

1. GENERAL

1.1 Scope of works

A. Supply

The materials have been classified as under.

Prior to the commencement of the supply / works all relevant drawings, designs must be got approved by SOUTHCO Utility, Rayagada.

C. The scope of the proposal for the balance materials to be supplied by the bidder to complete the job shall be on the basis of a single Bidder's responsibility, completely covering supply and erection of all the equipment specified under the accompanying Technical Specifications including other services. It will include the following

- (i) Detailed investigation of substation and preparation of BOQ to be done by the bidder.
- (ii) Complete manufacture, including **shops testing** & supply of materials from the approved vendor (materials which are to be supplied by the bidder)
- (iii) Providing Engineering drawings related to foundation details, structural details of both line & Sub-station works, equipments data, operational manual, preparation of Cable Schedule (in shape of a booklet) etc for the Owner's approval;
- (iv) Packing and transportation from the manufacturer's works to the site.
- (v) Receipt, storage, preservation and conservation of equipment at the site.
- (vi) Pre-assembly, if any, erection testing and commissioning of all the equipments;
- (vii) Reliability tests and performance and guarantee tests on completion of commissioning
- (viii) Loading, unloading and transportation as required,
- (ix) Erection of installations of specified voltages,
- (x) Testing, Commissioning of installations of of the Sub-Station inclusive of all related Civil works.
- (xi) Storing before erection
- (xii) Getting the Sub-Stations/lines inspected and certified by Electrical Inspection after completion of works.

Transportation of all above required materials from **Purchaser's** nearest store to site and all other required materials (to be supplied by bidder) from supplier's premises to works site, construction of new electrical/ civil structures, dismantling of existing electrical structures and return of these dismantled items at the purchaser's stores, safe custody of the items and return of unused purchaser supplied materials to the purchaser's stores.

1.2 GENERAL CONDITIONS OF CONTRACT

- **Responsibility of the Contractor:**

The Contractor shall be responsible for the complete design and engineering, overall co-ordination with internal and external agencies, project management, training of Employer's manpower, loading, unloading, storage at site, inventory management including OSM materials at site during construction, dismantling, re-erection of installations as per Engineer. in charge (Divisional Engineer.)'s advice, handling, moving to final destination, obtaining statutory clearances for successful erection, testing and commissioning of the substation.

- **Specific exclusions:**

The following items of works are specifically excluded from the Contractors scope of works unless otherwise specifically brought out.

- a) Substation site selection
- b) Land acquisition

- **Limit of contract:**

The scope of works shall also include all works incidentals for successful operation and commissioning and handing over of works whether specifically mentioned or not. In general, works are to be carried out by the Contractor in accordance with the stipulations in Conditions of Contract.

- **Quantity variation:**

The Employer reserves the right to order and delete such works which may be necessary for him within the quantity variation option laid down in the conditions of the contract. This shall include but not limited to the manufacture, supply, testing, and delivery to site, erection and commissioning as may be required in accordance with the Conditions of Contract at the prices stated in the Schedules. The Employer shall also be at liberty to delete Any Items from the Contractor's scope of supply at any time before commencement of supply of works under the detailed scope of works.

Location and site description

The details of the sub-substation locations, their approach, geography and topography etc are to be collected from the concern division to the extent possible. The Bidder shall make necessary visit to the substation sites and fully appraise himself before bidding. Deviations on account of inadequate data for substation works shall not be acceptable and the Bid shall not be considered for evaluation in such cases.

Completeness and accuracy of information

The Contractor shall note that the information provided above and in the relevant schedules may not be complete or fully accurate at the time of bidding. For his own interest the Contractor is advised to make site visits and fully satisfy himself regarding site conditions in all respects, and shall be fully responsible for the complete design and engineering of the substations.

1.3 GUARANTEES TECHNICAL PARTICULARS

The Contract Works shall comply with the guaranteed technical particulars specified or quoted in the bid. All plant and apparatus supplied under this Contract shall be to the approval of the Engg In-charge .All plant and equipment supplied under this contract must have been type tested and have been on satisfactory service at identical ratings for at least preceding three years. The bidder shall furnish in his bid the necessary supporting data in this regard in specified formats for consideration during bid evaluation. If during evaluation non compliance is identified, the successful Contractor shall be bound to supply the equipment from manufacturers complying with the stipulated requirements under SOUTHCO Utility's approval .The Contractor shall be responsible for any discrepancies, errors or omissions in the particulars and guarantees. The Bidder for his own interest, shall establish the technical responsiveness of his bid, shall provide all data in appropriate technical data sheets, general/ technical information, literature, and leaflets etc. along with the bid.

1.4 COMPLIANCE WITH SPECIFICATION

All apparatus should comply with this Specification. Any departures from the requirements of this Specification shall be stated with reasons in the relevant Bid Proposal Schedules Bid will be considered for evaluation if reasons shown are apparently justified. Unless brought out clearly in the technical schedules, it will be presumed that the equipment is deemed to comply with the technical specification. In the event of there being any inconsistency between the provisions of the conditions of contract and the provisions of this Specification, in respect of commercial requirements, the provisions of the conditions of contract shall take precedence for commercial matters and the provisions of this Specification shall take precedence in respect of technical matters. In case of inconsistency between technical specification (TS) quantities of various items as specified in the bid proposal sheet shall be considered for quoting. However the works shall be executed as specified in the technical specification. Only brief description is given in the BPS & the works shall be executed in line with the requirement given in the TS.

1.5 TEST AND MAINTENANCE EQUIPMENT

The Contractor shall supply the type, quantity of test and maintenance equipment specified in the Schedules as part of the contract works.

1.6 SPARES

The Contractor shall provide the mandatory spares detailed in the Schedules and shall, where considered necessary, provide a list of recommended spare parts (optional spares) together with their individual prices. The Employer may order all or any of the spare parts listed at the time of contract award and the spare parts so required by the Employer, shall be supplied as part of the Works under this specification. Additional spares may be ordered at any time during the contract at the rates stated in the Price Schedule.

1.7 Hardware maintenance

Courses for hardware maintenance shall identify techniques for preventative physical maintenance and for identification, isolation and replacement of faulty components. This course shall take place before equipment is delivered to site. An essential part of the hardware maintenance course shall include highlighting the philosophy of computer based preventive maintenance and identification of the various diagnostic/interrogation facilities available. The Contractor shall supply adequate documented instructions to enable a detailed interrogation and analysis process to be carried out using the diagnostic software facilities. All items of hardware to be supplied shall be covered by the course.

1.8 Installation and commissioning techniques

The Employer's staff will be present during the installation and commissioning period and it is essential that they are to be fully involved in any on-site corrections or modifications to hardware and software equipment. It is envisaged that it will be necessary for the Contractor to run installation and commissioning techniques courses each of approximately one week in duration at site for the training of the Employer's staff.

1.9 ERECTION AT SITE AND ACCOMMODATION

The Contractor shall provide, at his own cost and expense, all labors, plant and material necessary for unloading and erection at the Site and shall be entirely responsible for its efficient and correct operation. The Contractor shall be responsible for arranging and providing all living accommodation services and amenities required by his employees.

Use of electrical energy

The Contractor shall arrange at his own cost and expense, any site supplies of electrical energy which he may require for supplying power for heavy erection plant, welding plant or other tools, lighting and testing purposes. All wiring for such tackle and for

lighting from the point of supply shall be provided by the Contractor and all such installations shall comply with all appropriate statutory regulations.

1.10 SUPERVISION AND CHECKING OF WORKS ON SITE

All works on site included in the contractor's scope of works shall be supervised by sufficient number of qualified representatives of the Contractor. Before putting any plant or apparatus into operation the Contractor shall satisfy himself as to the correctness of all connections between the plant and apparatus supplied under this and other contracts. The Contractor shall advise the Engg Incharge in writing, giving the period of notice as specified in the General Conditions of Contract, when the plant or apparatus is ready for inspection or energisation.

1.11 RESPONSIBILITY OF THE CONTRACTOR

Until each Section of the Contract Works has been taken over or deemed to have been taken over under the Conditions of Contract, the Contractor shall be entirely responsible for the Contract Works, whether under construction, during tests, or in use for the Employer's service.

1.12 COMPLIANCE WITH REGULATIONS

All apparatus and material supplied, and all works carried out shall comply in all respects with such of the requirements of all Regulations and Acts in force in the country and state in particular of the Employer as are applicable to the Contract Works and with any other applicable regulations to which the Employer is subjected to oblige.

1.13 MAINTENANCE AND CLEARING OF SITE

The placing of materials and plant near the erection site prior to their being erected and installed shall be done in a neat, tidy and safe manner. The Contractor shall at his own expense keep the site area allocated to him and also the erection area of the Contract Works reasonably clean and shall remove all waste material as it accumulates and as directed by the Engg In-charge from time to time.

1.14 INSURANCE

1.14.1 General

In addition to the conditions covered under the Clause titled insurance in the Special Conditions of Contract, the following provisions will also apply to the portion of works to be done beyond the Suppliers own or his sub-Contractors manufacturing Works.

1.14.2 Worksmen's Compensation Insurance

This insurance shall protect the Contractor against all claims applicable under the worksmen's Compensation Act, 1948 (Government of India). This policy shall also cover the Contractor against the claims for injury, disability, disease or death of his or

his sub-contractor's employees, which for any reason are not covered under the Workman's Compensation Act, 1948. The liabilities shall not be less than;

a Workmen's Compensation- As per statutory provisions

b. Employee's liability-As per statutory provisions According to the Govt. rules.

c. Comprehensive automobile insurance

This insurance shall be in a such a form to protect the Contractor against all claims for injuries, disability, disease and death to members of public including the Employer's men and damage to the property of others arising from the use of motor vehicles during on or off the Site operations, irrespective of the ownership of such vehicles and as per latest prevailing Govt. rules.

d. Comprehensive General Liability Insurance

This insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of members or public or damage to property of others, due to any act or omission on the part of the Contractor, its agents, its employees, its representatives and sub-contractors or from riots, strikes and civil commotion. The hazards to be covered will pertain to all works and areas where the Contractor, its sub-contractors, agents and employees have to perform works pursuant to the Contracts.

1.15 WORKS AND SAFETY REGULATIONS

The Contractor shall ensure safety of all the workmen, plant and equipment belonging to him or to others, working at the Site. The Contractor shall also provide for all safety notices and safety equipment required by the relevant legislation and deemed necessary by the Engg In-charge.

1.16 SUBMITTALS

1.16.1 Submittals required with the bid

The following shall be required in duplicate :

- completed technical data schedule;
- descriptive literature giving full technical details of equipment offered;
- type test certificates, where available, and sample routine test reports;
- detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating;
- details of manufacturer's quality assurance standards and programme and ISO 9000 series or equivalent national certification;
- deviations from this specification. Only deviations approved in writing before award of contract shall be accepted;

1.16.2 Submittals required after contract award

1.16.2.1 Five copies of the programme for production and testing.

1.16.2.2 Drawings

Within 30 days of contract commencement the Contractor shall submit, for approval by the SOUTHCO, a schedule of the drawings to be produced detailing which are to be submitted for "Approval" and which are to be submitted "For Information Only". The schedule shall also provide a programme of drawing submission, for approval by the Project Manager that ensures that all drawings and calculations are submitted within the period specified above. All detail drawings submitted for approval shall be to scale not less than 1:20. Lettering sizes and thickness of lettering and lines shall be selected so that if reduced by two stages to one quarter of their size, the alphanumeric characters and lines are still perfectly legible so as to enable them to be microfilmed. For presentation of design drawings and circuit documents IEC Publication 617 or equivalent standards for graphical symbols are to be followed.

1.16.2.3 APPROVAL PROCEDURE

The Contractor shall submit all drawings, documents and type test reports for approval in sufficient time to permit modifications to be made if such are deemed necessary and re-submit them for approval without delaying the initial deliveries or completion of the contract works

1.17 MAINTENANCE AND CLEARING OF SITE

The placing of materials near the erection site prior to their being erected and installed shall be done in a neat, tidy and safe manner. The Contractor shall at his own expense keep the site area and erection area of the Contract Works reasonably clean and shall remove all waste material as it accumulates and as directed by the Engineer In-charge from time to time.

1.18 WORKS AND SAFETY REGULATIONS

The Contractor shall ensure safety of all the workmen, material, equipment belonging to him or to others, working at the Site. The Contractor shall also provide for all safety notices and safety equipment required by the relevant legislation and deemed necessary by the Engineers-In-charge.

1 GENERAL

The following provisions shall supplement all the detailed technical specifications and requirements brought out in accompanying Technical Specifications. The Contractor's proposal shall be based upon the use of equipment and materials complying fully with the requirements specified herein. It is recognised that the Contractor may have standardised on the use of certain components, materials, processes or procedures different to those specified herein. Alternate proposals offering similar equipment based on the manufacturers standard practice will also be considered, provided such proposals meet the specified design standard and performance requirement and are acceptable to the Engineer In-charge.

1.2 QUALITY ASSURANCE

1.2.1 General

To ensure that the supply and services under the scope of this Contract, whether manufactured or performed within the Contractor's works or at Site or at any other place of works are in accordance with the Specification, with the Regulations and with relevant Indian or otherwise Authorised Standards the Contractor shall adopt suitable Quality Assurance Programmes and Procedures to ensure that all activities are being controlled as necessary. The quality assurance arrangements shall conform to the relevant requirements of ISO 9001 or ISO 9002 as appropriate.

1.3 Non-conforming product

The Contractor shall retain responsibility for the disposition of non-conforming items.

1.3 STANDARDS

1. Except where otherwise specified or implied, the Contract Works shall comply with the latest edition of the relevant Indian Standards, International Electro-technical Commission (IEC) standards and any other standards mentioned in this Specification. The Contractor may submit for approval, equipment or materials conforming to technically equivalent National Standards. In such cases copies of the relevant Standards or part thereof, in the English language shall be submitted with the Tender. In case of conflict the order of precedence shall be (1) IEC, (2) IS and (3) other alternative standard.

Reference to a particular standard or recommendation in this Specification does not relieve the Contractor of the necessity of providing the Contract Works complying with other relevant standards or recommendations. The list of standards provided in the schedules of this Specification is not to be considered exhaustive and the Contractor shall ensure that equipment supplied under this contract meets the requirements of the relevant standard whether or not it is mentioned therein.

- (a) Unless otherwise specified, all materials covered under this specification shall be designed, manufactured, tested and installed in conformity with the latest Indian Standard Specifications. In case such Indian Standard Specifications are not published equivalent British Standard Specifications shall be followed. All equipments shall conform to latest Indian Electricity Rules, CEA Regulations, PWD and Local/State laws or byelaws as regards to safety, earthing and other essential provisions specified therein.
- (b) All the materials supplied by the contractor according to the contract conditions will be subject to inspection and approval by the Engineer-in-charge or their authorized representative from time to time. The contractor shall extend all required facilities for such inspection free of cost. At the time of inspection, the inspecting officer shall have full liberty to reject any such material, which does not conform to specifications or the requirements. The owner shall not entertain any claim for the rejected materials. The contractor shall remove all rejected materials from the site at his own cost.
- (c) The owner shall not accept any surplus material procured by the contractor.

- (d) The contractor will be responsible to get electrical installations inspected by the Electrical Inspector of the State Government and to obtain the statutory clearance for energisation. The Executive Engineer, RED will deposit the necessary inspection fees.
- (e) The contractor should possess valid electrical contract license and labour license issued by the appropriate statutory authority of the State Government during the execution of the contract.
- (f) The contractor shall be registered with Provident Fund Department for engagement of Labours/ Employees.

1.12 SUBMITTALS

1.12.1 Submittals required with the bid

The following shall be required in duplicate:

- completed technical data schedule;
- Descriptive literature giving full technical details of goods offered;
- type test certificates, where available, and sample routine test reports;
- Details of manufacturer's quality assurance standards and programme and ISO 9000 series or equivalent national certification where available.
- Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted;

1. Survey & scope of works:

1.1 Survey shall be carried out by the contractor for the new line.

1.2 Aligning / erection of poles in the route of line along with strengthening of its foundation is in the scope of bidder.

1.3 Before undertaking the construction works in the given line the bidder shall make assessment of quantity of the required materials in consultation with Engineer in charge. Accordingly the BOQ of the works may be prepared and get it approved from Engineer In charge.

1.4 Any other works not mentioned above exclusively but required for accomplishing desired works will be in the scope of the bidder.

1.5 For all above activities shutdown shall be arranged by the subject to advanced notice in writing by the contractor.

1.6 While placing the equipment, if any equipment gets damaged due to negligent handling of the contractor, the same shall be back charged to the contractor at penal rate.

2.0 Crossings

2.0.1 **Road Crossings:-** At all road crossings, the poles shall be fitted with strain type insulators. The ground clearance from the road surfaces under maximum sag condition shall be as per IS 5613.

3.0 Details Enroute-After survey and finalization of route, the contractor shall submit detailed route map for each line.

This would be including following details:

- a) Clearance from Ground, Building, Trees etc. – Clearance from ground, buildings, trees and telephone lines shall be provided in conformity with the Indian Electricity Rules, 1956 as amended up to date. The bidder shall select the height of the poles in order to achieve the prescribed electrical clearances.

4.0 Final Schedule-The final schedule including Bill of quantity indicating location of poles specifically marking locations of failure containment pole/structure, line tapping points angle of deviation at various tension pole locations, all type of crossings and other details shall be submitted for the approval of the Owner.

b) Earthing of Poles

Each poles shall be earthed with coil earthing as per REC construction standard J-1.

8.0 INSPECTION

8.1 All tests and inspection shall be made in the manufacturer's works unless otherwise specifically agreed upon by the manufacturer and purchaser at the time of placement of purchase order. The manufacturer shall afford to the inspector representing the purchaser, all reasonable facilities, without charge to satisfy him that the material being furnished is in accordance with these specifications. The purchaser reserves the right to get a component/material being used by the manufacturer of the Surge Arrestor tested from any recognized test house.

8.2 The inspection by the purchaser or his authorized representative shall not relieve the contractor of his obligation of furnishing equipment in accordance with the specifications.

9.0 DRAWING AND INSTRUCTION MANUALS

Within 15 days of receipt of the order, the successful tenderer shall furnish to the purchaser the following drawings and literature for approval:

- a. Outline dimensional drawings of Surge Arrestor and all accessories.
- b. Assembly drawings and weights of main component parts.
- c. Instructions manual
- d. Drawing showing details of pressure relief valve
- e. Volt-time characteristics of surge arrestors.
- f. Detailed dimensional drawing of porcelain housing/ Silicon polymeric i.e. internal diameter, external diameter, thickness, height profile creepage distance, dry arcing distance etc.
- (g) Unless otherwise specified, all materials covered under this specification shall be designed, manufactured, tested and installed in conformity with the latest Indian Standard Specifications. In case such Indian Standard Specifications are not published equivalent British Standard Specifications shall be followed. All equipments shall conform to latest Indian Electricity Rules, CEA Regulations, PWD and Local/State laws or byelaws as regards to safety, earthing and other essential provisions specified therein.
- (h) All equipments and materials selected shall also be supplied and installed taking into consideration the Factories Act, Fire Regulations and Local laws or byelaws. All light fittings and equipments selected shall be of well tied out design. All materials used in the assembly of fittings and their accessories shall be of high quality and manufactured in accordance with the best modern practice.
- (i) All the materials supplied by the contractor according to the contract conditions will be subject to inspection and approval by the Consultant or/and Engineer-in-charge or their authorized representative from time to time. The contractor shall extend all required facilities for such inspection free of cost. At the time of

inspection, the inspecting officer shall have full liberty to reject any such material, which does not confirm to specifications or the requirements. The owner shall not entertain any claim for the rejected materials. The contractor shall remove all rejected materials from the site at his own cost.

- (j) The owner shall not accept any surplus material procured by the contractor.
- (k) The contractor will be responsible to get electrical installations inspected by the Electrical Inspector of the State Government and to obtain the statutory clearance for energisation. The owner will reimburse the necessary inspection fees on production of documentary evidences.
- (l) The contractor should possess valid electrical contract licence and labour licence issued by the appropriate statutory authority of the State Government during the execution of the contract.
- (m) The contractor shall be registered with Provident Fund Department for engagement of Labours/ Employees.

1.5 STANDARDS

1. Except where otherwise specified or implied, the Contract Works shall comply with the latest edition of the relevant Indian Standards, International Electro-technical Commission (IEC) standards and any other standards mentioned in this Specification. The Contractor may submit for approval, equipment or materials conforming to technically equivalent National Standards. In such cases copies of the relevant Standards or part thereof, in the English language shall be submitted with the Tender. In case of conflict the order of precedence shall be (1) IEC, (2) IS and (3) other alternative standard.

Reference to a particular standard or recommendation in this Specification does not relieve the Contractor of the necessity of providing the Contract Works complying with other relevant standards or recommendations. The list of standards provided in the schedules of this Specification is not to be considered exhaustive and the Contractor shall ensure that equipment supplied under this contract meets the requirements of the relevant standard whether or not it is mentioned therein.

GENERAL TECHNICAL SPECIFICATION OF MATERIALS

A. TECHNICAL SPECIFICATION FOR ALL ALUMINIUM ALLOY

CONDUCTOR (AAAC)

1. SCOPE

This specification covers design, Engineering, Manufacture, Testing, Inspection before dispatch, forwarding, packing, transportation to sites, Insurance (both during transit & storage), storage, erection, supervision testing & commissioning of all sizes of All Aluminium Alloy Conductors of the Aluminium – magnesium- silicon type for use in the distribution overhead power lines of SOUTHCO ,Orissa.

The material offered shall have been successfully type testes and the design shall have been satisfactory operation for a period not less than two years on the date of bid opening. Compliance shall be demonstrated by submitting with the bid, (i) authenticated copies of the type test reports and (ii) performance certificates from the users.

The scope of supply includes the provision of type test, Rates of type tests shall be given in the appropriate price schedule of the bidding document and will be considered for evaluation. The Purchaser reserves the right to waive type tests as indicated in the section on Quality Assurance, Inspection and Testing in the specification.

The Aluminium Alloy Conductor shall conform in all respects to highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the Purchaser shall have the power to reject any work or materials, which, in his judgment, is not in full accordance therewith.

STANDARDS

Except where modified by the specification, the Aluminium Alloy Conductor shall be designed, manufactured and tested in accordance with latest editions of the following standards.

| | |
|----------------|----------------------------------------------------------------------------------------|
| IEC :1089 | Round wire concentric lay overhead electrical standard conductors |
| IS 398 | Aluminium Alloy Stranded Conductors |
| IS 9997 | Aluminium Alloy redraw rods for electrical purposes |
| IEC 502 : 1994 | Extruded solid dielectric insulated power cables for rated voltages 1.0 KV up to 30 KV |
| IEC 104 | Aluminium Magnesium Silicon alloy wire for overhead line conductors |
| IS 1778 | Reels and drums of bare conductor. |
| BS : 6485-1971 | PVC covered conductors for overhead power lines. |

This list is not to be considered exhaustive and reference to a particular standard or recommendation in this specification does not relieve the contractor of the necessity of providing the goods complying with other relevant standards or recommendations.

3. GENERAL

The wires shall be of heat treated Aluminium, magnesium silicon alloy containing approximately silicon-0.5 to 0.9 %. magnesium-0.6 % to 0.9%, Fe-0.5% (maximum) , Copper- 0.1% (max) , mn-0.03% , Cr-0.03%, Zn-0.1%, B-0.06%, and having the mechanical and electrical properties specified in the table and be smooth and free from all imperfections, such as, spills, splits and scratches.

Neutral grease shall be applied between the layers of wires. The drop point temperature of the grease shall not be less than 1200 °C.

3.1 Mechanical and Electrical Characteristics of Aluminium Alloy Wires used in the Construction of Stranded Aluminium Alloy Conductors

| Nominal Diameter | Minimum Diameter | Max. Diameter | Cross Sectional Area | Mass | Minimum Breaking Load | | Maximum Resistance at 200 C |
|------------------|------------------|---------------|----------------------|-------|-----------------------|-----------------|-----------------------------|
| | | | | | Before stranding | After stranding | |
| mm | mm | mm | mm ² | Kg/km | KN | KN | ohms/km |
| 4.26 | 4.22 | 4.30 | 14.25 | 38.48 | 4.40 | 4.18 | 2.345 |

Maximum resistance values given in column 8 have been calculated from the maximum values of the resistivity as specified and the cross sectional area based on the minimum diameter. The minimum breaking load is calculated on nominal diameter at ultimate tensile strength of 0.309 KN / mm² for wire before stranding and 95% of the ultimate tensile strength after stranding.

4. PHYSICAL CONSTANTS FOR ALUMINIUM ALLOY WIRES

4.1 Resistivity :

For the purpose of this specification, the standard value of resistivity of Aluminium alloy wire which shall be used for calculation is to be taken as 0.0325 ohm mm² /m at 200 °C. the maximum value of resistivity of any single wire shall not , however, exceed 0.0328 ohm. mm²/m at 20° C.

4.2 Density :

At a temperature of 200 °C, the density of aluminium alloy wire is to be taken as 2700 kg/m³.

4.3 Temperature Coefficient of Linear Expansion :

The temperature coefficient of linear expansion of aluminium alloy wire is to be taken as (23 x10⁻⁶) per °C .

4.4 Constant – Mass Temperature Coefficient

At a Temperature of 200 °C, the constant – mass temperature coefficient of resistance of Aluminium alloy wires, measured between two potential points rigidly fixed to the wire, is taken as 0.00360/°C

5. STANDARD SIZES

5.1 Nominal Sizes of Wires

The Aluminium alloy wires for standard constructions covered by this specification shall have the diameters as specified in the table and a tolerance of $\pm 1\%$ shall be permitted on the nominal diameter.

5.2 Standard Conductors

The sizes, resistance and masses (excluding the mass of grease) of stranded Aluminium alloy conductors shall be as given in table.

| Sl. No. | Actual Area | Stranding and Wire Dia | Approx. Overall Dia | Approx. Mass | Calculated Maximum Resistance at 200 C | Approx Calculated Breaking Load |
|---------|-----------------|------------------------|---------------------|--------------|----------------------------------------|---------------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | mm ² | mm | mm | Kg/Km | Ohm/Km | KN |
| 1 | 100 | 7/4.26 | 12.78 | 272.86 | 0.3390 | 29.26 |

5.3.1 Increase in Length due to Stranding

When straightened out, each wire in any particular layer of a stranded conductor, except the central wire, is longer than the stranded conductor by an amount depending on the lay ratio of that layer.

5.3.2 Resistance and Mass of Conductor

The resistance of any length of stranded conductor is the resistance of the same length of any one wire multiplied by a constant as set out in the table below.

The mass of each wire in any particular layer of the stranded conductor, except the central wire, will be greater than that of an equal length of straight wire by an amount depending on the lay ratio of that layer. The total mass of any length of an Aluminium stranded conductor is, therefore, obtained by multiplying the mass of an equal length of straight wire by an appropriate constant as mentioned below. In calculating the stranding constants as mentioned in the table below, the mean lay ratio, that is the arithmetic mean of the relevant minimum and maximum values in table for lay ratio has been assumed for each layer.

5.3.3 Calculated Breaking Load of Conductor

For a conductor containing not more than 37 wires, 95% of the sum of strength of the individual wires calculated from the values of the minimum breaking load given in this specification.

For a conductor containing more than 37 wires, 90% of the sum of the strengths of the individual wire calculated from the values of the minimum breaking load given in this specification.

5.3.4 Calculated Area and Maximum Resistance of Conductor

The actual area of a stranded conductor has been taken as the sum of the cross-sectional areas of the individual wires of nominal diameter.

Maximum resistance values of stranded conductor have been calculated on the basis of maximum resistivity and the cross-sectional area based on the minimum diameter of wires.

5.4 Stranding Constants

| Number of Wires in Conductor | Stranding Constants | |
|------------------------------|---------------------|-----------------------|
| | Mass | Electrical Resistance |
| 7 | 7.091 | 0.1447 |

6. JOINTS IN WIRES

6.1 Conductor containing seven wires

There shall be no joint in any wire of a stranded conductor containing seven wires, except those made in the base rod or wire before final drawing.

6.2 Conductors containing more than seven wires

In stranded conductors containing more than seven wires, joints in individual wires are permitted in any layer except the outermost layer (in addition to those made in the base rod or wire before final drawing) but no two such joints shall be less than 15 m apart in the complete stranded conductor. Such joints shall be made by cold pressure butt welding. They are not required to fulfill the mechanical requirements for unjointed wires.

7. STRANDING

The wire used in the construction of a stranded conductor shall, before and after stranding, satisfy all the relevant requirements of this standard.

The lay ratio of the different layers shall be within the limits given in the table for lay ratio.

In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed. The wires in each layer shall be evenly and closely stranded.

In Aluminium alloy stranded conductors having multiple layers of wires, the lay ratio of any layer shall not be greater than the lay ratio of the layer immediately beneath it.

7.1 Lay Ratios for Aluminium Alloy Stranded Conductors

| Number of Wires in Conductor | Lay Ratios | |
|------------------------------|------------|--------|
| 7 | Min-10 | Max-14 |

NOTE: For the purpose of calculation the mean lay ratio shall be taken as the arithmetic mean of the relevant minimum and maximum values given in this table.

8. LENGTHS AND VARIATIONS IN LENGTHS :

Unless otherwise agreed between the Employer and the Contractor, stranded aluminium alloy conductors shall be supplied in the manufacturer's usual production lengths to be indicated in the bid Schedule. The Employer reserves the right to specify particular lengths of conductor such that certain drum lengths will be shorter than others. There will in both cases be a permitted variation of $-0 + 5\%$ in the length of any one conductor length.

9. TESTS

9.1 Type Tests

The following tests shall be carried out as per relevant ISS once on samples of completed line conductor during each production run of up to 500 kms of the conductor from each manufacturing facility.

9.1.1 Ultimate Tensile Strength Test

This test is intended to confirm not only the breaking strength of the finished conductor but also that the conductor has been uniformly stranded.

A conductor sample of minimum 5 m length fitted with compression dead end clamps at either end shall be mounted in a suitable tensile test machine. Circles perpendicular to the axis of the conductor shall be marked at two places on its surface. Tension on the conductor sample shall be increased at a steady rate upto 50% of the minimum UTS specified and held for one minute. The circles drawn shall not be distorted due to relative movement of the individual strands. Thereafter the load shall be increased at a steady rate to the specified minimum UTS and held at that load for one minute. The conductor sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

9.1.2 D.C Resistance Test

On a conductor sample of minimum 5 m length two contact clamps shall be fitted with a pre-determined bolt torque. The resistance between the clamps shall be measured using a Kelvin double bridge by initially placing the clamps at zero separation and subsequently one meter apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 200 C, which shall conform to the requirements of this specification.

9.2 Routine Tests

Measurement of Physical Dimensions :

The samples should meet the desired dimensional requirements before conducting following Routine Tests as per relevant ISS.

9.2.1 Selection of Test Samples

Samples for the tests specified in this specification shall be taken by the manufacturer before stranding, from not less than 10% of the individual lengths of aluminium alloy wire included in any one final heat-treatment batch and which will be included in any one consignment of the stranded conductors to be supplied.

Alternatively, if desired by SOUTHCO at the time of placing an order, that the tests be made in the presence of his representative, samples of wire shall be taken from length of stranded conductor.

Samples shall then be obtained by cutting 1.2 meters from the outer end of the finished conductor from not more than 10% of the finished reels or drums.

Tests for electrical and mechanical properties of Aluminium alloy wire shall ordinarily be made before stranding since wires unlaidd from conductors may have different physical properties from those of the wire prior to stranding because of the deformation brought about by stranding and by straightening for test.

Spools offered for inspection shall be divided into equal lots, the number of lots being equal to the number of samples to be selected, a fraction of a lot being counted as s complete lot. One sample spool shall be selected at random from each lot.

The following test shall be carried out once on samples of completed line conductor during each production run of up to 500 kms of the conductor from each manufacturing facility.

9.2.2 Breaking Load Test

The breaking load of one specimen, cut from each of the samples taken shall be determined by means

of a suitable tensile testing machine. The load shall be applied gradually and the rate of separation of the jaws of the testing machine shall be not less than 25 mm / min and not greater than 100mm /min.

9.2.3 Elongation Test

The elongation of one specimen cut from each of the samples taken shall be determined as follows: The specimen shall be straightened by hand and an original gauge length of 200 mm shall be marked on the wire. A tensile load shall be applied as described above and the elongation shall be measured after the fractured ends have been fitted together. If the fracture occurs outside the gauge marks, or within 25 mm of either mark, and the required elongation is not obtained, the test shall be disregarded and another test should be made.

When tested before and after stranding, the elongation shall not be less than 4% on a gauge length of 200 mm.

9.2.4 D.C Resistance Test

The electrical resistance test of one specimen cut from each of the samples taken shall be measured at ambient temperature. The measured resistance shall be corrected to the value at 20 °C by means of the formula :

$$R_{20} = R_T [1/\{1+\alpha (T-20)\}]$$

where ,

R_{20} = resistance corrected at 20° C

R_T = resistance measured T° C

α = constant – mass temperature coefficient of resistance, 0.0036,

and T = ambient temperature during measurement.

The resistance corrected at 20 ° C shall not be more than the maximum values specified.

9.2.5 Chemical Analysis of Aluminium Alloy

Samples taken from the alloy coils / strands shall be chemically / spectrographically analyzed. The results shall conform to the requirements stated in this specification. The contractor shall make available material analyses, control documents and certificates from each batch as and when required by the Purchaser.

Test should be conducted at the independent test house by the purchaser in the case of absence Of facility at manufacturer. However the cost of such testing shall be borne by the manufacturer.

9.2.6 Dimensional and Lay Length Check

The individual strands of the conductors shall be dimensionally checked and the lay lengths checked to ensure that they conform to the requirements of this specification.

Ten percent drums from each lot shall be rewound in the presence of the Purchaser or his representative to allow visual checking of the conductor for joints, scratches or other surface imperfections and to ensure that the conductor generally conforms to the requirements this specification. The length of conductor wound on the drum shall be re-measured by means of an approved counter / meter during the rewinding process.

9.2.7 Visual and dimensional Checks on the Conductor Drums.

The drums shall be visually and dimensionally checked to ensure that they conform to the requirements of this specification and of IS 1778: Specification for reels and drums of bare conductors. For wooden

drums, a suitable barrel batten strength test procedure is required. The Bidder shall state in his bid the tests to be carried out on the drums and shall include those tests in the Quality Assurance Programme.

9.2.8 Acceptance Tests : All tests required to confirm enclosed Guaranteed Technical Particulars (GTP) requirements of this specification needs to be conducted as Acceptance Tests.

10. REJECTION AND RETESTS

10.1 Type Tests

Should the conductor fail any of the type tests specified above, the Purchaser will not accept any conductor manufactured from the material, nor conductor made by the manufacturing methods used for the conductor which failed the test.

The manufacturer shall propose suitable modifications to his materials and techniques in order that he can produce conductor which will satisfactorily pass the type test requirements.

10.2 Routine Tests

Should any one of the test pieces first selected fail the requirements of the tests, two further samples from the same batch shall be selected for testings, one of which shall be from the length from which the original test sample was taken unless that length has been withdrawn by the manufacturer.

Should the test pieces from both these additional samples satisfy the requirements of the tests, the batch represented by these samples shall be deemed to comply with the standard. Should the test pieces from either of the two additional samples fail, the batch represented shall be deemed not to comply with the standard.

If checks on individual strand diameters, conductor lay lengths and conductor surface condition indicate non-compliance with the requirements of the specification, the particular drum will be rejected. Inspection will then be carried out on two further drums within the same batch. If the conductor on either of the drums is non-complaint, the complete batch will be rejected.

10.3 Delivery Extension due to Rejection of Conductor

The rejection of conductor due to its failure to pass either type or routine tests shall not permit the Contractor to apply for any extension to the time period within which he has contracted to complete the project.

| Description | Requirement | Details furnished by the bidder |
|----------------------------------------------------|--------------------|----------------------------------------|
| | 55 Sq.mm | |
| 1. Stranding and diameter of Aluminum Alloy Strand | 7/3.15 mm | |
| 2. Over all diameter of conductor in mm | 9.45 | |
| 3. Standard nominal Aluminium Alloy area in Sq.mm | 55 | |
| 4. Calculated Aluminium alloy area in Sq.mm | 54.55 | |

| | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--|
| 5. Minimum ultimate tensile strength of Aluminium Wire strand in Kg/mm ² | 31.57 Kgs./Sq.mm | |
| 6. Guaranteed ultimate tensile strength of conductor in Kg/mm ² | 1634 Kgs | |
| 7. Minimum breaking load in Kg. For a) Aluminium Alloy Strand b) Aluminium Alloy Conductor | 2.29 KN 16.03 KN | |
| 8. Maximum working tension of conductor | 70% of UTS | |
| 9. Weight in Kg. Per KM of Aluminium Alloy conductor | 149.20 Kgs approx. | |
| 10. Resistance in Ohm per KM at 20 C | 0.621 max. | |
| 11. a) Continuous maximum current rating of conductor in still air at 45°C ambient temperature (A) b) Temperature rise for the above current (deg.C) | 173 Amps 30°C | |
| 12. Modulus of Elasticity of Aluminium Alloy conductor Kg/Sq.mm | 0.6320X10 ⁶ | |
| 13. Co-efficient of linear expansion per degree centigrade for a) Aluminium Alloy Strand/°C b) Alloy conductor/°C | 23X10 ⁻⁶ 23X10 ⁻⁶ | |
| 14. Standard length of each piece in KM | 1.70 and above | |
| 15. Dimension of the reel in Cms. | 135X50X71 | |
| 16. Gross weight of the reel including weight of the conductor Kg. | Max. 1500 | |
| 17. Standard according to which the conductor will be manufactured and tested | IS : 398 (Part-4) – 1994 | |
| 18. Other particulars | | |

(B) TECHNICAL SPECIFICATION MILD STEEL CHANNEL &

ANGLE

1. General:

The structure materials for DP structure and others shall be fabricated with specified sections of mild steel materials as per the drawing and bill of quantity. These structure materials and cross arms shall be fastened with clamps or other structure materials by means of 5/8" diameter G.I. bolts of appropriate length only. After fabrication or erection the structure materials/ cross arms shall be painted with two coats each of red oxide primer and aluminium paint.

2. Applicable Standard

Materials shall conform to the latest applicable Indian standards. In case bidders offer steel section and supports conforming to any other international specifications which shall be equivalent or better than IS, the same is also acceptable.

| Sl.No. | Standard No. | Title |
|--------|--------------|-------|
|--------|--------------|-------|

| | | |
|---|----------------------------|--------------------------------------------------------------|
| 1 | IS: 2062 Grade 'A' Quality | Specification for M.S. Angles, M.S. Channel |
| 2 | IS: 2062 | Chemical and Physical composition of material |
| 3 | IS: 1852 | Rolling and Cutting Tolerances for Hot Rolled Steel products |

3) Raw

material

The Steel Sections shall be re-rolled from the BILLETS/INGOTS of tested quality as per latest version of IS: 2830 or to any equivalent International Standard and shall be arranged by the bidder from their own sources. The Chemical composition and Physical properties of the finished material shall be as per the equivalent standards.

C TECHNICAL SPECIFICATION G.I. WIRE

The wires shall be drawn from the wire rods conforming to IS:7887-1975 or the latest version thereof.

1. Applicable standard:

The GI wire shall comply with the specific requirements of IS: 280-1978 and IS: 7887-1975 or the latest version thereof.

2. Galvanizing:

The wires shall be galvanized with Heavy coating as per IS: 4826-1979 or the latest version thereof.

(D). TECHNICAL SPECIFICATION OF EARTHING COIL:

1. Qualification Criteria of Manufacturer:-

The prospective bidder may source Earthing Coil from manufacturers who must qualify all the following requirements :

- a) The manufacturer must have successfully carried out Type Test of similar item from any NABL Accredited Laboratory within the last 5 years, prior to the date of submission of the bid.
- b) The manufacturer should have supplied at least 1000 nos. to electricity supply utilities / PSUs. The bidder should enclose Performance Certificates from the above users issued in the name of the manufacturer as proof of successful operation in field.

2. SCOPE

The specification covers design, manufacture, testing for use in earthing of the HT poles.

3. GENERAL REQUIREMENTS

Earthing coils shall be fabricated from soft GI Wire Hot Dip Galvanized. The Hot Dip galvanized wire shall have clean surface and shall be free from paint enamel or any other poor conducting material. The coil shall be made as per REC constructions standard.

The Hot Dip galvanizing shall conform to IS: 2629/1966, 2633/1972 and 4826/1969 with latest amendments.

4. TESTS

Galvanizing Tests

Minimum Mass of Zinc

On GI Wire used 280 gm/m²

After Coiling-266 gm/m². The certificate from recognized laboratory shall be submitted towards mass of zinc.

Dip Test

Dip test shall stand 3 dips of 1 minute and one dip of ½ minute before coiling and 4 dips of 1 minute after coiling as per IS: 4826/1979.

Adhesion Test

As per ISS 4826 – 1979.

5. DIMENSIONAL REQUIREMENT

Nominal dia of GI Wire -4 mm (Tolerance ±2.5%)

Minimum no. of turns – 115 Nos.

External dia of Coil (Min) – 50 mm
Length of Coil (Min) – 460 mm
Free length of GI Wire at one end coil (Min.) – 2500 mm
Minimum length of wire to be grounded during installation -1000 mm.
The turns should be closely bound. Weight of one finished Earthing Coils (min.) –1.850 Kg.

EARHTING COIL
GUARANTEED TECHNICAL PARTICULARS

(To be submitted along with Offer)

| Sl.No. | GENERAL TECHNICAL PARTICULARS | BidderOffer |
|---------------|--------------------------------------|--------------------|
| 1 | Nominal diameter of wire | |
| 2 | No. of turns | |
| 3 | External dia of Coil | |
| 4 | Length of Coil | |
| 5 | Mass of Zinc | |
| 6 | Total weight of Coil | |
| 7 | Whether drawing enclosed (yes) | |

BIDDER'S SIGNATURE WITH SEAL

(This form is to be duly filled up by the bidder & submit along with the Tender)

(E).TECHNICAL SPECIFICATION OF LT STAY SETS:

1. Qualification Criteria of Manufacturer:-

The prospective bidder may source Stay Sets from manufacturers only must qualify all the following requirements :

- a) Manufacturer must have successfully carried out Type Test of similar item from any NABL Accredited Laboratory within the last 5 years, prior to the date of submission of the bid.
- b) The manufacturer should have supplied at least 1000 sets (LT) to electricity supply utilities / PSUs. The bidder should enclose Performance Certificates from the above users issued in the name of the manufacturer as proof of successful operation in field.

2. SCOPE

This specification covers design, manufacture, testing and dispatch of LT stay sets 20 mm dia.

3. GENERAL REQUIREMENTS

20 mm Dia Stays Sets for LT Lines (Galvanized) LT Stay Set:

The Stay Set (Line Guy Set) will consist of the following components:

Anchor Rod with one Washer and Nut:

Overall length of Rod should be 1800mm to be made out of 20 mm dia GI rod one end threaded up to 40 mm length with a pitch of threads per cm. And provided with one square G.I Washer of Size 50x50x1.6mm and one GI Hexagonal nut conforming to IS:1363:1967 & IS:1367:1967. Both washer and nut to suit the threaded rod of 20 mm. The other end of the rod to be made into a round eye having an inner dia of 40mm with best quality of welding. Dimensional and other details are indicated and submitted by bidders for owner's approval before start of manufacturing.

Anchor Plate Size 300 x 300 x 8 mm

To be made out of G.S. Plate of 8 mm thickness. The anchor plate have its centre 22mm dia hole.

Turn Buckle, Eye Bolt with 2 Nuts.

To be made of 20 mm dia G.I Rod having an overall length of 450 mm. One end of the rod to be threaded up to 300 mm length with a pitch of 4 threads per cm. The 20 mm dia bolt so made shall be provided with two G.I Hexagonal nuts of suitable size conforming to IS: 1363:1967 & IS: 1367:1967. The other end of the rod shall be rounded into a circular eye of 40mm inner dia with proper and good quality of welding. Welding details are to be indicated by the bidder separately for approval.

Bow with Welded Channel:

To be made out of 16mm dia G.I Rod. The finished bow shall have an overall length of 995 mm and height of 450 mm. The apex or top of the bow shall be bent at an angle of 10R. The other end shall be welded with proper and good quality welding to a G.I Channel 200 mm long having a dimension of 100x50x4.7 mm. The Channel shall have 2 holes of 18 mm dia and 22 dia hole at its centre as per drawing No.3 enclosed herewith.

Thimble 2 Nos.

To be made of 1.5 mm thick G.I sheet into a size of 75x22x40mm and shape as per standard.

Galvanizing

The complete assembly shall be hot dip galvanized.

Welding

The minimum strength of welding provided on various components of 20 mm dia stay sets shall be 4900 kg respectively. Minimum 6mm fillet weld or its equivalent weld area should be deposited in all positions of the job i.e. at any point of the weld length. The welding shall be conforming to relevant IS:823/1964 or its latest amendment.

Threading

The threads on the Anchor Rods, Eye Bolts and Nuts shall be as per specification IS: 4218: 1967 (ISO Metric Screw Threads). The Nuts shall be conforming to the requirements of IS: 1367:1967 and have dimension as per IS 1363:1967. The mechanical property requirement of fasteners shall conform to the proper clause 4.6 each for anchor rods and Eye bolt and property clause 4 for nuts as per IS: 1367:1967. Average weight of finished 20 mm Stays Set: 14.523 Kg.(Min) (Excluding Nuts Thimble & Washer) :15.569 Kg.(Max.)

4. TESTS

The contractor shall be required to conduct testing of materials at Govt./Recognized testing laboratory during pre-dispatch inspection for Tensile Load of 4900Kg applied for one minute on the welding and maintained for one minute for 20mm dia stay sets.

5. IDENTIFICATION MARK

All stay sets should carry the identification mark of the Purchaser (SOUTHCO) applicable. This should be engraved on the body of stay rods to ensure proper identification of the materials. The nuts should be of a size compatible with threaded portion of rods and there should be no play or slippage of nuts. Welding wherever required should be perfect and should not give way after erection.

6. TOLERANCES

The tolerances for various components of the stay sets are indicated below subject to the condition that the average weight of finished stay sets of 20mm dia excluding nuts, thimbles and washers shall not be less than the weight specified above.

GUARANTEED TECHNICAL PARTICULARS OF LT STAY SET

| Sl. No. | Item Description | Specified parameters | | | Bidder's offer |
|---------|------------------|----------------------|------------------------|---------------------|----------------|
| | | Section Tolerances | Fabrication Tolerances | Material | |
| 1 | Anchor Plate | 8mm thick +2.5% - 5% | 300x300mm+ 1% | GI Plate 8 mm thick | |

SUPERENDING ENGINEER, ELECTRICAL CIRCLE, RAYAGADA

| | | | | | |
|----|------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--|
| 2 | Anchor Rod | 20mm dia +3% - 2% | Length1800mm +0.5% Round Eye 40mm inside dia+3%. Threading 40mm +11%-5% | GI Round 20mm dai GI Round 20mm dia | |
| 3 | Turn Buckle Bow | 16 mm dia +5%-3% | Overall Length 995mm +1% 16mm dia Height Length450mm +1% 100x50x4.7mm GI Channel length 200mm + 1% | 16mm dia. GI round G I Channel 100x50x4.7mm | |
| 4 | Eye Bolt Rod | 20mm dia + 3% - 2% | Length450mm +1% Threading 300mm +1% Round Eye 40 mm inside dia +3% | GI Round 20mm dia. | |
| 5 | Galvanisation thickness | | | | |
| 6 | Anchor Plate | | | | |
| 7 | Anchor Rod | | | | |
| 8 | Turn Buckle | | | | |
| 9 | Eye Bolt Rod | | | | |
| 10 | Weight of complete set | | | | |
| 11 | Whether drawing submitted | | | | |

BIDDER'S SIGNATURE WITH SEAL

(This form is to be duly filled up by the bidder & submit along with the Tender)

(F).TECHNICAL SPECIFICATION OF 7/10 GI STAY WIRES:

1. Qualification Criteria of Manufacturer:-

The prospective bidder may source Stay Wire from manufacturers only who must qualify all the following requirements :

- a) The manufacturer must have successfully carried out Type Test of similar item from any NABL Accredited Laboratory within the last 5 years, prior to the date of submission of the bid.
- b) The manufacturer should have supplied at least 1000 Kg (all sizes taken together) to electricity supply utilities / PSUs. The bidder should enclose Performance Certificates from the above users issued in the name of the manufacturer as proof of successful operation in field.

2. Application Standards

SUPERENDING ENGINEER, ELECTRICAL CIRCLE, RAYAGADA

Except when they conflict with the specific requirements of this specification, the G.I Stay Stranded Wires shall comply with the specific requirements of IS: 2141-1979. IS:4826-1979 & IS: 6594-1974 or the latest versions thereof.

3. Materials

The wires shall be drawn from steel made by the open hearth basic oxygen or electric furnace process and of such quality that when drawn to the size of wire specified and coated with zinc, the finished strand and the individual wires shall be of uniform quality and have the properties and characteristics as specified in this specification. The wires shall not contain sulphur and phosphorus exceeding 0.060% each.

4. Tensile Grade

The wires shall be of tensile grade 4, having minimum tensile strength of 700 N/mm² conforming to IS:2141.

5. General Requirements

The outer wire of strands shall have a right-hand lay.

The lay length of wire strands shall be 12 to 18 times the strand diameter.

1. Minimum Breaking Load

The minimum breaking load of the wires before and after stranding shall be as follows:

| No. of wires & constant | Wire Dia (mm) | Min. breaking load of the Single wire before stranding (KN) | Min. breaking load of the standard wire (KN) |
|-------------------------------------------------|------------------------|--------------------------------------------------------------------|-----------------------------------------------------|
| 7 (6/1) | 3.15 | 5.45 | 36.26 |
| Minimum weight of zinc coating before stranding | 490 gm/mm ² | 490 gm/mm ² | 490 gm/mm ² |
| Minimum weight of zinc coating before stranding | 475 gm/mm ² | 475 gm/mm ² | 475 gm/mm ² |

7. Construction

The galvanized stay wire shall be of 7-wire construction. The wires shall be so stranded together that when an evenly distributed pull is applied at the ends of completed strand, each wire shall take an equal share of the pull. Joints are permitted in the individual wires during stranding but such joints shall not be less than 15 metres apart in the finished strands. The wire shall be circular and free from scale, irregularities, imperfection, flaws, splits and other defects.

8. Tolerances

A tolerance of (+) 2.5% on the diameter of wires before stranding shall be permitted.

9. Sampling Criteria

The sampling criteria shall be in accordance with IS :2141.

10. Tests on Wires before Manufacture

The wires shall be subjected to the following tests in accordance with IS: 2141. Ductility Test and Tolerance on Wire Diameter

11. Tests on Completed Strand

The completed strand shall be tested for the following tests in accordance with IS: 2141.

A. Tensile and Elongation Test: The percentage elongation of the stranded wire shall not be less than 6%.

B. Chemical analysis

C. Galvanizing Test

The Zinc Coating shall conform to "Heavy Coating" as laid down in IS:4826.

12. Marking

Each coil shall carry a metallic tag, securely attached to the inner part of the coil bearing the following information:

- a) Manufacturers name or trade mark
- b) Lot number and coil number
- c) Size
- d) Construction
- e) Tensile Designation
- f) Lay
- g) Coating
- h) Length

- i) Mass
- j) ISI certification mark, if any

13. Packing

The wires shall be supplied in 75-100 Kg. coils. The packing should be done in accordance with the provisions of IS: 6594.

14. Other Items:

For remaining items of stay sets mentioned in the enclosed drawing, relevant applicable Indian standards shall be applicable.

GURANTEED TECHNICAL PARTICULARS OF STAY WIRE (7/10 SWG)

| Sl. No. | GENERAL TECHNICAL PARTICULARS | 7/10SWG | Specification by the Bidder |
|---------|--------------------------------------------------------------------------------------------------------------|----------------------|-----------------------------|
| 1 | Nominal diameter of wire | <u>3.15</u> | |
| 2 | Tolerance in diameter | <u>±2.5%</u> | |
| 3 | Sectional Area (In Sq. mm.) | | |
| 4 | Tensile strength | 700N/mm ² | |
| a | Min.K N/mm ² | 5.45 | |
| b | Max.K N/mm ² | | |
| 5 | Minimum breaking load (KN) | 36.26 | |
| 6 | Type of coating Heavy/Medium/Light | Heavy | |
| 7 | Variety Hard/Soft | | |
| 8 | Weight of Zinc coating (Gms/Sq. Mtr.) Min. | 475 | |
| 9 | No. of dips the coating is able to withstand as 18 ± 20°C | | |
| 10 | Adhesion Test (Wrap Test at 1 turn per second coiling while stress not exceeding % nominal tensile strength) | | |
| a | Min. complete turn of wrap | | |
| b | Dia of mandrel on which wrapped | | |
| 11 | Bend Test | | |
| a | Angle | | |
| b | Dia round a format to be bent | | |
| 12 | Freedom from defect | | |
| 13 | Chemical composition the MS Wire used shall not exceed | | |
| a | Sulphur 0.060% | | |
| b | Phosphorous 0.065% | | |

BIDDER'S SIGNATURE WITH SEAL

(This form is to be duly filled up by the bidder & submit along with the Tender)

(K). TECHNICAL SPECIFICATION OF ALUMINIUM BINDING WIRE:

1.0 SCOPE:

Scope covers manufacture, testing and supply of 3.53 mm dia Aluminium Binding Wire as per IS 398.

2.0 MATERIALS:

The material comprising the wire shall have the following chemical composition: Aluminium 99.5% minimum Copper, silicon and iron 0.5% maximum The surface of the wire shall be smooth and free from all irregularities and imperfections. Its cross sections shall closely approximate that of true circle.

| Diameter of wire | | | Cross sectional area of nominal dia. Wires (mm ²) | Weight of wire kg/km | Breaking Load (kN) |
|------------------|---------|---------|---------------------------------------------------------------|----------------------|--------------------|
| Minimum | Nominal | Maximum | | | |
| 3.15 | 3.53 | 3.55 | 9.787 | 26.45 | 1.57 |

Inspection and Tests

The following routine checks and tests shall be carried out on 10% of the coils of aluminium binding wire. If anyone sample fails to pass any one of the test nominated for that wire, then samples shall be taken from every coil in the consignment and any coil from which a sample proves defective shall be rejected. On no account shall any rejected material be presented for test again unless with the written approval of, and under conditions determined by the Purchaser.

Physical properties

The surface of the finished wires shall be checked to ensure that it is smooth , free from all irregularities, imperfections and inclusions and that its cross section approximates closely that of true circle. The wire shall be checked to ensure that its diameter and weight are within the values given in the table above for characteristic of a aluminium binding wire.

Ultimate tensile strength

When tested on a standard tensile testing machine, the value obtained for the ultimate tensile stress shall not be less than 1.57kN

Wrapping test

The wire shall withstand one cycle of a wrapping test as follows: The wire shall be closely wrapped round a wire of its own diameter form a close helix of eight turns. Six turns shall then be unwrapped and again closely rewrapped in the same direction as the first wrapping. The wire shall not break or crack when subjected to this test.

Packing & Delivery

The aluminum binding wire shall be delivered in 30m coils, with a permitted tolerance of +5%.Random or non standard lengths shall not be permitted. Each coil shall be adequately guarded against damage due to transportation and handling and shall have an outer layer of tightly wound polythene tape or be contained in a suitable, transparent plastic bag. The internal diameter of the wound coil shall not be such as to result in a permanent set in the conductor.

The coils shall be contained in non returnable wooden cases, with a gross weight not in excess of 300 kg. The number of coils contained shall be marked on the outside of each case.

GUARANTEED TECHNICAL PARTICULARS

| Sl.No. | Description | Bidder's offer |
|--------|-------------------------------------------------|----------------|
| 1 | Manufacturer Address | |
| 2 | Indian Standard No. IS 398 (Part-4) 1994 | |
| 3 | Material of Binding Wire | |
| 4 | Dia. Of Wire | |
| 5 | Maximum D.C. resistance at 20 degree centigrade | |
| 6 | Individual Aluminium Alloy Strands | |
| A | Tensile breaking stress | |
| B | Elongation on 200 mm length in breaking | |
| 7 | Particulars of Raw Materials | |
| 7.1 | Aluminium | |
| | a) Minimum Purity of aluminium | |
| 7.2 | Aluminium Alloy | |
| | a) Aluminium redraw rod conforming to element | |
| | (a) Si | |

| | | |
|-----------|--------------------------------------------------|--|
| | (b) Cu | |
| | (c) Other Element (If any) | |
| 8 | Linear mass of Wire | |
| 9 | Modulus of Elasticity | |
| 10 | Coefficient of Linear Expansion (per deg. Cent.) | |

BIDDER'S SIGNATURE WITH SEAL

(This form is to be duly filled up by the bidder & submit along with the Tender)

(G) TECHNICAL SPECIFICATION OF INSULATORS:

The insulators shall be of porcelain. These shall be non-absorbent and vitreous throughout. The exposed surface shall be glazed. Unless otherwise it is specified, the glaze is of brown colour. The glaze shall cover all the porcelain parts of the insulator except those areas which serve as supports during firing or are left unglazed for the purpose of assembly. The insulators shall have adequate mechanical strength, high degree of resistance to electrical puncture, resistance to climatic & atmospheric conditions prevailing at site and made from one piece of moulded porcelain.

Applicable standard:

Unless otherwise it is stipulated in this specification, the insulators shall comply with Indian standard specification IS: 731-1971 and the insulator fittings with IS 2486(Part-I)-1971 and IS: 2486(Part-II)-1974 or the latest version thereof.

(i) Pin Insulators

These shall be mounted on metallic cross-arms with the help of non-magnetic threaded galvanised iron pins. The pins shall be a single piece obtained preferably by the process of forging. The threads of the nuts shall be cut after galvanising and shall be well oiled and greased

TECHNICAL SPECIFICATION FOR (LT) PORCELAIN

PIN INSULATORS

1. SCOPE :

The specification provides for manufacture, testing before dispatch, supply and delivery of (LT) Porcelain Pin Insulators as per the particulars given in the "Schedule of Requirements" attached.

2. STANDARDS:

The (LT) Pin Insulators shall conform to the following standards with latest amendments if any. The tenders shall go through the IS thoroughly before making their offer. The material shall be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth (A).

| Sl.No. | Material | Indian Standards (amended up to date) |
|---------------|-------------------|--------------------------------------------------|
| 1 | LT Pin Insulators | IS: 1445 -1977 |

3. GENERAL REQUIREMENT:

- i) The porcelain shall be sound, free from defects thoroughly verified and smoothly glazed.
- ii) The design of Insulator should be such that, stresses due to expansion or and contraction in any part of the insulator shall not lead to its deterioration..
- iii) The glaze shall be Brown in colour –except for the screw threads and the top portion on which the conductor is supported during firing which may be left unglazed, all other surfaces of the insulator shall be effectively glazed.

4. TYPE AND DIMENSIONS:

The dimensions and construction of (LT) Pin Insulators should be as per IS mentioned in clause (2) with latest issues thereof.

5. ELECTRICAL AND MECHANICAL CHARACTERISTICS : -

The electrical and mechanical particulars of (LT) Pin insulators shall be as per the Guaranteed Technical Particulars shown, measured at the following standard atmospheric conditions.

| | |
|------------------------|------------------------------------------------------------------------------------------|
| 1. Ambient temperature | 55 Deg. C |
| 2. Barometric pressure | 1013 mill bars |
| 3. Absolute Humidity | 11 Grams of water per cubic mtrs. Corresponding to 63% relative humidity at 20 Deg C. |

6. BASIC INSULATION LEVELS: -

The test voltage of Pin insulators shall be as per the values given in Guaranteed Technical Particulars attached.

In this specification power frequency voltages are expressed as peak values divided by $\sqrt{2}$ and impulse voltages are expressed as peak values.

The withstand flashover voltages are referred to the reference atmospheric conditions.

- 7. As the insulators are to be used any where in A.P. State including the coastal area, the creepage distances of specified in GTP are minimum. However, the firm may offer insulators of higher creepage distance, but the mechanical and electrical parameters of their product shall be as per the mechanical and electrical requirement in GTP attached.

8. TESTS: -

- i) All the tenderers must submit copies of type test certificates along with laboratory approved drawings for the products offered by them. The

Certificates shall be from any NABL accredited laboratory, but not more than 5 years old as on date of opening the tender.

ii) Copy of type test certificate of each type offered must be submitted.
iii) The type test certificate shall be final and complete for all the tests as per the list of type tests given in specification Cl.No.8.1 of the specification.

iv) Failure to submit the type test certificates as described above shall be liable for rejection of tender offer.

v) Routine test shall be carried out on every insulator as specified in IS in clause no.2 with latest amendments. Details of test result on each of the insulator supplied, has to be submitted to inspector for his perusal and verification.

vi) The insulators shall comply with the type tests as per IS in clause no.2 with latest amendments.

TYPE TESTS:

The following shall constitute the type tests. However, the test voltage value shall be as per GTP.

- a) Visual examination.
- b) Verification of dimensions.
- c) Visible discharge test.
- d) Impulse voltage withstand test (+ve wave & -ve wave)
- e) Impulse voltage flashover test (+ve wave & -ve wave)
- f) Dry and wet power frequency voltage withstands test.
- g) Dry and wet power frequency flashover voltage test.
- h) Temperature Cycle test.
- i) Mechanical failing load test.
- j) Puncture test.
- k) Porosity test.
- l) Galvanizing test.

ACCEPTANCE TESTS: -

From the offered lot, samples shall be drawn randomly as per the criteria given. The firm has to arrange for carrying out all following acceptance tests at firms works only at firm's cost in presence of inspector deputed by AP PDCL.

- a) Verification of dimensions and Visual examination.
- b) Temperature cycle tests.
- c) Mechanical failing load test
- d) Puncture test.
- e) Porosity test.
- f) Galvanizing test.

ROUTINE TESTS: -

The following tests shall be carried out as routine tests by firm on each insulator before offering the lot for inspection.

- a) Visual examination.
- b) Mechanical routine test
- c) Electrical routine test
- d)

9. TEST CERTIFICATES:

The test shall be carried out as per the IS before dispatch and the test certificates shall be furnished for approval.

Copies of type test certificates of identical materials for each type with dimensional drawings shall invariably accompany the tender.

The type tests as specified in the IS should be carried out not later than 5 years from the date of opening of bid.

10. PACKING :

This shall be done in wooden crates suitable for rough handling.

11. GUARANTEED TECHNICAL PARTICULARS:

The technical particulars as specified in the IS shall be guaranteed and a statement of guaranteed particulars shall be furnished along with the tender as per the enclosed format, without which, the tender will be liable for rejection

12. SAMPLES :

Two Nos. sample of **(LT)** Pin Insulators shall invariably accompany the tender. Tenders for which samples are not received by the stipulated date will be rejected.

13. MARKING:

The Material shall be engraved with your trade mark, year of manufacture .

Marking on porcelain shall be printed and shall be applied before firing.

GUARANTEED TECHNICAL PARTICULARS:

| Sl. No. | Characteristics | LT Pin Insulators |
|----------------|--------------------------------------------------------|--------------------------|
| 1. | Maker's Name Address and Country | : |
| 2. | Type of insulator | : |
| 3. | Minimum failing load | : |
| 4. | Standard according to which the material shall confirm | : |
| 5. | Type of Glaze | : |
| 6. | DIMENSIONS (mm) | : |
| | a). Overall height | : |
| | b). Maximum Diameter of Insulator | : |
| | c). Top | : |
| | d). Neck | : |
| 7. | Creepage distance minimum | : |
| 8. | Working Voltage | : |
| 9. | Dry power Frequency 1 min. withstand Voltage | : |
| 10. | Wet power Frequency 1 min. withstand Voltage | : |

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| | | | |
|-----|------------------------------------------------------------------|---|--|
| 11. | Dry power Frequency Flashover Voltage | : | |
| 12. | Wet power Frequency Flashover Voltage | : | |
| 13. | Power Frequency puncture withstand Voltage | : | |
| 14. | Impulse flash over voltage a). positive KV b). negative KV | | |
| | Impulse withstand Voltage | : | |
| 15. | Visible discharge test voltage | : | |
| 16. | No. of threads per mm. | : | |
| 17. | Type of threads | : | |
| 18. | Thimble: | : | |
| | I). Type of material | : | |
| | II). Type | : | |
| 19. | Net weight of insulator | : | |
| 20. | Tolerance as per specification | : | |
| 21. | Packing details | : | |
| | Making details Minimum failing load | | |
| | I). Type of packing | : | |
| | II). No. of Insulators/crate | : | |
| | III). Weight of each packing approx in Kg | : | |
| 22. | Marking details | : | |
| 23. | Furnished drawing No./relevant information if any | : | |

| | |
|--------------------------------------------|------------------------------------------|
| Type of Insulators | Type I |
| Standards to which insulators will conform | IS: 1445/1977 Latest amendment |
| Dimensions | 70 mm X 100 mm |
| Color of Glaze | Brown |
| Dry Power freq. Withstand voltage (KV) | 23 KV |
| Wet Power freq. Withstand voltage (KV) | 10 KV |
| Puncture Withstand Voltage | 1.3 x Actual Dry Power Frequency Voltage |
| Minimum failing Load (KN) | 3.5 KN |
| Temp Cycle test (as per ISS) | As per clause 7.8 of IS 1445 |
| Porosity test (as per ISS) | As per clause 7.11 of IS 1445 |
| Furnished drawing no. | BPPL-LT-05 |

TECHNICAL SPECIFICATION FOR LT SHACKLE INSULATORS

1. SCOPE:

The specification provides for manufacture, testing before dispatch, supply and delivery of LT Shackle Insulators as per the particulars given in the "Schedule of Requirements" attached.

2. STANDARDS:

The LT Shackle Insulators shall conform to IS:1445/1977 (the latest issue thereof) and shall be brown glazed. The tenders shall go through the above IS thoroughly before making their offer. The material shall be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth.

2. GENERAL REQUIREMENT:

- i) The porcelain shall be sound, free from defects thoroughly vitrified and smoothly glazed.
- ii) The design of Insulator should be such that, stresses due to expansion or and contraction in any part of the insulator shall not lead to its deterioration.
- iii) The glaze shall be Brown in colour –except for the screw threads and the top portion on which the conductor is supported during firing which may be left unglazed, all other surfaces of the insulator shall be effectively, glazed.

3. TESTS :

The Insulator shall comply with the following routine, type and acceptance tests as per IS:1445/1977 (the latest issue thereof).

4.1. Routine Test : Visual Examination

Type Test :

The firm shall submit the type test report shall be from any NABL accredited laboratory not more than 5 years old along with offer .The following type tests are to be carried out on sample in the order mentioned bellow as per IS 5300/69.

- a) Visual examination.
- b) Verification of dimensions.
- c) Dry one minute power frequency withstand test.
- d) Wet one minute power frequency withstand test.
- e) Temperature Cycle test.
- f) Mechanical strength test
- g) Porosity test.
- h) Power frequency puncture withstand test

NOTE : The identification marks of firm provided on the insulator should be invariably mentioned in the type test certificate.

- a) Visual examination.
- b) Verification of dimensions.
- c) Temperature Cycle test.
- d) Mechanical strength test.

e) Porosity test (Applicable only to HT Guy Insulator Type-C).

4. MARKING:

The Insulators shall be legibly and indelibly marked as shown below.

- a) Name and trade-mark of the manufacturer.
- b) Month and year of manufacture and.

Markings on porcelain shall be printed and shall be applied before firing.

5. TYPE AND DIMENSIONS:

The dimensions shall be of size 90X75 mm and construction of the LT Shackle Insulators should be as per IS 1445/1977 and shall be brown glazed.

6. TEST AND TEST CERTIFICATES:

The test shall be carried out as per the IS before dispatch and the test certificates shall be furnished for approval.

Copies of type test certificates of identical materials for each type with dimensional drawings shall invariably accompany the tender.

The type tests as specified in the IS should be carried out not later than 5 years from the date of opening of bid.

7. PACKING :

This shall be done in wooden crates suitable for rough handling.

8. SAMPLES :

Two Nos. samples of LT Shackle Insulators shall invariably accompany the tender. Tenders for which samples are not received by the stipulated date will be rejected.

9. GUARANTEED TECHNICAL PARTICULARS :

The technical particulars as specified in the IS shall be guaranteed and a statement of guaranteed particulars shall be furnished along with the tender.

GUARANTEED TECHNICAL PARTICULARS

| Sl. No. | Details | Guaranteed particulars | Details to be furnished by bidder |
|-----------------------------|----------------------------------------------------------------------------------|----------------------------------------------------|-----------------------------------|
| 1. | Name of the Manufacturer | | |
| 2. | i) Rating of shackle insulators | 1.1 KV | |
| | ii) Electric characteristics of Insulators | | |
| | a) Normal system voltage KV | 1.1 KV | |
| | b) Highest system voltage KV | 1.1 KV | |
| | c) Visible discharge test voltage (Power Frequency) KV (RMS) | --- | |
| | d) Dry one minute withstand voltage KV (RMS) | 23 KV | |
| | e) Wet Power Frequency withstand voltage KV (RMS) | 10 KV | |
| | f) Power frequency puncture withstand voltage KV (RMS) | 1.3 X the actual dry flashover voltage | |
| | g) Impulse withstand voltage (1/50 micro second wave KV (Peak) | --- | |
| | h) Impulse flash over voltage (1/50 micro second negative voltage KV (Peak) | --- | |
| | i) Impulse flashover voltage (1/50 micro second negative voltage KV (Peak) | ---- | |
| | j) Dry flashover voltage KV | --- | |
| k) Wet flashover voltage KV | --- | | |
| 3. | Mechanical characteristics of insulators | | |
| | a) Min. failing load KN | 15 KN (Transfer strength) | |
| | b) Min. creepage distance | 66mm | |
| 4. | Colour of glaze | Brown | |
| 5. | Weight per unit | --- | |
| 6. | Size of Insulator | Height 75 mm | |
| 7. | Material of thimble | --- | |
| 8. | Whether pin insulator is suitable for use with small steel head/large steel head | --- | |
| 9. | Standard to which the insulator will be manufactured and tested | IS-1445/1977 | |
| 10. | Contents of each package and packed weight | 50 Nos. in each bag grass packing with Bag/38 Kgs. | |
| 11. | Tolerance in dimensions, if any | As per Standard | |
| 12. | Other particulars, if any | Nil | |
| 13. | Marking Details | Make, Month & Year of Manufacture and AP PDCL | |

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| | |
|--------------------------------------------|---------------------------------------|
| STANDARD PARTICULARS | IS 1445:1977 |
| Type | IS type 1 |
| Mechanical strength | 11.5 |
| Dry Power frequency withstand voltage (kv) | 23 |
| Wet power frequency withstand voltage (kv) | 10 |
| Power frequency puncture voltage(kv) | 1.3 times of actual flashover voltage |

TECHNICAL SPECIFICATIONS

PSC Pole (8 Mtr x 200 Kg)

I. Qualification Criteria of Sub Vendor / Manufacturer:-

The prospective bidder may source PSC Poles from manufacturers who should have supplied at least the following quantity of PSC Poles to Electricity Supply Utilities / PSUs. The bidder should enclose Performance Certificates from the above users, issued in favour of the Sub Vendor / manufacturer, as proof of successful operation in field.

| Sl. No. | Size | Minimum Past Supply Qty |
|---------|-----------------|-------------------------|
| 1 | 8 Mtr. X 200 Kg | 1000 |

Applicable Standard:

The Poles shall comply with latest standards as under:

REC Specification No. 15/1979, REC Specification No. 24/1983, IS 1678, IS 2905, IS 7321.

II. Materials :

Cement

Cement to be used in the manufacture of pre-stressed concrete poles shall be ordinary for rapid hardening Portland cement confirming to IS: 269-1976 (Specification for ordinary and low heat Portland cement) or IS: 8041 E-1978 (Specification for rapid hardening Portland cement).

Aggregates

Aggregates to be used for the manufacture of pre-stressed concrete poles shall confirm to IS: 383 (Specification for coarse and fine aggregates from natural sources for concrete) .The nominal maximum sizes of aggregates shall in no case exceed 12 mm

Water

Water should be free from chlorides, sulphates, other salts and organic matter. Potable water will be generally suitable.

Admixture

Admixture should not contain Calcium Chloride or other chlorides and salts which are likely to promote corrosion of pre-stressing steel. The admixture shall conform to IS: 9103.

Pres-Stressing Steel

Pre-stressing steel wires including those used as un tensioned wires should conform to IS:1785 (Part-I) (Specification for plain hard-drawn steel wire for pre-stressed concrete, Part-I cold drawn stress relieved wire).IS:1785 (Part-II)(Specification for plain hard-drawn steel wire) or IS:6003 (Specification for indented wire for pre-stressed concrete).The type design given in the annexure are for plain wires of 4 mm diameter with a guaranteed ultimate strength of 160 kg/mm². All pre-

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stressing steel shall be free from splits, harmful scratches, surface flaw, rough, aged and imperfect edges and other defects likely to impair its use in pre-stressed concrete.

Concrete Mix

Concrete mix shall be designed to the requirements laid down for controlled concrete (also called design mix concrete) in IS: 1343-1980 (Code of practice for pre-stressed concrete) and IS: 456 – 1978 (Code of practice for plain and reinforced concrete) subject to the following special conditions:

Minimum works cube strength at 28 days should be at least 420 Kg/cm².

The concrete strength at transfer should be at least 210 Kg/cm².

The mix should contain at least 380 Kg of cement per cubic meter of concrete.

The mix should contain as low water content as is consistent with adequate workability. It becomes necessary to add water to increase the workability the cement content also should be raised in such a way that the original value of water cement ratio is maintained.

III. Design Requirements

The poles shall be designed for the following requirements:

The poles shall be planted directly in the ground with a planting depth as per IS: 1678. Wherever, planting depth is required to be increased beyond the specified limits or alternative arrangements are required to be made on account of ground conditions e.g. water logging etc., the same shall be in the scope of the bidder at no extra cost to owner. The bidder shall furnish necessary design calculations/details of alternative arrangements in this regard.

The working load on the poles should correspond to those that are likely to come on the pole during their service life.

for 8.0 M poles, the factor of safety shall not be less than 2.5.

The average permanent load shall be 40% of the working load.

The F.O.S. against first load shall be 1.0.

At average permanent load, permissible tensile stress in concrete shall be 30 kg/cm².

At the design value of first crack load, the modulus of rupture shall not exceed 53.0kg/cm² for M-40.

The ultimate moment capacity in the longitudinal direction should be at least one fourth of that in the transverse direction.

The maximum compressive stress in concrete at the time of transfer of pre-stress should not exceed 0.8 times the cube strength.

The concrete strength at transfer shall not be less than half, the 28 days strength ensured in the design, i.e. $420 \times 0.5 = 210 \text{ kg/cm}^2$. For model check calculations on the design of poles, referred to in the annexure, a reference may be made to the REC “Manual on Manufacturing of solid PCC poles, Part-I-Design Aspects”.

IV. Dimensions and Reinforcements

The cross-sectional dimensions and the details of pre-stressing wires should conform to the particulars given in the enclosed drawing. The provisions of holes for fixing cross-arms and other fixtures should conform to the REC specification No.15/1979.

All pre-stressing wires and reinforcements shall be accurately fixed as shown in drawings and maintained in position during manufacture. The un-tensioned reinforcement as indicated in the drawings should be held in position by the use of stirrups which should go round all the wires.

All wires shall be accurately stretched with uniform pre-stress in each wire. Each wire or group of wires shall be anchored positively during casing. Care should be taken to see that the anchorages do not yield before the concrete attains the necessary strength

V. Cover

The cover of concrete measured from the outside of pre-stressing tendon shall be normally 20 mm.

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VI. Welding and Lapping of Steel

The high tensile steel wire shall be continuous over the entire length of the tendon. Welding shall not be allowed in any case. However, joining or coupling may be permitted provided the strength of the joint or coupling is not less than the strength of each individual wire.

VII. Compacting

Concrete shall be compacted by spinning, vibrating, shocking or other suitable mechanical means. Hand compacting shall not be permitted.

VIII. Curing

The concrete shall be covered with a layer of sacking, canvass, Hessian or similar absorbent material and kept constantly wet up to the time when the strength of concrete is at least equal to the minimum strength of concrete at transfer of pre-stress. Thereafter, the pole may be removed from the mould and watered at intervals to prevent surface cracking of the unit the interval should depend on the atmospheric humidity and temperature. The pre-stressing wires shall be de-tensioned only after the concrete has attained the specified strength at

transfer (i.e. 200 or 210 kg/cm² as applicable). The cubes cast for the purpose of determining the strength at transfer should be cured, as far as possible, under condition similar to those under which the poles are cured. The transfer stage shall be determined based on the daily tests carried out on concrete cubes till the specified strength indicated above is reached. Thereafter the test on concrete shall be carried out as detailed in IS: 1343 (code of practice for pre-stressed concrete). The manufacturer shall supply, when required by the owner or his representative, result of compressive test conducted in accordance with IS: 456 (Code of practice for plain and reinforced concrete) on concrete cubes made from the concrete used for the poles. If the manufacturer so desired, the manufacturer shall supply cubes for test purpose and such cubes shall be tested in accordance with IS: 456 (Code of practice for plain and reinforced concrete).

IX. Lifting Eye-Hooks or Holes

Separate eye-hooks or hoes shall be provided for handling the transport, one each at a distance of 0.15 times the overall length, from either end of the pole. Eye-hooks, if provided, should be properly anchored and should be on the face that has the shorter dimension of the cross-section. Holes, if provided for lifting purpose, should be perpendicular to the broad face of the pole.

X. Holes for Cross Arms etc

Sufficient number of holes shall be provided in the poles for attachment of cross arms and other equipments.

XI. Stacking & Transportation

Stacking should be done in such a manner that the broad side of the pole is vertical. Each tier in the stack should be supported on timber sleeper located at 0.15 times the overall length, measured from the end. The timber supported in the stack should be aligned in vertical line.

XII. Earthing

(a) Earthing shall be provided by having length of 6 SWG GI wire embedded in Concrete during manufacture and the ends of the wires left projecting from the pole to a length of 100mm at 250 mm from top and 1000 mm below ground level.

(b) Earth wire shall not be allowed to come in contact with the pre-stressing wires

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B. PSC POLE (8 MTR X 200 KG) GUARANTEED TECHNICAL PARTICULARS

(To be submitted along with offer)

| Sl No. | Description | Unit | Bidder's Offer | | | | |
|--------|---------------------------------|--------------------|----------------|--|--|--|--|
| | | | 8 Mtr X 200 Kg | | | | |
| 1 | Type of pole | | | | | | |
| 2 | Factor of Safety | | | | | | |
| 3 | Overall Length of Pole Meters | meters | | | | | |
| 4 | Working Load Kg | Kg | | | | | |
| 5 | Overall Dimensions | | | | | | |
| A | Bottom Depth | mm | | | | | |
| B | Top Depth | | | | | | |
| C | Breadth | | | | | | |
| 6 | Reinforcement Detail: | | | | | | |
| 7 | Diameter of prestressing wire | | | | | | |
| 8 | No. of Tensioned wires | | | | | | |
| 9 | No. of Untensioned wire | | | | | | |
| 10 | Length of each untensioned wire | | | | | | |
| 11 | Concrete Detail | | | | | | |
| A | Cement Type | | | | | | |
| B | Grade | | | | | | |
| C | Type | | | | | | |
| D | Quantity | Cubic meter/pole | | | | | |
| E | Standard confirming to: | | | | | | |
| 12 | Steel Quality | Kg/Pole | | | | | |
| A | Ultimate Tensile Strength (UTS) | Km/Cm ² | | | | | |
| B | Weight | | | | | | |

5.0.5.1 All the poles shall be provided with a RCC block base or MS base plate having dimensions as mentioned at 5.0.2 © as per the site requirement to be decided by Engineer in Charge. The decision of Engineer in Charge will be Final.

5.0.5.2 The poles shall then be lifted to the pit with the help of wooden supports. The pole shall then be kept in the vertical position with the help of 25 mm (min.) manila ropes, which will act as the temporary anchor. The verticality of the pole shall be checked by spirit level in both longitudinal & transverse directions. The temporary anchor shall be removed only when **poles set properly in the**

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pit for foundation concreting & backfilling with proper compacting the soil. The backfilling should be done in layers (maxm. 0.5 mts at a time with sprinkling of water and by using wooden hammer. No stone more than 75 mm should be used during back filling.

5.0.5.3 Suspension type H/W fittings in all tangent locations and Four pair bolted type tension H/W fittings should be used in all new 33&11 Kv lines.45 KN & 70 KN normal B&S insulators will be used in suspension & tension locations respectively.

5.0.5.4 Concreting of foundation up to a minimum height of 1.8 mtrs from the bottom of the pit with a circular cross-section of radius 0.25 mtrs. (volume of 0.3 cu.mtr. per pole) in the ratio of 1:2:4 shall be done at the following locations: The **depth** has to be increased to 2mtr or as required at site condition if poles more than 11 Mts. are to be used.

- i) At all the tapping points and dead end poles.
- ii) At all the points as per REC construction dwg. No. A-10 (for the diversion angle of 10-60 degree) or **better there of as per the instruction of Engineer in charge. The decision of Engineer in charge will be final.**
- iii) Both side poles at all the crossing for road, Nallaha railway crossings etc.
- iv) Where Rail poles, Joist poles, double pole and four pole structures are to be erected.

6.0. Earthing of Support

6.0.1 Each pole shall be earthed with coil type earthing as per REC Construction Standard J-1.

6.0.2 All DP & Four pole structures & the poles on both sides of railway crossing shall be earthed by providing two nos. **pipe earthing as per Drawing provided by SOUTHCO, SOUTHCO & SOUTHCO.**

6.0.3 Each tower/structures should be earthed by providing 2.5 mts.50x6 GI flat and 40 x 3000 mm heavy gauge ISI mark earthing pipe. The top of the earthing pipe should remain 600 mm below ground level. All railway X-ing locations two nos. earthing should be provided.

In case the required footing resistance is not achieved on measurement, counterpoise earthing has to be provided as per the standard.

TECHNICAL SPECIFICATION

(For supply of LT XLPE AB Cables)

Part-1:

1. SCOPE:

This specification covers the design, manufacturing, testing, supply, delivery and performance requirements of LV overhead ISI marked Aerial Bunched Cable (ABC) of different sizes indicated in our Schedule of Requirements for use in the LV network of SOUTHCO.

The materials offered shall have been successfully type tested and the design shall have been in satisfactory operation for a period of not less than two years on the date of bid opening. Compliance shall be demonstrated by submitting with the bid (i) authenticated copies of the type test reports and (ii) performance certificates from the users.

However where the bidder offers similar but not identical material but higher size to that which has been type tested, the difference shall be stated in Test Certificate Schedule. The purchaser shall adjudge whether to accept or reject the offered material and type test data presented.

The scope of supply includes the provision of type tests. Rates for type tests shall be given in the appropriate price schedule of the bidding document and shall be considered for evaluation. The purchaser reserves the right to waive type tests as indicated in the section on Quality Assurance, Inspection and Testing in this specification.

The Aerial Bunched Cable shall conform in all respects to highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the Purchaser shall have the power to reject any work or material, which, in his judgment is not in full accordance therewith.

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2. STANDARDS:

Except where modified by this specification, the Aerial Bunched Cable shall be designed, manufactured and tested in accordance with the latest editions of the following standards.

| IES/ISO | Indian Standard | Material |
|-----------|----------------------|---------------------------------------------------------------------------------|
| IEC: 1089 | IS: 398/1994 | Round wire concentric lay Overhead electrical Stranded Conductors. |
| | IS: 398(Part-4)/1994 | All Aluminum Alloy Conductors, Quality Management Systems. |
| ISO: 9000 | IS: 8130/1984 | Conductors for insulated Electric cables. |
| | IS: 10810/1984 | Method of Tests for cables. |
| IEC: 502 | IS:7098/1998 | XLPE Insulated PVC. Sheathed power cables. |
| | IS:14255/1995 | Aerial Bunched Cables for working voltage up to and including 1100 volts. |

The Bidder may propose alternative standards, provided it is demonstrated that they give a degree of quality and performance equivalent to or better than the referenced standards. The purchaser shall adjudge whether to accept or reject any standards.

The Bidder shall furnish a copy of the alternative standard proposed along with his bid. If the alternative standard is in a language other than English, an English translation shall be submitted with the standard.

In case of conflict the order of the precedence shall be (1) IEC or ISO standards, (2) Indian Standards, (3) Other alternative standards. This list is not to be considered exhaustive and reference to a particular standard or recommendation in this specification does not relieve the Contractor or the necessity of providing the goods complying with other relevant standards or recommendation.

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3.0 SERVICE CONDITIONS:

The service conditions shall be as follows:

- Maximum altitude above sea level 500m
- Maximum ambient air temperature 50°C
- Maximum daily average ambient air temperature 35°C
- Maximum ambient air temperature 5°C
- Maximum temperature attainable by an object exposed to sun 60°C
- Maximum yearly weighted average ambient temperature 32°C
- Maximum relative humidity 100%
- Average number of thunderstorm days per annum 70
- Average number of rainy days per annum 120
- Average annual rainfall 150cm
- Wind pressure as per IS:5613(Part-I/Sec.I) 1985

| Wind Zones IS:5613 Part-I/Sec-I | Light | Medium | Heavy |
|------------------------------------|-----------------------|-----------------------|-----------------------|
| Terrain Category | 100 Kg/m ² | 150 Kg/m ² | 200 Kg/m ² |

Environmentally, the region where the work will take place includes coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators.

Therefore, outdoor material shall be designed and protected for use in exposed, heavily polluted salty corrosive and humid coastal atmosphere.

4. SYSTEM CONDITIONS:

The materials shall be suitable for installation in supply systems of the following characteristics.

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- Frequency 50Hz
- Nominal System Voltage 400/230V
- Maximum System Voltage LV System 440/250 V
- Minimum LV Voltage 370 V
- Power frequency one minute withstand (set & dry) 2KV
- Neutral Earthing arrangement LV System Solidly earthed

Part-2: TECHNICAL

GENERAL/ TECHNICAL

The design of Aerial Bunched Cable offered shall comprise a compacted, standard, hard drawn H2 / H4 grade aluminum phase conductor as applicable under IS-8130

/ 84 with cross linked polyethylene (XLPE) insulation 0.65 to 1.1. KV class, having of carbon black content $2.5\% \pm 0.5\%$.

The sizes and number of cores required are:

■ $3 \times 50\text{mm}^2 + 1 \times 16\text{mm}^2 + 1 \times 35\text{mm}^2$ (catenaries type)

▪ $3 \times 35\text{mm}^2 + 1 \times 16\text{mm}^2 + 1 \times 25\text{mm}^2$ (catenaries type)

▪ $3 \times 35\text{mm}^2 + 1 \times 25\text{mm}^2$

▪ $1 \times 35\text{mm}^2 + 1 \times 25\text{mm}^2$

The type of Bunched Cables shall be three phase and street lighting insulated bundled. All Aluminum Conductors combined with a neutral and catenaries (bare) which shall be of heat treated aluminum magnesium silicon alloy wires containing approximately 0.5% each of magnesium and silicon respectively. The catenaries must have an ultimate tensile stress of not less than that specified in the table of technical requirements.

The Bidder shall specify the standard to which this bundle shall be manufactured.

The conductor bundle offered shall be designed to meet the requirements set out in this specification taking note of safety factors pertaining to conductor or catenary tensioning and NESC specification: General Technical Requirements for LV overhead lines.

However, a bid of Aerial Bunched Cables shall not be considered, unless it is accompanied by a list of all special tools and equipments necessary to complete the installation.

6.0 CONDUCTORS:

(a) The phase & street light conductors shall be of multi-stranded aluminum of compacted circular cross section. The aluminum shall comply with IS 8130:1984. The messenger conductor shall be of multi-stranded Aluminum Alloy conforming to IS 398 (Part 4) - 1994.

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In addition to meeting all requirement of relevant ISS the LT XLPE AB Cables supplied shall satisfy following general requirements.

FOR PHASE AND STREET LIGHT CONDUCTORS

| Sl. No. | Specified Cross Sectional Area (mm ²) | No. of Strands | Minimum Dia Of each strand in mm | Minimum. Over all dia. Of conducting part of the compacted conductor. (mm) | Maxm. D.C Resistance at 20 degree centigrade.(Ohm / Km) | Nominal Insulation thickness (mm) |
|---------|---------------------------------------------------|----------------|----------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------|
| 1 | 16 | 7 | 1.75 | 5.25 | AS PER ISS / GTP | 1.2 |
| 2 | 25 | 7 | 2.14 | 6.42 | | 1.2 |
| 3 | 35 | 7 | 2.54 | 7.6 | | 1.2 |
| 4 | 50 | 7 | 3.05 | 9.15 | | 1.5 |
| 5 | 70 | 19 | 2.18 | 10.9 | | 1.5 |
| 6 | 95 | 19 | 2.54 | 12.7 | | 1.5 |

FOR MESSENGER CONDUCTORS

| Sl. No. | Phase Conductor Size of the LT AB Cable in mm ² | Specified Cross Sectional Area of the Messenger Conductor (mm ²) | No. of Strands | Nominal dia Of each strand | Appx. Over all dia. Of conducting part of the compacted conductor. (mm) | Maxm. D.C Resistance of the messenger at 20 degree centigrade.(Ohm / Km) | Appx. Mass (Kg / Km.) for the messenger |
|---------|------------------------------------------------------------|------------------------------------------------------------------------------|----------------|----------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------|
| 1 | 16 | 25 | 7 | 2.14 | 5.2 | AS PER ISS/GTP | 65 |
| 2 | 50 | 35 | 7 | 2.54 | 7.6 | | 95 |
| 3 | 70 | 50 | 7 | 3.05 | 9.15 | | 136 |
| 4 | 95 | 70 | 7 | 3.6 | 10.8 | | 191.8 |

6.0 (b) The bidder must take required precaution to ensure that the average diameter of each strand of conductor shall be ascertained through physical measurement of dimensions of finished cables at ambient temperature during pre-dispatch inspection or / and verification at SOUTHCO Store by consignee and the value so obtained shall have a tolerance limit with reference to the nominal diameter of each strand of conductor as stated in the tables above.

7.0 TOLERANCES:

The measurement of strand diameter of the finished AB Cable shall not be less 0.03mm for strands up to and including 3.00mm diameter. For strands above that size, measurement of strand diameter shall not be less than 1% of the nominal strand diameter.

For the purpose of checking compliance with the above requirement, the diameter shall be determined by two measurements at right angles taken at the same cross section. The physical

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measurement of strands shall be conducted after opening the strands of a finished AB Cable offered for inspection.

8.0 SPLICES IN WIRES:

Splices in Wires shall generally comply with requirements of IEC 1089.

The aluminum alloy rods may be spliced by cold pressure butt welding before drawing provided the manufacturer can guarantee that the splice can develop 90% of the tensile strength of the unspliced rod. Wires which break during stranding may be spliced by cold pressure butt-welding provided that:

No two splices in the completed conductor occur within 15m of each other and no two splices in any individual wire are less than 150m apart.

The splice shall be done with high skilled workmanship. The finished splice shall be smooth and at no point shall the cross sectional area be less than that of the unspliced wire.

Splicing of the alloy wires on the stranding machine in order to utilize lengths of wires on reels shall not be permitted.

STRANDING AND CORE LAY:

The conductor cores shall be stranded and the direction of lay must be as defined in IEC: 1089.

10.0 INSULATION:

The Aerial Bunched Cables shall be insulated for a voltage class of 0.65/1.1 KV and shall be capable of operating permanently at 1.2KV.

The insulation wall thickness shall be determined in accordance with Table-4 (Clause- 7.2 and Clause 7.3) of IS: 14255/1995.

The insulating material shall be black and suitable to resist ultra violet radiation, salt laden sprays, chemical pollution, ageing effects, abrasion and mechanical shocks and

mechanical and electrical stress at temperature up to 90°C in normal operation and

250°C under short circuit conditions per IEC: 502/1994.

The carbon black content in the XLPE insulation shall be $2.5\% \pm 0.5\%$

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PHASE IDENTIFICATION:

The individual insulated conductors within a bundle shall be identified by means of longitudinal projections.

The three phase conductors shall be marked by one, two or three longitudinal projections, indicating the red, yellow and blue phases.

The projections shall have the following dimensions.

- The distance between the tips of two adjacent projections, where there is more than one, shall be between 1.0 and 1.5.
- The width of the projection at the base shall be 1.0mm; and
- The height of the projections shall be 0.5mm.

INSULATION MARKINGS:

Each individual conductor comprising a bundle shall have the range of non-erasable distinct markings listed below legibly printed on the insulation surface at one meter intervals. The embossing should be very clear & easily visible to naked eye.

■ ISI Mark, IS 14255-95, Manufacturer"s B.I.S License No. legibly embossed on the insulation.

- Name of the Purchaser.
- P.O No. & Date
- Manufacturer"s trademark identification for example "UCXLPE50"
- Year of manufacture: last two digits are sufficient:
- Designation of conductor type
- Size: for example "3x50"
- Shape of conductor.
- Rated voltage class: 0.65/1.1KV
- Back up conductor identification: conductors with one, two and three projections shall be marked R, Y and B respectively. The conductor with no projection shall be marked N and
- The height of the printed lettering shall be not less than 20% of the overall diameter of the conductor

The markings shall be made in the sequence indicated above. Thus if the manufacturer were XY, the aerial bunched cable had been manufactured in 1994, size 3x50mm² + 1x35mm² + 1x16mm² with conductors of circular cross section and with a bundle of the self

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supporting type, manufactured to a recognized international standard then the core with two projections would be marked as follows:

XY-04-NFA4X50+1X16-r-m-0.65/1.1KV-Y

Where, N is the international standard, F indicates overhead cable, A is aluminum alloy conductor and 2X refers to XLPE insulation, „r“ means round core, „m“ self- supporting and „y“ the phase identification.

13.0 TWIST:

The direction of lay of the conductors comprising the bundle shall be left-handed and the lay ration shall comply with IEC: 1089.

With a bare catenaries configuration the insulated phase cables together with the street lighting cores shall be twisted round the neutral catenaries to form the ABC. This cable bundle is then strung directly onto the distribution poles supported by the catenaries with standard approved hardware.

14.0 CABLE DRUM LENGTH:

The cable shall be supplied in 500m . Drum Lengths as the case may be for different sizes of LT XLPE AB Cable.

TESTS:

General

Where not specified, all tests and test results shall conform to the requirements of IEC 502/1994 or IS 7098 (Part-I) 1998, IS 10810/1984, IS: 398(Part-IV) and IS: 14255/1955.

Unless expressly stated otherwise, the ambient temperature for routine tests as well as voltage tests shall be $20 \pm 15^{\circ}\text{C}$ and for all other tests be $20 \pm 15^{\circ}\text{C}$.

The frequency of the alternating test voltage shall be 49 Hz to 51Hz. The voltage wave form should be sinusoidal.

Type Tests

The test sample shall be 10m to 15m in length. All cores of the bundles shall be tested.

- Insulation resistance at ambient temperature.
- Insulation resistance at operating temperature.
- AC voltage test.

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The insulation resistance test at ambient temperature shall be carried out in a water bath at ambient temperature.

The insulation resistance test at a operating temperature shall be conducted in a water bath at 90°C.

The longitudinal projections used for phase identification shall be ignored. The results of this test shall be used to calculate the volume receptivity and the results conform to the requirements of IEC:502/1994 or IS 10810 (Part-43).

The AC voltage test shall be carried out by applying 1.95KV ($3U_0$) for four hours to the sample, which shall be submerged in a water bath at ambient temperature, having been steeped for a period not less than one hour. The test shall only be deemed to have been passed if no breakdown occurs.

Furthermore, the following non-electrical type tests shall also be carried out:

- Insulation wall thickness: the longitudinal projections used for phase 1 identifications shall be ignored as per IS 10810 (Part-6);
- Ageing test, consisting of an evaluation of the retention of the mechanical properties of the insulation after ageing.
- Wrapping test: as per IS 10810 (Part-3);
- Tests for bleeding and blooming of pigment as per IS 10810 (Part-9)
- Thermal expansion of insulation.
- Measurement of carbon black content as per IS 10810 (Part-32).
- Water absorption by the XLPE insulation, shrinking of the XLPE insulation.
- Tensile test: adhesion between conductor and insulation.

The adhesion test requires a tensile testing machine. A sample of at least 300mm length shall be selected and straightened out. The insulation shall be removed for a length of 150mm. The insulated end shall be held in the upper grip head and the bare conductor on the lower grip head. Tension shall be applied at a speed of 500mm/ min until the conductor first begins to slide within the insulation. The test shall have been passed if the conductor and insulation combination can stand 75N/mm² without slippage occurring.

The neutral conductor/catenaries shall be type tested in accordance with the requirements of IS 398 (Part-IV) 1994.

Routine Tests

The following measurement or tests shall be carried out on all drums and coils of Bunched cable:

- Conductor resistance
- Voltage test.

The conductor to be tested for conductor resistance shall be stored for at least 12 hours in a room at particular constant temperature. If it cannot be established that the conductors have reached the room temperature, the test should be postponed for a period of further 12 hours. Alternatively, the test can be carried out on short sample after remaining one hour in a temperature controlled water bath. The test shall be carried out and the conversion factors used to convert the resistance value to a base of 200°C and one Km. The DC resistance of each conductor shall not exceed the appropriate maximum values specified in IEC:228/IS:6474.

The voltage test shall be conducted by applying to each core 3.5KV AC (2.5 U₀ plus 2 KV) or 8.4 KV DC for 5 minutes with the specimen lying in a water bath at ambient temperature. The conductor shall pass the test if no electrical breakdown occurs.

Acceptance Tests

The following sample check, measurements and test shall be carried out in addition to the Acceptance Tests as per IS 14255 - 1955, IS : 398 (Part - IV) 1994, IS 8130 / 1984

- Measurement of insulation wall thickness;
- Measurement of diameter of each strand, overall outside dia & Cross Sectional Area of the conducting Part out of the finished product during pre-dispatch inspection.
- Thermal expansion test;
- Check of physical characteristics
- Tensile strength of individual wires of conductor.

■ High Voltage Test on drums immersed in water(apply voltage 3.5 KV AC for 5 min)

These tests should be carried out on one length from each production batch of the same sample.

The thickness of the insulation wall shall be measured on a piece removed from each end of the sample length. If either means or minimum values are not met, two further samples shall be removed at 0.5m from the end corresponding to the failed specimen. If these samples do not satisfy the mean and minimum thickness requirements, the test shall be deemed to have been failed.

The longitudinal projections used for phase identifications shall be ignored. The thermal expansion test need only be carried out on one core.

In relation to the tensile test, the tensile strength of the aluminum wires before stranding and that of the finished conductor shall comply with IEC:1089.

Test on the Catenary (messenger) Conductor

Breaking load, elongation and resistance tests shall be completed on the aluminum alloy catenaries conductor in accordance with the requirements of IS:398 (Part- IV)/1994 or IEC:1089.

Bending Test on a complete cable

This test shall be performed on a sample of completed cable. The sample shall be bent around a test mandrel at room temperature for at least one turn. It shall then be unwound and the process shall be repeated after turning the cable sample around its axis by 180°. This process shall be repeated twice more. There shall be no signs of breaking or cracking of the cable insulation during this test.

The diameter of the mandrel shall be:

10 (D+d)

here D = Actual diameter of the cable

(mm) d = Actual diameter of the conductor

(mm)

Rejection and Retests

Should any one of the test pieces first selected fail to pass the tests, two further samples from the same batch shall be selected for testing, one of which shall be from the length from which the original test sample was taken unless the length has been withdrawn by the supplier.

Should the test pieces from both of these additional samples satisfy the requirements of the tests, the batch represented by these samples shall be deemed to comply with the standard. Should the

test pieces from either of the two additional samples fail, the batch represented shall be deemed to have failed.

16.0 COMPLIANCE WITH SPECIFICATION:

The Aerial Bunched Cable shall comply in all respects with the requirements of this specification. However, any minor departure from the provisions of the specification shall be disclosed at the time of bidding in the Non-compliance Schedule of this document.

17.0 COMPLIANCE WITH REGULATIONS:

All the cables shall comply in all respects with the Indian Regulations and Acts in force. The cables and connections shall be designed and arranged to minimize the risk of fire and any damage, which might be caused in the event of fire.

18.0 Non-conforming Product

The Purchaser reserves the right for decisions regarding acceptance, modification or rejection of non-conforming items.

19.0 Inspection and Testing

The Purchaser or his authorized representative has free entry at all times, while work on the contract is being performed, to all parts of the manufacturer's works which concerns the processing of the cables ordered. The manufacturer shall afford the the purchaser or his authorized representatives without charge, all reasonable facilities to ensure that the cable being furnished is in accordance with these specifications.

The cables shall successfully pass all the type tests, routine tests & acceptance Tests referred to in the section on tests and those listed in the most recent edition of the standards given in the specification.

The Purchaser reserves the right to reject any of the cables if the test results do not comply with the values specified or with the date given in the Technical data schedule.

Type tests shall be carried out at an independent testing laboratory or at the manufacturer's works if such facilities are available and to be witnessed by the purchaser. The contractor, at no extra cost at the manufacturer's work shall carry out routine and Acceptance tests in presence of the Purchaser's representatives.

Type Test Certificates for the tests conducted earlier shall be submitted with the bid for evaluation. The requirements of additional type tests will be at the discretion of the Purchaser

The Purchaser may witness routine and type tests. In order to facilitate this, the contractor shall give the purchaser of 15days notice that the material is ready for inspection & testing. The

supplier shall extend all assistance to the representative of the Purchaser during his inspection & testing of samples at his works. The materials shall be dispatched only after approval of such Test Reports and issue of Despatch clearance by the Purchaser. However the Purchaser reserves the right to retest the materials after delivery at any NABL Accredited Testing Laboratory in case of any disputes regarding size & quality of supplied materials at a later date during guarantee period. The cost of such retesting shall be borne by the supplier.

All costs in connection with the testing, including any necessary retesting shall be borne by the Contractor, who shall provide the Purchaser with all the test shall have the right to select the samples for test and shall also have the right to ensure that the testing apparatus is correct. Measuring apparatus for routine tests shall be calibrated at the expense of the contractor at an approved laboratory and shall be approved by the purchaser before testing.

The Contractor shall be responsible for the proper testing of the materials supplied by sub-Contractor to the same extent as if the materials were completed or supplied by the contractor.

Any cost incurred by the Purchaser in connection with inspection or retesting as a result of failure of the equipment under test or damaged during transport or off loading shall be to the account of the Contractor.

The Contractor shall submit to the Purchaser three signed copies of the test Certificates, giving the results of the tests as required. No materials shall be dispatched until the Purchaser has received the test certificate and the contractor has been informed that they are acceptable.

The test certificate must show the actual values obtained from the tests, in the units used in this specification, and must merely confirm that the requirements have been met.

In the case of components for which specific type tests or routine tests are not given in this specification, the Contractor shall include a list of the tests normally required for these components. All materials used in the Contract shall withstand and shall be certified to have satisfactorily passed such tests.

No inspection or lack of inspection or passing by the Purchaser's representative of equipment or materials whether supplied by the Contractor or sub- Contractor, shall relieve the contractor from his liability to complete the contract works in accordance with contract or exonerate him from any of his guarantees.

20.0 GUARANTEE:

The contractor shall guarantee the following:

1. Quality and strength of materials used.
2. Satisfactory operation during the guarantee period of 24 months from the date of commissioning or 30 months from the date of receipt of the cables at SOUTHCO, whichever is earlier.

Performance figures as supplied by the bidder in the technical data sheet.

21.0 PACKING AND SHIPPING:

The cable shall be wound on strong drums or reels capable of withstanding all normal transportation and handing.

22.0 PERMANENT EMBOSSING:

All equipments and materials supplied/erected shall bear distinct mark of “ SOUTHCO and Purchase Order No & Date “by way of embossing/punching/casting etc. including other information mentioned in GTP. This should be clearly visible to naked eye.

GUARANTEED TECHNICAL PARTICULARS FOR LT XLPE AB CABLES

| Sl No | Description | 3X35 + 1X16 +1X25mm2 | To be submitted by the Bidders |
|--------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------|
| | | Requirement | |
| 1 | Ref. ISS / IEC followed | IS 14255/95, IS 398 Part IV | |
| 2 | Phase Conductor material / Insulation type | H2 / H4 E.C grade aluminium as per IS 8130/84 / XLPE insulation (IS 14255/95) | |
| 3 | Material of Neutral Catenary | Aluminum alloy as per IS 398 Pt - IV | |
| 4 | Voltage Class | 0.65/1.1 KV | |
| | No. of Strands of Phase Conductor | 7 | |
| 5 | No. of strands/ Average /Minimum Strand Dia. In mm. (Finished Phase conductor.) | 7/2.52 | |
| 6 | Approximate Overall Dia. Of compacted phase conductor after removal of insulation.(in mm.) | 7.0 | |
| 7 | No. Of Strands / Average Strand Dia. In mm. (Neutral Catenary.) | 7 / 2.15 | |
| 8 | Minimum Overall Dia. Of compacted Bare Neutral Catenary .(in mm.) | 6.0 | |

| | | | |
|----|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9 | No. Of Strands / Average strand dia. / Nomunal cross sectional area of conducting part In No / mm ² . (St. Light Conductor) | 7 /1.75 / 16mm ² | |
| 10 | Minimum average thickness of insulation of phase Cond. (mm) | 1.2 | |
| 11 | Minimum thickness of insulation of Phase Cond. At any point (mm) | 0.98 | |
| 12 | Minimum thickness of insulation at any point in street light conductor (mm) | 0.98 | |
| 13 | Maximum DC resistance of Phase conductor at 20 °C ohm/ KM | 0.868 | |
| 14 | Maximum DC resistance of street light conductor Ω / Km | 1.91 | |
| 15 | Maximum DC resistance of neutral cond.Ω / Km | 1.38 | |
| 16 | Ultimate tensile strength of neutral conductor (KN) | 7 | |
| 17 | Maximum temperature (Continuous) | 90°C for phase and 75 °C for neutral | |
| 18 | Embossing on insulation at each one meter interval | Distinct Non- erasable ISI Mark, IS 14255-95, Manufacturer"s B.I.S License No., Name of the Purchaser, Name of the manufacturer, Size of cable, voltage Grade along with sequential marking of length. | Distinct Non- erasable ISI Mark, IS 14255-95, Manufacturer"s B.I.S License No., Name of the Purchaser, Name of the manufacturer, Size of cable, voltage Grade along with sequential marking of length.. |
| 19 | Cable drum length | 500 m | 500 m |
| 20 | Volume Resistivity of insulation at 27°C | 1X10 ¹³ Ω - cm min. | 1X10 ¹³ Ω - cm min. |
| 21 | Volume Resistivity of insulation at 70°C | 1X10 ¹¹ Ω - cm min. | 1X10 ¹¹ Ω - cm min. |

N.B : 1) For values not available in relevant ISS, values indicated in our GTP/ Tender Specification shall be valid. In case of discrepancies between values of ISS & GTP, better will prevail. Average diameters of strands of each cable shall be ascertained by physical measurement after opening the strands of each phase of a finished AB Cable offered for inspection.

SOURCE OF MATERIALS/PLACES OF MANUFACTURE, TESTING AND INSPECTION

| Sl.No. testing | Item | Source of material | Place of manufacture | Place | of |
|-------------------|-------------------------------------------|--------------------|----------------------|-------|----|
| 1. | Lamination | | | | |
| 2. | Copper aluminium | | | | |
| 3. | Core plate | | | | |
| 4. | Steel castings | | | | |
| 5. | Tank | | | | |
| 6. | Radiators | | | | |
| 7. | Insulators | | | | |
| 8. | Cylinders | | | | |
| 9. | Insulation paper | | | | |
| 10. | Bushing HV/LV | | | | |
| 11. | Oil | | | | |
| 12. | Insulated winding wire | | | | |
| 13. | a) Tap changer b) Pressure relief vent | | | | |

SCHEDULE OF DEVIATION TECHNICAL

| Sl. No. | Requirements / Equipment | Specification Clause No. | Deviations | Remarks |
|---------|--------------------------|--------------------------|------------|---------|
| | | | | |
| | | | | |

