

# PART - II

## TECHNICAL SPECIFICATIONS: INDEX

### 2.0 Earthing

#### **GENERAL INFORMATION (TECHNICAL):**

##### **1.1. CODES, STANDARDS & REGULATIONS**

The design, manufacture, erection, cable laying and testing of the equipments and material to be supplied shall comply with latest revisions of relevant Indian Standards or equivalent IEC standards. In addition, the Indian Electricity Rules, Electricity Act 2003, Statutory requirements of Central Govt., GERC and State Government of Gujarat( applicable codes), shall also be complied with. Any complications arising out of it will be set right by the bidder without any implication to DGVCL. The bidder shall submit his offer as per information given in submission of tender.

##### **Drawings, Data and Documents**

The bidder shall furnish following documents/ information along with offer in spiral bound volumes. General description of equipment offered specifying the important features, make, technical parameters, materials of construction etc. To enable DGVCL to have proper understanding of the material offered and its operation.

The drawings and documents shall be furnished to DGVCL by the successful bidder for approval of DGVCL, within the period stipulated in the draft contract/mutually agreed terms at the time of placement of order, the bidder shall submit a list of all such drawings and documents he proposes to submit. The list will be approved by DGVCL and may be modified, if necessary. Each drawing /document in the list shall be identified with a serial number, description and scheduled date of

Submission. This should be submitted in a spiral bound volumes.

##### **1.2. FOR REFERENCE**

- OEM's Complete and comprehensive instruction manuals with drawings for operation and maintenance of the equipments supplied by the bidder.
  - Preventive maintenance schedule for each equipment.
  - Procedure for shutdown and HT equipment.
  - Safety procedures for safe operation of equipment and complete system.
  - Test procedure for site tests.

##### **1.3. AS- BUILT DRAWINGS**

On completion of installation, testing and commissioning, the bidder shall in Corporate visions/ modification if any, in the reproducible and submit 'as built' drawing for DGVCL's record in spiral bound volumes and soft copy. The drawings shall be in AutoCAD DXF format.

#### **1.4. TEST AND INSPECTION FOR INDIVIDUAL ITEM**

Routine test/ Acceptance tests shall be carried out on all equipment at manufacture's works/ ERDA as per appropriate IS/IEC. The bidder shall make reasonable facilities, at his cost for inspection and testing of the equipment/material by DGVCL's Officials. No equipment/item shall be dispatched to site without provisional certificates of acceptance issued by DGVCL. Inspection and test shall be carried out at the place of manufacture as well as on receipt of the equipment at site if required. Inspection and tests do not relieve the bidder of his contractual obligations regarding performance of the equipment at site/in actual use.

The bidder shall submit the brief summary of all type test certificates for similar equipment supplied by him elsewhere and the actual type test certificates as and when asked. In case type test certificates for similar equipment is not available, the same shall be conducted in the presence of DGVCL's Authorized representative if DGVCL so desires, without any financial implications to the DGVCL. The type test report shall not be older than 5 year from the date of tender opening (Technical bid opening). The supplier of the equipment shall ensure that the equipment available at his works for routine test/type test/acceptance test are duly calibrated and necessary certificate shall be made available to the inspecting officer of DGVCL.

As far as possible, the supplier of equipment shall give a minimum of 15 days notice of readiness of material and give the inspection call accordingly. If on arrival of inspecting officer at the works, the material is not found to be ready, the concerned supplier of equipment shall be liable for additional expenditure DGVCL may incur on account of retention or re-deputation of the inspecting officer.

The officer deputed for inspecting for particular lot of material according to intimation from you may also like to check Quality Control Plan and for that purpose he may demand the Test Reports of raw material being procured.

#### **1.5. FUNCTIONAL AND COMPOSITE TESTING**

Following test shall be conducted on equipment after completion of erection in the presence of Engineer-in-charge from point of view of completeness in the presence of DGVCL's Authorized Representative.

- Visual inspection of total system.
- Checking of continuity of power and LT/HT cables.
- Checking of nameplate data of complete system.
- Verification and measurement of earthing resistance.
- Checking of cable terminations and laying, dressing etc. in the equipment kiosk.
- Checking of safe accessibility of components.
- All the equipments and materials shall be passed through checks and test as per approved Field Quality Plan.
- The insulation resistance test shall be carried out
- HV installation above 11 KV- by 2500V Megger
- Power circuit of voltage up to 1KV- by 1000 V Megger

#### **1.6. BAR CHARTS**

The Bidder shall furnish along with the bid, the bar charts in Project and project schedules indicating starting and completion dates of each activity, such as preparation & approval of drawings, manufacturing/supply/ delivery, civil works, Cable laying erection, testing, pre commissioning and commissioning etc. so that quarter wise completion activities suffice the purpose for releasing the connections.

## **1.7 GENERAL**

Identification labels shall be provided on all equipments as per client's approval. All labels shall be engraved on plastic (white letters with black background) and all text shall be in English language.

Any exclusion /deviation from specification shall be clearly spelt out and listed at one place only and bidder shall substantiate the same with appropriate reasons. In the absence of clearly spelt out and mutually agreed deviation, it shall be considered that the bidder has undertaken to comply with the technical specification totally, in letter and spirit.

It will be responsibility of the successful bidder to obtain necessary approval of statutory authority as per rules of Govt. of Gujarat before energizing/ charging the equipment/system. However bidder shall be extended all assistance by the DGVCL in regard to application for the same. For installation work at site, the bidder shall be fully responsible for arranging the supply of required tools and tackles, welding sets, cable crimping tools, labours, scaffolding, ladders, etc.

The power connection will be provided by DGVCL at one point only at the prevailing tariff, from where the bidder has to arrange for temporary connection and further distribution of supply at his own cost. The installation of energy meter, cut out, switches etc. for construction power shall be as per prevailing norms of DGVCL. The test report and other requirement to release the connection shall be as per prevailing rules of DGVCL.

On completion of the installation but before energizing the system, all installation shall be physically checked and properly tested. These checks and tests shall be conducted by the bidder under the supervision of Engineer In-charge and bidder shall furnish the final status and test results shall be made good by the bidder free of cost within contract completion period.

All clamps, brackets, bolts, nuts, screws, markers, ferrules, lugs and glands and other hardware necessary for erection work, shall include in the scope of work and shall be arranged by the bidder.

## **1.8 APPROVED MAKES OF EQUIPMENTS /ITEMS OF SUPPLY.**

### **2..0 INSPECTION AND TESTING OF EQUIPMENT**

Manufacturing Progress reviews, inspection & testing of equipment covered under the technical specification shall be carried out by the DGVCL's Authorized Representative at the manufacturer's works/premises prior to dispatch, to ensure that their quality & workmanship are in conformity with the contract specifications and approved drawings.

### **3..0 RESPONSIBILITY FOR INSPECTION**

Any inspection by the DGVCL's Authorized Representative does not relieve the Bidder from his responsibility of quality assurance and quality control functions.

As such, any approval which the Inspecting Engineer of the DGVCL may have given in respect of equipment and other particulars and the work or workmanship involved in the contract (whether with or without test carried out) shall not bind the DGVCL to accept the plant & equipment, should it on further tests at site be found not comply, with the requirements of the contract. If required, audit wing of DGVCL Inspection Department shall also be entrusted with inspection of particular item/equipment received at site. The bidder is to meet the inspection & testing

requirements for the equipment coming under the statutory regulations e.g. weights & measures, safety, IE rules, etc. and submit calibration certificates and documents from appropriate authority to the DGVCL Inspecting Engineer for the same, on demand.

### **4..0 METHOD OF GIVING INSPECTION CALLS**

Inspection calls shall be given by the Bidder to Chief Engineer DGVCL Surat in accordance with mutually agreed program with 15 days' clear time for all equipments. Four sets of relevant test certificates and inspection report of the Bidder/ Sub-bidder after satisfactory completion of internal

inspection and test shall be submitted along with acceptance/routine test certificate of the tests witnessed by DGVCL Inspector.

The DGVCL reserves the right to visit at any stage of manufacture at plant and ask for additional inspection & tests if it is found necessary after completion of detailed design & engineering and approval of drawings. The DGVCL or his duly authorized representative shall on giving written instructions to the bidder, setting out any grounds of objection which he may have in respect of the work, be at liberty to reject all or any part of plant/equipment or workmanship which are not in conformity with the contract provisions.

#### **5..0 BIDDER'S RESPONSIBILITY**

The Bidder shall provide all reasonable facilities to the Inspecting Engineer of the DGVCL to the Bidder's or their sub-bidder's premises at any time during contract period, to facilitate him to carryout inspection & testing of equipment during manufacture of equipment.

The Bidder shall delegate a representative/coordinator to deal with DGVCL on all inspection matters. The Bidder shall comply with instructions of the DGVCL's Inspecting Engineer fully. The Bidder shall ensure that the equipment and materials once rejected by the Inspecting Engineer are not reused in the manufacturing of the equipment and materials. Where parts rejected by the Inspecting Engineer have been rectified as per agreed procedures laid down in advance, such parts shall be segregated for separate inspection and approval, before being used in the work.

#### **6..0 INSPECTION WAIVER**

For certain standard bought-out items and the products of reputed firms where the DGVCL has earlier experience on the quality of their products, the DGVCL may consider allowing of inspection waiver for such items. The Chief Engineer DGVCL, Surat shall issue approval of inspection waiver certificate after scrutiny of bidder's internal inspection report, test certificates and other documents. However, it is not binding upon DGVCL to give waiver on bidder's request. DGVCL may weigh the important issues like quantity of material, cost of material, importance of material, distance of travel & time of travel required to inspect before deciding the waiver of the inspection.

#### **7.0 AUDIT INSPECTION**

From the lots inspected by the DGVCL, the Inspector of DGVCL may pick up samples from the lots supplied at stores of contractor at random for quality check only.

The samples picked up will be tested for acceptance test / type test or as decided by DGVCL at Government/ NABL approved laboratory or ERDA laboratory at DGVCL RSO, in presence of representatives of contractor and DGVCL as per relevant ISS/BIS/ DGVCL specifications. The test results will be binding on the suppliers and DGVCL, in general will not allow re-sampling. If the material fails in any of the acceptance tests carried out, the full lot of materials will be considered as rejected, and if replacement is not possible due to consumption of the materials then in that case for whole of the rejected lot, DGVCL will deduct maximum up to 30% (Thirty) of the contractual order cost of that item. If the same are not utilized / consumed, then DGVCL may ask for replacement at sole discretion of DGVCL or may accept with maximum deduction up to 30% (Thirty) of the contractual order cost of that item, and all these will be binding on the contractor.

In case if the materials does not confirm to specifications or fails at Government approved laboratory or other laboratory decided by DGVCL for testing and if subsequent testing are to be carried out (which will solely at DGVCL discretion), then all Testing fees, expenses of the inspector and other expenses incurred by DGVCL will be to contractor's account. The decision in this regard for acceptance as above of DGVCL shall be final and this will be binding on the contractor.

#### **8.0 OTHER CONDITIONS**

Any clarification / amendment necessary, in any or more clauses incorporated in the present A/T, you will have to make a detailed reference to the DGVCL latest within ten days from the receipt of A/T. If you fail to do so, no request for any clarification / amendment shall be considered thereafter. Please also note that all the points which need clarification / amendment should be brought out at once. No piecemeal clarification/amendment will be entertained.

## **9.0 PRE INSPECTION AND VERIFICATION OF SITE BY BIDDERS**

Bidder, if desire, may visit and inspect proposed work site of **Concerned S/Dn** before bidding. Prospecting bidder may contact our Deputy Engineer (O&M) **Concerned S/Dn.** with prior appointment and confirmation.

### **SPECIAL INSTRUCTIONS TO BIDDER**

Please read following instructions carefully before submitting your bid.

1. All the drawings, i.e. elevation, side view, plan, cross sectional view etc., in AutoCAD format and manuals in PDF format, for all items including installation (civil work) shall be submitted. Also the hard copies as per specification shall be submitted.
2. The bidder shall submit Quality Assurance Plan for manufacturing process and Field Quality Plan with the technical bid.
3. The bidder shall have to submit all the required type test reports for the offered item. However, in the event of partial submission or reports older than specified limit, bidder must submit his confirmation for those type test report/s to be submitted in the event of an order, without affecting delivery schedule, before commencement of supply, free of cost. In absence of this confirmation, the evaluation shall be carried out accordingly as non submission of type test reports.
4. The bidder must fill up all the point of GTP for offered item/s. Instead of indicating “Refer drawing, or as per IS/IEC”, the exact value/s must be filled in.
5. All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.
6. The bidder is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works, to the person/s identified by DGVCL, in the event of an order, free of cost. The cost of logistics will be bear by DGVCL.
7. Please note that the evaluation will be carried out on the strength of content of bid only. No further correspondence will be made.
8. The bidder shall bring out all the technical deviation/s only at the specified annexure.
9. The bidder should indicate manufacturing capacity by submitting latest updated certificate of a Chartered Engineer (CE).

### **QUALIFYING REQUIREMENT DATA**

(For Supply, if any)

Bidder to satisfy all the following requirements.

- 1) The principal manufacturer/s of bidder shall be Original Equipment Manufacturer (OEM). The offered equipment have to be designed, manufactured and tested as per relevant IS/IEC with latest amendments.
- 2) The minimum requirement of manufacturing capacity of OEM for offered type, size and rating of equipment shall be 7 times tender / bid quantity. The bidder should indicate manufacturing capacity by submitting latest updated certificate of a Chartered Engineer (CE).
- 3) Equipment proposed shall be of similar or higher rating and in service for a minimum period of Five (5) years and satisfactory performance certificate in respect of this is to be available and submitted.
- 4) The bidder should clearly indicate the quantity and Single Value Contract executed during last FIVE (5) years, for the offered equipment. Bidder should have executed one single contract during last five years for the quantity equivalent to tender / bid.

The details are to be submitted in following format,

Sr. No	ITEMS SUPPLIED TO	ORDER REFERENCE No. & DATE	ITEMS	QUANTITY	ORDER FULLY EXECUTED. YES/NO	STATUS, IF ORDER UNDER EXECUTION	REMARK

- 5) Equipment offered shall have Type Test Certificates from Govt approved/accredited laboratory (accredited based on ISO/IEC Guide 25 / 17025 or EN 45001 by the National accrediting body of the country where laboratory is located), as per IEC / IS / technical specification. All the required type tests Should not be older than 5 (five) years from the date of opening of technical bid.

TECHNICAL SPECIFICATION FOR  
22211KV XLPE POWER CABLE  
(CROSS LINKED POLYTHELENE DRY GAS CURED)

SECTION – I

1.1 SCOPE:

1.1.1 **THE SPECIFIED CABLES WILL BE SUPPLIED BY DGVCL.** This Section of the Specification covers design, manufacturing, testing, packing, supply & delivery of 22kV XLPE Dry gas cured insulated power cable for effectively earthed specification system.

1.2 STANDARDS:

1.2.1 Unless otherwise specified, the cable shall conform in all respect to IS: 7098 (Part-II)-1985 with latest amendment thereof.

1.3 CLIMATIC CONDITIONS:

The climatic conditions under which the cables shall operate satisfactorily are as follows:

1.3.1	Maximum ambient temperature of air	50° C
1.3.2	Minimum ambient temperature of air in shade	4° C
1.3.3	Maximum daily average ambient temperature	40° C
1.3.4	Maximum yearly average ambient temperature	30° C
1.3.5	Maximum relative humidity	95 %
1.3.6	Average number of thunder storm days per annum	15
1.3.7	Average annual rainfall	150 cm
1.3.8	Maximum wind pressure	150 kg/cm <sup>2</sup>
1.3.9	Altitudes not exceeding above MSL	1000 mtrs
1.3.10	Maximum soil temperature at cable depth	30° C
1.3.11	Maximum soil thermal resistivity	150°C - cm/watt

#### 1.4 PRINCIPAL PARAMETERS:

22 KV (E) Grade XLPE, 3-Core, power cable shall be of high conductivity, stranded compacted, HD aluminum circular shaped conductor with XLPE (cross linked Polyethylene) Dry/Gas cured insulation provided with shielding of extruded semi-conducting materials 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) for 22KV (E), 3-phase, 50 Hz. Earthed systems.

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.

Cable shall be suitable for laying in covered trenches and / or buried under-ground in outdoor.

1.

Bending radius of the cables specified by the manufacturer.

Standard gauge of pipe filling shall be used for sizing the pipe.

After installation and testing of cables, conduit ends shall be plugged with a suitable weatherproof plastic compound/ putty for sealing purpose as directed. No extra payments shall be allowed for the laying.

1.6.3.7 Prior approvals for cutting holes for laying cable in existing structures and foundations shall be obtained from the Engineer in charge.

1.6.3.8 At road/railway/canal crossing where cable enters pipe sleeves adequate bed of sand shall be given so that the cable do not slack and get damaged by pipe ends.

1.6.3.9 Drum number shall be recorded for each cable in cable schedule. Cables shall be routed so that they are not subjected to heat from adjacent hot piping and vessels.

1.6.3.10 Appropriate support shall be provided to prevent sagging of cable as per cable trench drawing.

1.6.3.11 supporting angles for cables shall be suitably clamped/tied by means of nylon cords.

1.6.3.12 The identification marker shall be placed on each cable at every 2 Mtrs intervals and at every cable joint locations, of adequate size fabricated from 3 mm thick, 25 mm wide aluminum strip. The marker shall be tied by nylon string with cable. The marker shall be embossed by letter as stated below as



applicable.

1.7 DGVCL- 11 KV – Name of feeder  
Termination: (Will Be Supplied By Bidder)

The 11 kV cable termination/joints shall be done by skilled and experienced jointers duly approved by the Engineer in charge. Termination including supply of jointing kit is included in the contractor's scope unless specified otherwise.

Termination kits shall be suitable for termination of the cables to indoor switchgear or to weather proof cable end box of an outdoor mounted transformer an outdoor type for termination at poles. The terminating kits shall preferably be as of the following types.

PUSH ON/Heat shrink type of 3m (M seal) or Raychem make using factory molded silicone rubber insulators. For outdoor installations weather shields, shielding ends and any other accessories required should form part of the kit.

Straight through jointing kits shall be suitable for underground installation with uncontrolled backfill and possibility of flooding by water. The jointing kit shall be preferably of PUSH ON/Heat shrink type of 3m (M seal) or Raychem make.

Fixing of end termination & straight through joints.

1. END TERMINATION & STRAIGHT THROUGH JOINTING KITS WILL BE IN BIDDERS SCOPE.

- (i) Contractor should clarify the make of cable end termination and straight through joint. The heat & shrink type end termination & straight through joints shall be utilized for the job.
  - (ii) Dual wall molded type should be available in straight through joint.
  - (iii) After completing work of cable laying end termination straight through joints, following test shall be carried out jointly by engineer in charge of DGVCL and contractor.
  - (iv) Insulation resistance test before & after with 5 KV insulation tester. (A) Hypo test
  - (v) Contractor has to furnish Guaranteed Technical Parameters (GTP) type test certificate of various tests conducted at any Govt./ NABL approved laboratory for the joints they intend to supply for this job. The test certificate should not be prior to 5 years from the date of tender. The contractor shall have to submit the same with technical bid and failure in which technical bid will be disqualified & the price bid of that party will not be opened.
  - (vi) One competent skilled supervisor shall have to co-ordinate the site authority and he has to do all communication with engineer in charge of DGVCL.
  - (vii) It is essential to have suppliers certificate of training for cable jointing of cable jointer.
  - (viii) Jointer has to ensure safety while making joints so that other nearby cables will not be damaged.
  - (ix) The material of jointing kit will be inspected at manufacturer's works by the inspector of DGVCL. The bidder has to give inspection call 15 days in advance to S.E. (O&M) for the works to be carried out in their jurisdiction.
- 2 The Bidder shall have to supply cable end joint / straight joint kit as per IS 13573-1992 with latest amendment No. 2, 1998 IEEE 48-1990 and shall be Class -1, ESI-09-13 performance specification for high voltage cable accessories.
- 3 The work of laying of cable along the road / road crossing to be carried out by Horizontal Drilling Machine / Auger boring machine enclosed in HDPE Pipe only.

APPLICABLE STANDARDS:

IS 13573-1992 with latest amendment - Latest amendment No. 2, 1998. IEEE 48-1990. The termination shall be Class 1. ESI-09-13 performance specification for high voltage cable accessories. The cable accessories being supplied in the form of kit which has different components to be assembled at site.

MATERIALS:

The term 11 KV / 22 kV XLPE Cable refers to extruded or Molded Polymeric. Polymeric material which are cross linked by gamma radiation to develop elastic memory and supplied in an expanded or otherwise deformed size and shape. Bidders should submit

the proof that the tubes are cross linked by gamma radiations. However chemically cross linked, crotch seal and lug seals are permitted.

For straight joints, the insulation over the ferrules should be reinsulated by dual wall tubing. This should have an inner insulating layer vulcanized to an outer semi-conducting layer. This is required to ensure reconnection of cable insulation screen of the core from one end of the joint to the other. The dual wall tubing ensures that there is no entrapment of air pockets between the insulating and semi-conducting layers.

#### FOR JOINTS:

11 kV XLPE underground flexible polymeric tubing, preferably black colored pre coated with adhesive shall be provided for sealing the exposed metallic sheaths and sheath/earth connections.

#### PROVISION OF ADDITIONAL CREEPAGE INDOOR / OUTDOOR TERMINATIONS:

Single piece, 11 KV XLPE underground cable, weather sheds having non-tracking, erosion and weather resistant properties shall be supplied with the kits for application over non-tracking tubing. The quantity of sheds to be supplied shall depend on voltage grade and indoor/outdoor application and shall be indicated along with offer. Each shed shall give an additional creepage length of at least 100mm.

#### INSULATION AND SCREEN REINSTATEMENT FOR JOINTS:

The reinstatement of insulation shall be by means of heat shrinkable, flexible, polymeric tubing made from a discharge resistant polymer, preferably colored red. The tubing after complete recovery shall have a minimum wall thickness to ensure provisions of adequate insulation in step.

#### EARTH & SCREEN CONTINUITY FOR TERMINATION & JOINTS:

Screen continuity by using tinned copper mesh and earth continuity by using tinned copper braids of appropriate size shall be provided for transfer of screen/earth in straight through joints. In termination, tinned copper braids of appropriate size or equivalent current carrying capacity of cable conductor along with copper lugs of appropriate size shall be provided for continuity of screen to armour to the earth.

#### LUGS & FERRULES:

The requisite number and type of aluminum/ copper lugs/ferrules shall be provided for termination/joints. The Lugs and ferrules for XLPE cables shall be crimping type suitable for compacted circular conductor having two nos. of holes.

#### TECHNICAL SPECIFICATION

D.C High voltage 18 kV test shall be conducted after installation on the following and test results to be recorded as per DGVCL format in presence of Engineer in charge.

a) All cables above 1100 volts.

Type tests are to be carried out at manufacturer's works for quality approval

of termination/jointing kits. Following tests confirming to the latest IS 13573 and or IEC 502.2, 466 and VDE 0278 and C 81 specifications. The report of last three years type tests result shall be submitted for approval of the Kits. Terminations shall be kept open so that switchgears, transformers etc are not subjected to test voltage.

Tests for termination/jointing kits:

Indoor & Joint IS 13573
1) Conductor Resistance Test
2) Impact Test
3) AC High Voltage Test ( Dry )
4) Partial Discharge Test
5) Impulse with stand test
6) AC Voltage life test with cyclic current loading
7) Partial Discharge Test
8) AC Voltage life test with cyclic current loading
9) Thermal Short circuit test
10) AC Voltage life test with cyclic current loading
11) Conductor Resistance Test
12) Impulse with stand test
13) D.C.High Voltage test

Out Door IS 13573
1) Conductor Resistance Test
2) AC High Voltage Test ( Dry )
3) Wet Power frequency test
4) Partial Discharge Test
5) Impulse with stand test

6) AC Voltage life test with cyclic current loading
7) Partial Discharge Test
8) AC Voltage life test with cyclic current loading
9) Thermal Short circuit test
10) AC Voltage life test with cyclic current loading
11) Water Tightness Test for Out door
12) Conductor Resistance Test
13) Impulse with stand test
14) D.C.High Voltage test

Indoor as per VDE 0278
1) Partial Discharge Test
2) Partial Discharge Test
3) Conductor Resistance Test
4) Partial Discharge Test
5) AC High Voltage Test ( Dry )
6) Tan Delta as a Function of Voltage & Capacitance.
7) Tan Delta as a Function of temperature
8) Impulse with stand test
9) AC Voltage life test with cyclic current loading
10) Partial Discharge Test
11) Tan Delta as a Function of Voltage & Capacitance.
12) AC Voltage life test with cyclic current loading
13) Thermal Short circuit test

14) AC Voltage life test with cyclic current loading
15) Partial Discharge Test
16) Conductor Resistance Test
17) Impulse with stand test
18) D.C.High Voltage test

Outdoor Termination VDE 0278
1) Partial Discharge Test
2) Partial Discharge Test
3) Conductor Resistance Test
4) Impact Test
5) Wet power frequency AC High Voltage Test
6) Partial Discharge Test
7) Tan Delta as a Function of Voltage & Capacitance.
8) Tan Delta as a Function of temperature
9) Impulse with stand test
10) AC Voltage life test with cyclic current loading
11) Partial Discharge Test
12) Tan Delta as a Function of Voltage & Capacitance.
13) AC Voltage life test with cyclic current loading
14) Short circuit test
15) AC Voltage life test with cyclic current loading
16) Conductor Resistance Test
17) Impulse with stand test

18) D.C.High Voltage test
19) Dynamic short circuit
20) Impulse with stand test
21) D.C.High Voltage test

As per C - 81

1) Impact Test
2) Insulation Resistance Test
3) A.C High Voltage Test
4) Insulation Resistance Test
5) Heat shock Test
Test after Heat shock Test
6) Insulation Resistance Test
7) A.C High Voltage Test
8) Insulation Resistance Test
9) Electric Heat cycle Test
Evaluation after Electrical heat cycle Test
10) Insulation Resistance Test
11) A.C High Voltage Test
12) Insulation Resistance Test
After Sheath Damage Test
13) Electric Heat cycle Test
Evaluation after Electrical heat cycle Test & sheath damage
14) Insulation Resistance Test
15) A.C High Voltage Test
16) Insulation Resistance Test
17) Examination Of Joint

The bidder shall furnish all Guaranteed Technical Particulars, as called for, in Appendix - I of this Specification. Particulars, which are subject to guarantee, shall be clearly identified. Offer not containing these informations will not be considered for acceptance.

1.10 PERFORMANCE CERTIFICATE:

Bidders shall also submit performance reports for the specified size of cables supplied to other State Electricity Boards / reputed firms, with the clear indication of the period since when the cables performed satisfactory service.

1.11 LEGIBLE SUBMISSION:

Only required relevant, legible documents shall be submitted to avoid delay due to back reference.



## 2.0 Earthing

### 1.0 INSTALLATION SPECIFICATION FOR EARTHING:

#### GENERAL:

All the non-current metal parts of electrical installation (Cables terminals) shall be earthed properly. All metal conduits, trucking, cable sheaths, switchgear, distribution fuse boards, lighting fittings & fixtures and all other parts made of metal shall be bonded together and connected by means of specified earthing system. All earthing will be conformed to Indian Standard Specifications IS: 3043 – 1987. The bidder shall measure the resistivity of various places in the proposed sub stations and design suitable earthing system and get it approved from DGVCL.

#### EARTHING CONDUCTORS:

All earthing conductors shall be of high conductivity G.I./Aluminum/copper and shall be protected against mechanical injury or corrosion.

#### CONNECTION OF EARTHING CONDUCTORS:

- (i) Main earthing conductors shall be taken from the earth connections at the main switchboards to an earth electrode with which the connection is to be made. Sub-main earthing conductors shall run from the main switchboard to the sub-distribution boards. Final distribution boards earthing conductors shall run from sub-distribution boards.
- (ii) Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor or its distribution boards or to an earth leakage circuit breaker. Metal conduits, cable sheathing and armoring shall be earthed at the ends adjacent to switchboards at which they originate or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, lighting fitting etc. which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of earthing conductor for earthing purposes, even though the run of metallic conduit is earthed.
- (iii) All metal clad switches and other equipment carrying single phase current shall be connected to earth by a single connection. All metal clad switches, carrying medium voltages and high voltage shall be connected with earth by two separate and distinct connections. The earthing conductors inside the building, wherever exposed, shall be

properly protected from mechanical injury by running the same in GI pipe of adequate size.

- (iv) Earthing conductors, outside the building, shall be laid as per IS motioned above below the finished ground level.
- (v) In case of copper earthing strips, the cover lapping at joints (wherever required), shall be of minimum 75 mm. Sweated lugs of adequate capacity and size shall be used for all termination of wires above 6 sq. mm size and bare copper wire above 2.5 mm dia. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance and properly tinned.
- (vi) Neutral conductor, sprinkler pipes or pipes conveying gas, water or flammable liquid, structural steel work, metallic enclosures for cables and conductors, metallic conduits and lightning protection stem conductors shall not be used as a means of earthing an installation or even as a link in an earthing system. The electrical resistance of metallic enclosures for cables and conductors measured between earth connections at the main switchboard shall be low enough to permit the passage of current necessary to operate fuse or circuit breakers and shall not exceed one ohm.

#### PROTECTION FROM CORROSION:

Connections between copper and galvanized equipment shall be made on vertical face and protected with paint and grease. Galvanized fixing clamps shall be used for fixing earth conductors. When there is evidence that the soil is aggressive to copper, buried earthing conductors shall be protected by suitable serving and sheathing.

#### PLATE ELECTRODE EARTHING:

Earthing electrode shall consist of plate, not less than 600 mm x 600 mm x 12 mm thick. The plate electrode shall be buried as far as practicable below permanent moisture level but, in any case, not less than 3 meters below ground level. Wherever possible, earth electrodes shall be located as near the water tap, water drain or near down take pipe. Earth electrodes shall not be installed in proximity to a metal fence. It shall be kept clear of the buildings foundations and in no case it shall be nearer than 2 meters from the outer face of the wall. The earth plate shall be set vertically and surrounded with 150 mm thick layer of charcoal dust and salt mixture. 20 mm GI pipe shall run from the top edge of the plate to the ground level. The top of the pipe shall be provided with a G.I. threaded cap for watering the earth through a pipe. The G.I. Cap over the GI pipe shall be housed in a masonry chamber, approximately 300 mm x 300 mm x 300 mm deep. The masonry chamber shall be provided with a cast iron inspection cover resting over a GI frame, embedded in masonry.

#### PIPE ELECTRODE EARTHING:

Earthing electrode shall consist of a CI pipe (class B of approved make), not less than 40 mm dia. and 3 meters long. CL pipe electrode shall be cut tapered at the bottom and provided

with holes of 12 mm dia. drilled at 75 mm interval up to 2.5 meters length from bottom. The electrode shall be buried vertically in the ground as far as practicable below permanent moisture level, but in any case not less than 3 mtr. Below ground level. The electrode shall be in one piece and no joints shall be allowed in the electrode. Wherever possible, earth electrodes shall be located close to water tap, water drain or a down take pipe. Earth electrode shall not be located in proximity to a metal fence. It shall be kept clear of the building foundations and in no case; it shall be nearer than 2 meters from the outer face of the wall.

The pipe earth electrode shall be kept vertically and surrounded with 150mm thick layer of charcoal dust and salt mixture up to a height of 2.5 meters from the bottom. At the top of the electrode a G.I. threaded cap shall be provided for watering the earth. The main earth conductors shall be connected to the electrode just below the G.I. cap, with proper terminal lugs and check nuts. The G.I. cap over the CL pipe and earth connection shall be housed in a masonry chamber, approximately 300 mm length x 300 mm wide and 300 mm deep. The masonry chamber shall be provided with a cast iron inspection cover resting over a C.I. frame, embedded in masonry.

#### EARTH RESISTANCE:

The earth resistivity result of the soil where the earthing stations are located shall be submitted to the engineer-in-charge before the earthing work starts. If the earth resistance is too high and multiple electrode earthing does not give adequate low resistance to earth, the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding sodium chloride, calcium chloride, sodium carbonate, copper sulphate, salt and soft coke or charcoal in suitable proportions as required.

#### RESISTANCE TO EARTH:

The resistance of each earth system shall not exceed 1 ohm in the case of M.V. system and 0.5 ohm in the case of H.V. system.