**Annexure – ‘B’**

**Technical Specification of 11 KV 3Cx400 sqmm. XLPE Cable**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 1.1 |  | | **SCOPE**  This section of the specification covers design, manufacturing, testing, packing, supply and | | | | |
|  |  | | delivery of 11 KV XLPE dry gas cured insulated power cable for effectively earthed system. | | | | |
| 1.2 |  | | **STANDARDS**: | | | | |
| 1.2.1 |  | | Unless otherwise specified, the cable shall confirm in all respect to IS:7098 (Part-II)-1985 | | | | |
|  |  | | with latest amendment thereof. | | | | |
| 1.3 |  | | **CLIMATIC CONDITIONS**: | | | | |
| 1.3.1 |  | | The climatic conditions under which are cables shall operate satisfactorily are as follows: | | | | |
|  | (a) | | Maximum ambient temperature of air °C : 50 | | | | |
|  | (b) | | Minimum ambient temperature of air in shade °C : 40 | | | | |
|  | (c) | | Maximum daily average ambient temperature °C : 40 | | | | |
|  | (d) | | Maximum yearly average ambient temperature °C : 30 | | | | |
|  | (e) | | Maximum relative humidity % :95 | | | | |
|  | (f) | | Average no. of thunder storm days per annum :15 | | | | |
|  | (g) | | Average annual rainfall cm : 150 | | | | |
|  | (h) | | Minimum wind pressure Kg/cm² :150 | | | | |
|  | (i) | | Altitude not exceeding above MSL mtrs. : 1000 | | | | |
|  | (j) | | Maximum soil temperature at cable depth °C : 30 | | | | |
|  | (k) | | Maximum soil thermal resistively cm/watt °C : 150 | | | | |
| 1.4 |  | | **PRINCIPLE PARAMETERS** | | | | |
| 1.4.1 |  | | 11 kV (E) Grade XLPE, 3-core, power cable shall be of high conductivity, stranded | | | | |
|  |  | | compacted, H.D. aluminium circular shaped conductor with XLPE (cross linked Poly | | | | |
|  |  | | Ethelene) Dry gas cured insulation provided with shielding of extruded semi-conducting | | | | |
|  |  | | material over conductor and XLPE insulation. Each insulated core shall have copper tape | | | | |
|  |  | | screen, laid together and provided with common covering of PVC Inner Sheath (Extruded). | | | | |
|  |  | | Overall galvanized steel strip armour and PVC outer sheath shall be provided. The | | | | |
|  |  | | specification for manufacture of cable shall be conforming to IS :7098 (Part-II) 1985 (latest | | | | |
|  |  | | edition) 11 KV (E) 3 Phase 50 Hz. | | | | |
| 1.4.2 |  | | Outer sheath shall be designed to afford high degree of mechanical protection and shall also | | | | |
|  |  | | be heat, oil, chemical and weather resistant, common acid, alkalis and sealing solution shall | | | | |
|  |  | | not have adverse effect on material of PVC Sheath. | | | | |
| 1.4.3 |  | | Cable shall be suitable or laying in cover trenches and / or buried under-ground in outdoor. | | | | |
| 1.4.4 |  | | Cable Parameters | | | | |
|  | (i) | | Voltage grade (Uo/U) KV : 11 KV | | | | |
|  | (ii) | | Cores Nos. : 03 | | | | |
|  | (iii) | | Nominal system voltage KV : 11 | | | | |
|  | (iv) | | Highest System Voltage KV : 12 | | | | |
| (v) | | System frequency Hz | : | 50 |
| (vi) | | Variation in Frequency % | : | + 3 |
| (vii)(a) | | Maximum allowable temp. of conductor during |  |  |
|  | | continuous normal operation at rated full load current | °C : | 90 |
| (vii)(b) | | Maximum allowable temperature under short circuit |  |  |
|  | | condition | °C : | 250 |
| (viii) | | 1.2/50 microsecond lightning impulse withstand |  |  |
|  | | Voltage wave value KVP | : | 75 |
| (ix) | | 5 Min. Power Frequency withstand voltage (KV rms) | : | 17 |

(x) System earthling : effectively earthed.

1.5 General technical requirements:

1.5.1 Conductor:

The cable conductor shall be made from high conductivity stranded high density aluminum to form compacted circular shaped conductor having resistance within limits specified in IS:

8130/1984 and any latest amendment to it.

1.5.2 Conductor shield :

The conductor having semi conducing screen shall ensure perfectly smooth profile and avoid concentration of stress. The conductor screen shall be extruded in the same operation as the insulation. The semi-conducting polymer shall be cross- linked.

1.53 Insulation

The XLPE insulation shall be suitable for 11 kV system voltage and should be manufactured with Dry gas curing process. The bidder shall submit the description of dry gas curing process, with the clear inclusion of equipments/ parameters involved. The manufacturing process shall ensure that the insulation shall be free of voids. The insulation shall withstand mechanical and thermal stress under steady state and transient operating conditions. The extrusion method should give very smooth interface between semi-conducting screen and insulation. The insulation of the cable shall be of high standard quality generally confirming to IS7098 (part-II)-1985 and any latest amendment to it.

1.5.4 Insulation shield:

Non-metallic semi-conducting shield shall be provided over the insulation to confine electrical field to the insulation. The insulation shield shall be extruded in the same operation as the conductor shield and the insulation by suitable extrusion process. The XLPE insulation shield shall be of tended type. The copper metallic overlapped tape shield shall be provided.

1.5.5 Filter and inner sheath:

The sheath shall be suitable to withstand the site conditions and the desired temperature. It shall be of adequate thickness, consistent quality and free from all defects. The PVC sheath shall be extruded. The material of filters and inner-sheath shall be compatible with the temperature ratings of the cable and shall have no deterious effect on any other component of the cable. Central PVC filter shall also be provided with other peripheral PVC filers to have proper circular section.

1.5.6 **Armour**:

Armouring of galvanized steel strip shall be provided. The dimensions of steel strips shall be as per latest edition of IS:3975/1979

1.5.7 **Outer sheath**

Extruded type ST-2 PVC outer sheath confirming to IS 5381 – (1984) (latest edition) over armouring with suitable additives (to prevent attack by rodents & termites) shall be provided.

1.5.8 **Construction**

1.5.8.1 The cable shall have suitable PVC fillers laid up with insulation cores to have subsequently circular cross-section before the inner sheath is applied. The fillers shall be suitable for operating temperature of the cable.

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

1.5.8.2 All materials should comply with the requirements / tests as per applicable IS/IEC specification. Indian Electricity Rules and any other statutory provision of rules & regulations.

1.5.8.3 The PVC material used in the manufacturing of cable shall be reputed manufacturer. No recycling of PVC is permitted. 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 per checking of quality control. Quality Assurance plans shall be submitted.

1.5.9 **Current Rating**

The indicative value of continuous current capacities of Maxi. Conductor temp. of 90°C (for design purpose by field) of the various sizes of the cables are given below:

|  |  |  |  |
| --- | --- | --- | --- |
| Sl.No. | Size of 3 core cable  (sq.mm) | Cont. current carrying capacity in Amps. | |
| In ground | In air |
| 1 | 400 | As per IS | As per IS |

1.5.9.1 Short circuit ratings of various sizes of 3 core cable calculated for duration of one second

at maximum temperature of 250°C are given below

|  |  |  |
| --- | --- | --- |
| Sl.No. | Size of 3 core cable  (sq.mm) | Conductor short circuit  rating in KA (rms) |
| 1 | 400 | As pes IS |

1.5.9.2 The current rating shall be based on maximum conductor temperature of 90°C with ambient site condition specified for continuous operation at the rated current.

1.5.10 **Operation**

1.5.10.1 Cable shall be suitable for operation under frequency variation of + 3% and voltage variation +10% -15 and combined frequency voltage variation of 10% (absolute sum)

1.5.10.2 Cable shall be suitable for laying in duct or buried background.

1.5.10.3 Cable shall have heat and moisture resistance properties. These shall be of type & design with proven record on distribution network service.

1.5.10.4 **Length**.

The cable shall be supplied in standard drum length of 300 mtrs. + 5% tolerance for all the sizes of cable.

Overall tolerance in total quantity of ordered cables shall be + 2%

1.5.10.5 **Identification Mark**

(i) The cable drum shall be printed with information as per cl. 21:2 of IS and ISI certification mark. Bidder shall submit Xerox copy of valid ISI Licenses with technical bid.

(ii) For identification of cores, coloured strip of Red, Yellow and Blue colours shall

be used for identification of phases. Following details of identification shall be embossed at intervals of length of one meter of cable outer sheath.

(iii) (a) Name of manufacturer (b) year of manufacture (c) voltage grade (d) Name

of purchaser ”JBVNL RAPDRP PART B”

1.6 **Tests**

1.6.1**A) Type tests**

All the cables offered should have been fully type tested as per relevant standards at any government laboratory. The bidder shall furnish complete sets of type test reports along with the offer.

For any change in design / type already type tested and the design / type offered against this specification, the purchaser reserves the right to demand reputation of type tests without any extra cost.

1.6.1 B) Type test certificates for following type test shall be invariably with the offer:

(a) Test of conductor

(i) Tensile test

(ii) Wrapping test

(iii) Resistance test

(b) Tests for armouring strips / wires

(c) Tests for thickness of insulation and sheath.

(d) Physical tests for insulation :

(i) Tensile strength and elongation at break

(ii) Ageing in air oven

(iii) Hot set

(iv) Shrinkage test

(v) Water absorption

(e) Physical tests on outer sheath

(i) Tensile strength and elongation at break

(ii) Ageing in air oven.

(iii) Shrinkage test

(iv) Hot deformation

(v) Bleeding and blooming test

(f) Partial discharge test

(g) Bending test

(h) Dielectric power factor test

(i) As a function of voltage

ii) As a function of temperature

(i) Insulation resistance test (volume resistivity)

(j) Heating cycle test

(k) Impulse withstand test

(l) High voltage test

(m) Flammability test

1.6.2 **Acceptance Test**

1.6.2.1 The selection of samples for acceptance test shall be 10% of each lot offered for inspection or part thereof or minimum one drum.

1.6.2.2 The following acceptance tests shall be carried out on the selected samples as per IS:7098 (Part-II)

1985

a) Annealing test (for copper)

b) Tensile test ( for aluminium)

c) Wrapping test (for aluminium)

d) Conductor resistance test

e) Test for thickness of insulation and sheath

f) Hot set test for insulation

g) Tensile strength and elongation at break test for insulation and sheath

h) Partial discharge test (for screened cables only)

i) High voltage test for 4 hours (as per cl. 19.7.1)

j) Insulation resistance (volume resistivity) test

1.6.2.3 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 15 days advance notice to the purchaser to enable him to depute the engineer for witnessing the tests. The test certificates for acceptance test witnessed by inspecting officer / engineer shall be submitted for approval before dispatch of material.

1.6.3 **TESTS**

1.6.3.1 The bidder shall have to submit, well in advance , the following test certificate for following routine tests for approval prior to inspection of the materials for the complete lot offered for inspection at a time.

a) Conductor resistance test

b) Partial discharge test

c) High voltage test for 5 minutes (as per cl. 19.7.2 of IS:7098 / (Part-II)/1985)

1.7 **Stage Inspection**

The inspection may be carried out by the purchaser at any stage of

manufacture. The successful bidder shall grant free access to the purchaser’s representative at reasonable time when the work is in progress. Inspection and acceptance of any cables under this specification by the purchaser, shall not relieve the supplier of his obligation of supplying cable in accordance with the specification and shall not prevent subsequent rejection, if the cable are found defective.

The supplier shall keep the purchaser informed in advance about the programme of manufacturing of cables so that arrangement can be made for inspection.

The purchaser reserves the right to insist for witnessing the acceptance /routine tests of the bought out items.

1.7.1 Manufacturing experience & process specification

(i) The manufacturer should have at least 6 (six) years of continuous manufacturing and supplying experience in 11 KV or higher grade with Dry cure Dry cooled system.

(ii) The cable should be manufactured with Dry cure Dry cooled insulated cores

using triple extrusion process through common triple cross head. Documentary evidence for the same to be submitted failing which offer will be technically disqualified.

1.8 **PACKING AND FORWARDING**

1.8.1 The cable shall be wound on 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 aluminium

pint. Similarly, the inside surface of drum shall have the protective layer of varnish / paint to protect it from white ants.

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

protection.

9.3 The end of the cable shall be sealed by means of non-hygroscopic sealing materials.

9.4 The following information may be stensilled on the drum with either water

proof ink or oil paint.

i. Reference of IS/IEC standard

ii. Manufacturer’s name or trademark

iii. Type of cable and voltage grade iv. No. of cores

v. Nominal cross-sectional area of conductor

vi. Cable code

vii. Length of cable on the drum

viii. No. of length on the drum (if more than one)

ix. Direction of rotation of drum (by means of an arrow)

x. Position of outer end of cable xi. Gross weight

xii. Country of manufacture xiii. Years of manufacture xiv. Reference of A/T & date xv. Property of “JBVNL”

xvi. Name of consignee and the destination

The drum may also be marked with ISI Certification Mark.

Over and above, name plate of aluminium of suitable size and thickness containing all the above information, shall be fixed on the drum in addition to the painting.

1.9.5 The firm shall be responsible for any damage to the cables during transit due to improper and inadequate packing, wherever necessary, proper arrangement for lifting, such as lifting hooks, shall be provided. Any cable found short inside the packing cases shall be supplied by the supplier, without any extra cost.

1.9.6 Each consignment shall be accompanied by a detailed packing list, containing

the following information:

a) Name of consignee

b) Detail of consignment c) Destination

d) Total weight of consignment

e) Handling and unpacking instruction

f) Bill of materials indicating contents of each package.

1.10 **Technical and guaranteed particulars**

The bidder shall furnish all guaranteed technical particulars, as called for, in appendix E of this specification particulars, which are subject to guarantee shall be, clearly, identified. Offer not containing these information, will not be considered for acceptance.