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TECHNICAL SPECIFICATIONS

FOR

LT SINGLE CORE UNARMoured, ALUMINIUM CONDUCTOR XLPE INSULATED, PVC SHEATHED, FRLS CABLE, OF VARIOUS SIZES.

(1.1kV)

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This is a Tender Specification for procurement of “LT SINGLE CORE UNARMoured, ALUMINIUM CONDUCTOR CROSS LINKED POLYETHYLENE INSULATED (XLPE) PVC SHEATHED ,FLAME RETARDANT LOW SMOKE(FRLS) CABLE OF VOLTAGE GRADE 1.1 kV ISI MARKED OF VARIOUS SIZES”, subject to the modification by the Purchaser as per actual field requirement. Supplier to submit the Guaranteed Technical Particulars (GTP) and Drawings, after the award of the Contract, for approval of the Purchaser.

SECTION A

TECHNICAL SPECIFICATIONS OF LT SINGLE CORE UNARMoured, ALUMINIUM CONDUCTOR CROSS LINKED POLYETHYLENE INSULATED (XLPE) PVC SHEATHED ,FLAME RETARDANT LOW SMOKE(FRLS) CABLE OF VOLTAGE GRADE 1.1 kV ISI MARKED OF SIZES 35/50/70/95/120/185/240/300 and 400 SQ-MM

1. SCOPE:-

- 1.1 This specification covers the design, manufacture, testing at manufacturer's work and supply of 1 Core , Unarmoured, Aluminium conductor XLPE, PVC sheathed Flame retardant low smoke (FRLS) type specification ISI marked and conforming to IS: 7098 Part-I of 1988 with up to date amendments suitable for earthed system for 1.1 kV of sizes 35 sq mm, 50 sq mm, 70 sq mm, 95 sq mm, 120 sq mm, 185sq mm, 240sq mm, 300sq mm and 400 sq mm.
- 1.2 It is not the intent to specify completely herein all details of the design and construction of the equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to the bidder's guarantee in a manner acceptable to the purchaser, will interpret the meanings of drawings and specifications and shall have the discretion to reject any work or material which, in his judgment, is not in accordance there with.

2. LOCATION:

- 2.1 The cables may be laid anywhere in Kashmir Valley for indoor connection for indoor switchgear
- 2.2 Cables shall be suitable for Climatic conditions as listed in **Section -B.**

3. SYSTEM DETAILS:

S.NO	PARTICULARS	DATA
a.	Nominal System Voltage	0.443 kV
b.	Highest System Voltage (kV)	1.1 kV
c.	Number of Phase	3
d.	Frequency	50Hz
e	Variation in frequency	± 3%
e.	Type of Earthing	Solidly Earthed

f.	Total Relay & Circuit breaker Operating Time	15-20 Cycles
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4. Applicable standards for manufacturing:

4.1 The materials shall conform to the latest editions of the following Indian/International Standards:

S.NO	Indian Standards	Title	International
1	IS 7098 Part 1 - 1984	Specification for XLPE insulated PVC sheathed cables For working voltages up to and including 1.1 kV	
2	IS 5831 : 1984	Specification for PVC Insulation and sheath of electric cables	
3	IS 8130:1984	Specification for Conductors for insulated electric cables and flexible cords	
4	IS 3975:1999	Specification for Mild steel wires, formed and tapes for armouring of cable.	
5	IS: 10810 –1984	Method of tests for cables	
6		Standard test method for density of smoke from burning or decomposition of plastics.	ASTM-D 2843-1993
7		Standard test method for measuring minimum oxygen concentration to support candle-like combustion of plastics(Oxygen index)	ASTM-D 2863-1991
8	IS: 10418 – 1982	Drums for electric cables	
9	IS:10462-1991	Fictitious calculation method for determination of dimensions of protective covering of cables	
10	IEC-754	Test on gases evolved during combustion of electric cables	
	Part-I :1994	Determination of the amount of halogen acid gas evolved during combustion of polymeric material taken from the cables.	
11	NEMA_WCS-1992	Thermoplastic insulated wire and cable for the transmission and distribution of electrical energy	

4.2 The cable joints, outdoor and indoor termination and their accessories and fittings may conform to IS -1255(1983) and/or equivalent standards or important

publications to improve upon their performance, but shall not fall short of the requirement of this specification. The tenderer shall clearly indicate such standards in their offers.

5. CONSTRUCTION:

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

5.2 Conductor shall be of uniform, of good quality, free from defects.

5.3 INSULATION: The insulation shall be cross linked polyethylene applied by extrusion and shall be steam (wet) cured as per IS: 7098 PART 1 (1988) and curing in hot water tank/bath is not accepted.

5.3.1 The Cross Linked Polyethylene (XLPE) insulation should be suitable for specified 1.1 kV system voltages.

5.3.2 The manufacturing process shall ensure that insulation shall be free from voids.

5.3.3 The insulation shall withstand mechanical and thermal stresses under steady state and transient operating conditions.

5.3.4 The insulation of the cable shall be high standard quality , specified in IS :7098 (PART –I/1988) .Withstand continuous conductor temperature of 90 degree Celsius, which means higher continuous rated current carrying capacity .

5.4 INNER SHEATH: The sheath shall be suitable to withstand the site conditions and the desired temperature. It should be of adequate thickness, consistent quality and free from all defects. The PVC Sheath shall be extruded as per IS 7098 (PART-1-1988). Single core shall have no inner sheath.

5.5 OUTER SHEATH: The outer sheath shall consist of extruded tough outer sheath of PVC compound insulation. Extruded PVC ST2, outer sheath as per IS: 5831/1984, IS: 7098Part 1, IEC: 60502 Part – 1, BS: 6622, LSOH to BS: 7835 shall be applied with suitable additives to prevent attack by rodents and termites. Outer sheathing shall be designed to offer high degree of mechanical protection and shall also be heat, oils, chemicals, abrasion and weather resistant. Common acids, alkalis, saline solutions etc., shall not have adverse effects on the PVC sheathing material used. The colour of the outer sheath shall be black. The cable must meet all the requirements of the IS: 7098 (Part 1) amended up to date and shall bear ISI mark.

Suitable additives shall be added to give anti-termite protection.

5.6 FRLS Properties - All cable shall be Flame Retardant, Low Smoke (FRLS) type. Outer sheath shall have the following properties –

- Acid Gas Generation – Max 20%(as per IEC 754-1)
- Smoke density rating: 60% (As per ASTM D 2843)
- Flammability test - As per Swedish chimney test F3 as per SEN 4241475 As per IEC 332 part-3 (Category B)

5.7 Repaired cables shall not be acceptable.

5.8 GENERAL:

All materials used in manufacturing of cable shall be new, unused and of finest quality.

All materials shall comply with the requirements / tests as per applicable IS / IEC specification, Indian Electricity Rules and any other statutory provision of rules & regulations. The purchaser reserves the right to ask for documentary evidence of the purchase of various materials, (to be used for the manufacture of cable) as a part of quality control. Quality Assurance plan shall be submitted. Each of cable type and size shall be ISI certified. The manufacturer shall submit self- certified Xerox copy of valid ISI license with the offer.

5.9 Short circuit Current rating: As per given in Specific Technical Requirements.

6. SPECIFIC TECHNICAL REQUIREMENTS

Technical parameters of the cable shall be as follows:

SI No	Particulars	Unit	Requirements
1	Type of Cable	:	LT XLPE POWER CABLE OF FRLS TYPE SINGLE CORE OF SIZES 35/50/70/95/120/185/240/300 and 400 sq mm
2	Standard applicable in general	:	IS 7098 PART (1)
3	Rated voltage	V	240/440
4	Single /Three core	:	Single core
5	Armoured/Unarmoured	:	Unarmoured
6	System	:	1100 V Earthed
7	Highest system voltage	V	1100
8	Short circuit current for 1 sec duration		
	35 sq mm	KA	3.29
	50 sq mm		4.70
	70 sq mm		6.58
	95 sq mm		8.93
	120 sq mm		11.28
	185 sq mm		17.39
	240 sq mm		22.56
	300 sq mm		28.20
	400 sq mm		37.60
9	High Voltage withstand capacity		kV rms
10	Max D.C Resistance of conductor at 20 degree Celsius	:	
	35 sq mm	Ohm/Km	0.868
	50 sq mm		0.641

	70 sq mm		0.443
	95 sq mm		0.320
	120 sq mm		0.253
	185 sq mm		0.164
	240 sq mm		0.125
	300 sq mm		0.100
	400 sq mm		0.0778
11	CONDUCTOR		
a	Material of a conductor	:	Material to IS :8130 ,H4 Grade Aluminium ,Class 2
b	Standard Applicable	:	IS :8130
c	Shape of a conductor	:	Circular
d	Conductor size	:	35/50/70/95/120/185/240/300 sq mm and 400 sq mm
e	Minimum No. of Strands	:	
	35 sq mm		6
	50 sq mm		6
	70 sq mm		12
	95 sq mm		15
	120 sq mm		15
	185 sq mm		30
	240 sq mm		30
	300 sq mm		30
	400 sq mm		53
12	INSULATION		
a	Material	:	XLPE
b	Voltage Grade	V	650/1100
c	Standard Applicable	:	IS :7098 Part –I
d	Continuous withstand temperature	Degree Celsius	90 Degree Celsius
e	Short Circuit withstand temperature	Degree Celsius	250 Degree Celsius
f	Method of application	:	By triple extrusion ,sleeve extrusion not permitted
g	Minimum Thickness		
	35 sq mm		0.9
	50 sq mm		1.0
	70 sq mm		1.1
	95 sq mm		1.1
	120 sq mm		1.2
	185 sq mm		1.6
	240 sq mm		1.7

	300 sq mm		1.8
	400 sq mm		2.0
13	INNER SHEATH		Single core cables shall have no inner sheath
14	OUTER SHEATH		
a	Material	:	Extruded FRLS ,PVC Type ST2 as per IS :5831
b	Colour	:	Black
c	Method of Application	:	Extruded
d	Minimum thickness of outer sheath	mm	As per IS -7098 PART –I (1988)
15	CABLE DRUMS		As specified
a	Type and construction	:	Wooden Drum As per IS :10418
b	Standard Drum Length	:	As per IS :10418

7. PACKING AND MARKING:-

7.1 The cable shall be wound on the drums as per IS : 10418 – 1982 (amended up to date) and packed. The ends of the cable shall be sealed by means of non-hygroscopic material.

7.2 Cables shall be supplied in non-returnable wooden or steel drums of heavy construction and drum shall be properly seasoned, sound and free from defects. Wood preservative shall be applied to the entire drum.

7.3 The cable as per specified delivery lengths, shall be securely wound/packed on non-returnable wooden drums as per IS: 10418 – 1972 and packed in drums suitable for vertical / horizontal transport, as the case may be and shall be suitable to withstand rough handling during transport and outer storage. The outer surface of the drum shall be painted with white aluminum paint. Similarly, the inside surface of drum shall have the protective layer of varnish/ paint. The dimensional drawings of wooden drums shall be furnished after Purchase order both as hard copy and soft copy(PDF format and AutoCAD format).

7.4 The wooden drums shall be reinforced with steel bends and strips for better

protection.

- 7.5** Length: The cable shall be supplied in standard drum length of 500 m (+_5% tolerance)
- 7.6** A layer of water proof paper shall be applied to the surface of the drums and over the outer most cable layer.
- 7.7** A clear space of at least 40 mm shall be left between the cables and the logging.
- 7.8** Packing shall be sturdy and adequate to protect the cables from any injury due to mishandling or other conditions encountered during transportation, handling and storage. Both cable ends shall be sealed with PVC /Rubber caps so as to eliminate ingress of water during transportation and erection.
- 7.9** The cable shall carry the following information either stenciled on the drum or contained in the label attached to it:
- Reference to the Indian Standard i.e reference IS-7098 (Part-I)1988
 - Manufacturer's name or trademark.
 - Number of cores.
 - Nominal cross-sectional area of conductor.
 - Cable code.
 - Length of cable on the drum.
 - Number of length on the drum (if more than one).
 - Direction of rotation of drum (by means of an arrow)
 - Gross mass.
 - Country of manufacture
 - Year of manufacture.
- 7.10** The cable (drum or label) shall bear **ISI certification mark**.

- 7.11** The manufacturer shall be identified throughout the length of cable by manufacturer name or trade mark, voltage grade & year of manufacture indented, printed or embossed or by way of a tape bearing this information. The identification printing or embossing shall be done on the outer sheath.
- 7.12** The identification of core of cables of 1.1 kV shall be color coded and/or numbered for proper identification in accordance with clause 10.1 of IS 7098(PART-I).

8. TESTS

The Type, Acceptance, Routine and Optional tests shall be in accordance with clause 15.1, 15.2, 15.3 and 15.4 of IS: 7098 (PART-I) of 1988 respectively.

Tenderer shall have to submit type test report along with the Bid. The Type test reports shall not be older than TEN years from the date of submission of Bid. Bidder will be disqualified for non-submission of type test reports.

8.1 Type Tests

All the cable types and sizes i.e. items offered shall have been fully type tested as per IS 7098 (Part-1) with amendments up to date at CPRI/ERDA or other reputed third party NABL accredited Laboratory The bidder shall upload one set of the original authenticated copy of type test reports along with the offer. These type tests must have been conducted within last TEN years prior to date of Bid opening. The purchaser however reserves the right to demand repetition of type tests without any extra cost. For each type and size the type test must be carried out independently.

The following shall constitute type tests:

- i) Tests on conductor
 - a. Tensile tests (for aluminium)
 - b. Wrapping tests (for aluminium)
 - c. Resistance test
- ii) Tests for armouring wires/strips
- iii) Test for thickness of insulation and sheath
- iv) Physical tests for insulation
 - a. Tensile strength and elongation at break
 - b. Ageing in air oven
 - c. Hot set test

- d. Shrinkage test
- e. Water absorption (gravimetric)

- v) Physical tests for outer sheath
 - a. Tensile strength and elongation at break
 - b. Ageing in air oven
 - c. Loss of mass in air oven
 - d. Shrinkage test
 - e. Hot deformation
 - f. Heat shock test
 - g. Thermal stability

- vi) Insulation resistance (volume resistivity) tests

- vii) High voltage test

- viii) Flammability test

- ix) FRLS Tests- The following FRLS tests are to be conducted as per the referred standard
 - HCL gas evolution test (IEC - 754.1)
 - Oxygen Index (ASTM-D-2863)
 - Temperature Index (ASTM-D-2863)
 - Smoke density test (ASTM-D-2863)
 - Flammability test (IEC-332.1)
 - Swedish Chimney test (SS-424 14 75)
 - Ladder Test (IEEE-383)

XLPE cables shall be tested as per IS 7098 / IEC.

The LT XLPE cables shall be routine tested as per relevant IEC/IS.

8.2 Acceptance tests

The selection of sample pieces for acceptance test shall be as per Appendix A of IS 7098 (Part-I), of each lot offered for inspection or part thereof. The minimum shall be one drum. The following shall constitute the acceptance test:

- a. Tensile test (for aluminium)

- b. Wrapping tests (for aluminium)

- c. Conductor resistance test,
- d. Test for thickness of insulation
- e. Hot set test for insulation,
- f. Tensile strength and elongation at break test for insulation and sheath
- g. High voltage test and
- h. Insulation resistance (volume resistivity) test

All the acceptance tests shall be carried out by the firm, in the presence of Purchaser's representative at their works. The firm shall give at least 30 days advance notice to the Purchaser to enable him to depute the Engineer for witnessing the tests. The test certificates for Acceptance Tests witnessed by Inspecting Officer /Engineer shall be submitted for approval before dispatch of material.

8.3 Routine test

The following shall constitute routine tests:

- i) Conductor resistance test
- ii) High voltage tests.

8.4 Optional tests

Cold Bend and impact tests for outer sheath (IS: 5831-1984) and part 20 and 21 of IS 10810 shall constitute the optional tests.

9. CHALLENGE CLAUSE:

Purchase reserves the right to have the material, received after the inspection by the authorized inspecting officer, again tested for any parameter(s) from approved/NABL Accredited testing house/in house technique of the Purchaser. The results if found deviating/unacceptable or in non-compliance with the approved GTP's , the lot shall be rejected and bidder shall arrange to replace the rejected LOT within **thirty (30) days** of such detection at his cost including to and fro transportation.

10. DETAILS OF TESTS

The tests shall be governed by section 15 (classifications of tests) and clause -16 (details of tests) as per IS: 7098 (part –I) 1988.

SECTION -B
CLIMATIC AND ISOCERAUNIC CONDITIONS (CIC)

1. The climatic and isoceraunic conditions at the site of work are approximately given as under:

S.No.	Description	Values
i.	Max. temp of air in shade	30.6 ⁰ C
ii.	Min. temp of air in shade	-20 ⁰ C
iii.	Max. temp of air in sun	45 ⁰ C
iv.	Height above sea level (Approx.)	1600 m
v.	Max. relative humidity	90%
vi.	Min. relative humidity	15%
vii.	Average no. of thunder storm days per year	54
viii.	Average rainfall	80 cm
ix.	Wind Zone	WZ – 3
x.	Average number of rainy days per year	106
xi.	Seismic Zone	SZ – 5
xii.	Area of installation	HSZ

HSZ = Heavy Snow Zone, LSZ = Light Snow Zone

2. Communication and Transport

The nearest railway station is Jammu/Udhampur on the broad gauge line and is connected to the Divisional Stores by a metal road. The equipment is required to pass en-route through various Tunnels on NH-44. The weights and maximum dimension of the packages suitable for transportation through tunnel route are as follows:

i.	Length	7.0m
ii.	Width	3.0m
iii.	Height	4.55m
iv.	Weight	40 Ton (Metric)

The supplier shall get the permissible weight and dimensions confirmed from the Highway Authorities before proceeding with the manufacture of the equipment. It will be the responsibility of the supplier to ensure timely and proper delivery of the equipment on door delivery at Srinagar, through road transport. The supplier shall also ensure that the weights and dimensions of the packages which are suitable to be carried by road transport up to Srinagar.

GUARANTEED TECHNICAL PARTICULARS

SECTION –C

Technical parameters of the cable shall be as follows:

SI No	Particulars	Unit	Requirements
1	Type of Cable	:	
2	Standard applicable in general	:	
3	Rated voltage	V	
4	Single /Three core	:	
5	Armoured/Unarmoured	:	
6	System	:	
7	Highest system voltage	V	
8	Current rating		
a	In ground at 30 degree Celsius for sizes:	Amps	
	35 sq mm		
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
b	In air at 40 degree Celsius	Amps	
	35 sq mm		
	50 sq mm		
	70 sq mm		
	95 sq mm		

	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
9	Short circuit current for 1 sec duration	KA	
	35 sq mm		
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
10	High Voltage withstand capacity	kV rms	
11	Max D.C Resistance of conductor at 20 degree Celsius	:	
	35 sq mm	Ohm/Km	
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
400 sq mm			
12	Max A.C Resistance of conductor at 90 degree Celsius	Ohm/Km	
	35 sq mm		
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
400 sq mm			

13	Reactance of cable at normal frequency (Approx)		
	35 sq mm	Ohm/Km	
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
14	Electrostatic capacitance at normal frequency		
	35 sq mm	Microfarads per Km	
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
15	CONDUCTOR		
a	Material of a conductor	:	
b	Standard Applicable	:	
c	Shape of a conductor	:	
d	Conductor size	:	
e	Minimum No. of Strands	:	
	35 sq mm		
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
16	INSULATION		
a	Material	:	
b	Voltage Grade	V	
c	Standard Applicable	:	

d	Continuous withstand temperature	Degree Celsius	
e	Short Circuit withstand temperature	Degree Celsius	
f	Method of application	:	
g	Minimum Thickness	mm	
	35 sq mm		
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
17	INNER SHEATH		
a	Type and material	:	
b	Whether extruded /wrapped	:	
c	Minimum thickness	mm	
	35 sq mm		
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
17	ARMOUR		
a	Material	:	
b	Minimum Coverage	:	
c	Gap between Armour Wires	:	
d	Breaking load of joint	:	
e	Nominal Dimension of Al Round Wire	:	
	35 sq mm		
	50 sq mm		
	70 sq mm		

	95 sq mm	mm	
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
18	OUTER SHEATH		
a	Material	:	
b	Colour	:	
c	Method of Application	:	
d	Minimum thickness of outer sheath	:	
	35 sq mm	mm	
	50 sq mm		
	70 sq mm		
	95 sq mm		
	120 sq mm		
	185 sq mm		
	240 sq mm		
	300 sq mm		
	400 sq mm		
	19		Minimum Bending Radius
20	CABLE DRUMS		
a	Type and construction	:	
b	Standard Drum Length	:	