

Seal & Signature of Tenderer