# **SOUTHERN POWER DISTRIBUTION COMPANY OF T.G. LIMITED HYDERABAD**

# **CE, Operation, Medchal Zone,**

# **Mint Compound, Hyderabad**

# tgspdcl.jpg

# **BID DOCUMENT**

**Name of the Work: "**Erection of 33/11KV Outdoor Sub-station at 2 X 8.0 MVA Power Transformer at **B.L Nagar** (Yadadri Colony) in Boduappl Municipal Corporation in Medipally Mandal in Boduppal section in Uppal Sub-Division in Keesara Division of Habsiguda Circle"**.**

**Specification No: CE/OP/Medchal Zone- 35/2024-25.**

Issued to Sri/Smt. M/s. ---------------------------------------------------------------

---------------------------------------------------------------

--------------------------------------------------------------

Chief Engineer/Operation,

Phone: 040 – 23431094 Medchal Zone, TGSPDCL,

Mint Compound, Hyderabad – 500004.

CONTENTS

1. **INVITATION FOR BIDS (IFB)**
2. **SECTION –1 INSTRUCTIONS TO BIDDERS (ITB)**
3. **SECTION –2: FORM OF BID, QUALIFICATION INFORMATION**

**AND LETTER OF ACCEPTANCE**

1. **SECTION-3: GENERAL CONDITIONS OF CONTRACT**
2. **SECTION-4: CONTRACT DATA**
3. **SECTION-5: TECHNICAL SPECIFICATIONS**
4. **SECTION-6: BILL OF QUANTITIES**
5. **SECTION-7: FORMS OF SECURITIES**

**Note:**

1. **“Payment terms, Bank Guarantee, Taxes & Duties” should be on line/DD with the Terms and Conditions of the specification. If any bidder does not meet any one of the Conditions, such tender will not be considered.**

**The bidder shall submit the tender ONLINE with the Terms & Conditions of the specification.**

1. **The bidders shall check the** [www.tgsouthernpower.org](http://www.tgsouthernpower.org) / [www.tender.telangana.gov.in](http://www.tender.telangana.gov.in)

**For amendments, if any, up to one day prior to the date of tender opening. The amendments shall be binding on the bidders.**

**Chief Engineer/Operation,**

**Medchal Zone**, **TGSPDCL**

Ph**one: 040-23431094**

**SOUTHERN POWER DISTRIBUTION COMPANY OF T.G LTD “ELECTRICITY SAVED is ELECTRICTY PRODUCED”**

**1 INVITATION FOR BIDDERS (IFB):**

On line Bids are invited through e-procurement plat form in accordance with Local Competitive procedures from eligible Bidders who have experience in

1. Construction of Division Office building (OR) related work experience.

**(b)** The works are executed on turnkey basis as specified by TGSPDCL. Interested and eligible Bidders may participate Online through e-procurement only and obtain further information in respect of Bid Documents at the office of the Chief Engineer, **Medchal Zone**, TGSPDCL, Mint Compound Gr. Hyderabad.

**(c)** A complete set of Bidding Documents may be downloaded from [**www.tender.telangana.gov.in**](http://www.eprocurement.gov.in) **at free of cost.** Those who interested to submit bids will have to register in the above mentioned site and also have to obtain Digital Certificates. The details and procedure for obtaining digital certificate are mentioned in the website or contact the helpdesk for the site.

Interested bidders shall upload/quote their bid on line through e-procurement plat form only on or before the Schedule **time** with Bid security amount specified for the work in the Annexure payable at Hyderabad from any Nationalized Banks/Scheduled Banks in favor of **TGSPDCL, Hyderabad** Other details can be obtained through[**www.tender.telangana.gov.in**](http://www.eprocurement.gov.in)OR[**www.tgsouthernpower.org**](http://www.tgsouthernpower.org)**.** Xerox Copies of relevant certificates shall be uploaded wherever necessary.

**(d)** TGSPDCL reserves right to accept or reject or cancel any or all tenders received without assigning any reasons.

**Chief Engineer/**Operation,

**Medchal Zone**, TGSPDCL

Ph**one: 040-23431094**

# **SOUTHERN POWER DISTRIBUTION COMPANY OF T.G LIMITED HYDERABAD**

**Specification No: CE/OP/Medchal Zone- 35/2024-25**

|  |  |  |  |
| --- | --- | --- | --- |
| **1.** | **Name of the work** | : | Erection of 33/11KV Sub-station at 2 X 8.0 MVA Power Transformer at **B.L Nagar** (Yadadri Colony) in Boduappl Municipal Corporation in Medipally Mandal in Boduppal section in Uppal Sub-Division in Keesara Division of Habsiguda Circle. |
| **2.** | **Scheduled Amount of tender (ECV)** | : | **Rs. 2,02,02,299/-** |
| **3.** | **Period of completion of work** | : | As per the time line in Clause No:35 |
| **4.** | **Issue of Tender Schedule** | : | The bidders need to register on the electronic procurement market place of Government of T.S. that is [www.tender.telangana.gov.in](http://www.tender.telangana.gov.in). On registration on the e-procurement market place they will be provided with a user ID and password by the system using which they can submit their bids on line. |
| **5.** | **Bid Downloading Start Date & Time** | : | **09.01.2025 from 14:00 hrs.** |
| **6.** | **Bid Downloading End Date & Time** |  | **20.01.2025 from 14:00 hrs** |
| **7.** | **Last Date for Submission of Hard copies** | : | **21.01.2025 from 14:00 hrs.** |
| **8.** | **Tech Bid Opening Date & Time** |  | **21.01.2025 from 14:30 hrs.** |
| **9** | **2% of Bid Security to be paid along with Tender** |  | **Rs. 4,04,046/-** |
| **10** | **Transaction Fee Payable** | : | As specified by the TSTS department |

All Bidders shall hand over the originals for Bid Security payments and uploaded Documents to the Chief Engineer/Operation/Medchal Zone/TGSPDCL, Mint Compound, Hyderabad authorized representative directly or through his agent or by registered post or by courier service so as to reach on 21.01.2025 on or before at 14:00 Hrs after opening of the tender.

|  |  |  |
| --- | --- | --- |
| **Notice Inviting Bid Details** | | |
| **S. No** | **Description** |  |
| 1 | Department Name | TGSPDCL |
| 2 | Office | Chief Engineer/ Operation/ Medchal Zone / TGSPDCL. |
| 3 | Bid Number | **Tender Specification No: CE/OP/MDCL Zone - 35/2024-25** |
| 4 | Name of the Work | Erection of 33/11KV Sub-station at 2 X 8.0 MVA Power Transformer at **B.L Nagar** (Yadadri Colony) in Boduappl Municipal Corporation in Medipally Mandal in Boduppal section in Uppal Sub-Division in Keesara Division of Habsiguda Circle. |
| 5 | Work completion Schedule | As per the time line in Clause No:35 |
| 6 | Type of Bid | e-tender |
| 7 | Bid Category | Open tender |
| 8 | Bid Security (INR) | **Rs. 4,04,046/- (Excluding 18% GST for DD/BG/Online)** |
| 9 | ECV amount | **Rs. 2,02,02,299/-Excluding GST 18%)** |
| 9 | Bid Security Payable to | In the form of Demand Draft/Bank Guarantee in favor of TGSPDCL payable at Hyderabad, from any Scheduled/Nationalized Banks. |
| 10 | **Transaction** Fee | **Transaction Fee**: All the participating Bidders who submit, have to pay an amount @ 0.03% of their final Bid value online a cap of Rs.10,000/- for quoted value of work up to Rs.50 Cores Rs. 25000/- if the purchase value is above Rs.50 crores& services applicable as levied by Govt. of India on transaction fee the online to the agency specified by TGTS department and the same amount is non refundable.  **Corpus Fund**: Successful Bidder has to pay an amount of 0.04% on quoted value through demand draft in favour of Managing Director TGTS, Hyderabad towards corpus fund at the time of conclusion of agreement. |
| 11 | **Transaction** Fee Payable to | As specified by TGTS department |
| 12 | Bid submission closing date & time (for uploading) | **20.01.2025 , 14:00 hrs** |
| 13 | Bid Submission | On line |
| 14 | Technical Bid opening date & time | **21.01.2025 , 14:00 hrs.** |
| Price Bid opening date & time | **23.01.2025 , 14:30hrs.** |
| 15 | Place of Tender Opening | Chief Engineer/Operation/ Medchal Zone/TGSPDCL/Mint Compound, Gr. Hyderabad – 500004 |
| 16 | Officer Inviting Bids/Contact Person | Chief Engineer /Operation/Medchal Zone/TGSPDCL/Mint Compound, Hyderabad – 500004 |
| 17 | Address | O/o the Chief Engineer /Operation/ Medchal Zone/TGSPDCL/ Mint Compound, Hyderabad -500004 |
| E-mail Id | [**cgm\_op\_medchal@tgsouthernpower.org**](mailto:cgm_op_medchal@tgsouthernpower.org) |
| 18 | Contact Details/Telephone, Fax | Office Tele. Ph .No/ Fax No 23431094 |
| 19 | Procedure for Bid Submission | 1. Bids shall be submitted online on [**www.tender.telangana.gov.in**](http://www.tender.telangana.gov.in) platform.  2.The participating Bidders in the Bid should register themselves free of cost on e-procurement platform in the website [**www.tender.telangana.gov.in**](http://www.tender.telangana.gov.in)  3.Bidders can log-in to e-procurement platform in secure mode only by signing with the Digital certificates.  4.The Bidders who are desirous of participating in e-tendering shall submit their technical Bids, price Bids as per the standard formats available at the e-procurement platform.  5.The Bidders are requested to upload the document as mentioned below in online and submit the same as hard copies, so as to reach on or before **21.01.2025**, **14:00Hrs** otherwise the bidder will be declared as Disqualified. |

**Eligibility Criteria: Mandatory Conditions**

The Bidder shall upload all the mandatory Documentsduly attested by the Gazetted Officer in online. Further the mandatory documents namely **Self declaration, Litigation History, ON Hand works and Critical Equipment** are to be uploaded on Original letter heads with **self attestation** and need not to be attested by the Gazetted Officer and should submit the **EMD** in the form of DD/BG(Original) hard copy or if online payment is done the copy of the same shall be submitted as hard copy, on or before last date of bid submission, otherwise the bidder will be declared as disqualified.

|  |  |
| --- | --- |
| **S.No** | **Description** |
| **1** | **Financial Turn over**: The bidder should submit the financial turn over certificate of **50%** of Bid value **(i.e., Rs.1,01,01,150/-)** during any one Financial Year in the preceding **Seven Financial years** certified by Chartered Accountant. |
| **2** | Bid security: Valid Bid security @ 2% of ECV i.e., Rs. 4,04,046/- in the form of Online/Demand Draft/BG, DD in favor of TGSPDCL payable at Hyderabad & the Bidders may furnish a B.G in original in favour of Chief Engineer/Operation/Medchal zone/TGSPDCL duly mentioning the Specification No. of the bid & Name of the work from any Scheduled or Nationalized Banks & the validity should not be less than 135 days from the date of bid opening.  Note: Exemption of EMD for SC/ST Category Reserved tenders, as per T.O.O. (CE/Civil) Ms. No. 511, Dt. 03-01-2020 & SP.O.O. (Projects) Ms.No.521, Dt.24-06-2020  i. Exemption of EMD shall be for the works costing up to 1.00 crore (ECV).  ii. However, in order to provide level playing field to all, EMD will be recovered from running bills after expenditure of 25% of the concerned works. This will also inculcate the responsibility for completion of the works. The Bonafideness of SC/ ST Contractors shall be considered based on the SC/ ST Certificate issued by the Mandal Tahasildar. |
| **3** | Liquid Assets/ Solvency Certificate not less than 20 % of Bid value (i.e., Rs.40,40,460/-) and should be issued by any scheduled bank or Nationalized bank not earlier than 12 Months prior to the date of bid opening. The TGSPDCL reserves the right where ever necessary to make queries with the bidders bankers. |
| **4** | **Electrical Experience:**  The Bidder should have executed the each prime quantities mentioned below or part thereof should be completed in any consecutive **24 Months** period during the **last 7 Financial Years.**   1. **25%** of **7.2KM** length of Stringing of 33 KV SCOH (or) DCOH line –**i.e., 1.8 KM.** 2. **25% of 980Mtrs** of Laying of 33KV UG Cable Single Run (or) Double Run – **i.e., 245Mtrs.** 3. **25%** of **7.6KM** length of Stringing of 11 KV SCOH (or) DCOH line – **i.e., 1.9 KM.**   **Note: (i)**The date of work commencement and completion along with Agreement No. should be invariably furnished in the certificates issued by the Engineer not below the cadre of Divisional Engineer**.(ii**)**If needed, 33 kV UG/OH experience may be considered against 11 KV UG/OH experience for the required route length of 11 KV UG/OH route length.**   1. **Substation**:   **(a)** As a prime contractor should have executed erection of **One 33/11KV Substation (OR)**  **(b)** As a prime contractor in the following Substation related works  **(i) Erection of 33KV Bay with 33KV VCB (Or) (ii) Erection of 11KV Bay with 11KV VCB**  **Note: (i)** If the Bidder posses later qualification as indicated (b) above, their Bids will be considered for award of one Outdoor SS Only **(ii)** For 33/11KV Indoor SS, erection of 33/11KV Outdoor or Indoor experience is required. |
| **5** | **Civil Technical Experience:**  The bidder should upload a copy of the experience certificate of **50% value of work** as prime contractor (in the same name) in a consecutive period of **24 months during the last 7 Financial years**. The work experience certificate should be issued by an Engineer not below the cadre of the **Executive Engineer**.   |  | | --- | | 1. **50% of 27.3** Cubic meters RCC **: i.e., 13.6 Cubic meters** | | 1. **50% of 3.1Tons** of Steel**: i.e., 1.5 Ton** | | 1. **50% of 100** Cubic meters of Brick Masonry**: i.e., 50 Cubic meters** | | 1. **50% of 1168** Square meter ofPlastering: i.e., **584** **Square meter** | |
| **6** | The Bidder has to submit the Goods and Services Tax (GST) Registration certificate. |
| **7** | The contractor shall have **valid A Grade Electrical Contractors** **license** from CEIG, Government of Telangana upto 33KV or above voltage grade. |
| **8** | Self declaration by the bidder in token of having gone through carefully and thoroughly all the terms and conditions mentioned in the Bid document and abide by all the terms and conditions clearly mentioning the name of work or specification no of the bid. |
| **9** | The Bidder should upload the copies of EPF/ESI registration certificates. |
| **10** | The Bidder should uploadthe information of **Litigation History** **on letter head**. |
| **11** | Bidders must submit the number of Substation works executing as on date of Bid submission. Bidders who have **On hand/ executing 3Nos. LOI/Agreement for erection of new 33/11kV SS including structure and connected 33kV & 11kV line works** in any of the TGSPDCL Zones (Masterplan, Rangareddy, Medchal & Rural) is not eligible to participate in the Bid. Further, substation works which are under site dispute & switching station SS will also be counted as on-hand. |
| **12** | **Critical Equipment:** For executing Sub Station and line works, the bidder shall submit a declaration certificate for the availability of CRITICAL EQUIPMENT either owned or leased such as ROLLERS, tractors, JCBs, Cranes, ropes, safety equipment with first aid kit, meggar, Tong tester, CHAIN PULLEY BLOCKS, welding machines, Drilling machines, gas cutters, concrete millers, Pin Vibrators, slab vibrators, RCC centering Equipment, Transport vehicles etc, as the case may be.**(**Note: Bidders without giving declaration for Cable Rollers & Pullying machines will be summarily rejected as the cable work must be carried out using rollers only). |
| **13** | Bidder should submit declaration of Qualification of key person/Site incharge with B.Tech/ Diploma in Electrical Engineering from Recognized Universities. |
| **14** | Copy of  **TGSPDCL Registration of the Vendor** |
| **15** | The bidder shall submit "**Willingness to provide Watch & Ward to the new Substation, till the Substation is made operational and handed over to Operation wing**". Further, the bidder is responsible for any theft of material in the substation till handing over of the SS to Operation wing. |

**Optional Documents**

|  |  |
| --- | --- |
| **16** | Firm Registration/ Registered Partnership deed in case of firm :Firm Registration/Registered Partnership deed in case of firm |
| **17** | Email address of the bidder :Bidder must furnish the email address for correspondence |
| **18** | PAN Card |
| **19** | Submission of Hard copies :The Bidder should submit the hard copy of all uploaded mandatory documents for verification. |
| **20** | **Supporting documents for Financial turnover :**  (i) The Bidder shall submit a copy of financial turnover in the preceding Seven financial years certified by Chartered Accountant.  (ii) The bidder shall submit the last seven financial years Profit & Loss statements, Balance sheets and Income tax return statements supporting the Financial Turnover certified by Chartered Accountant. |

**Note:** Contractors are requested to upload above relevant documents as per order mentioned in the above Eligibility Criteria.

SECTION -1

**INSTRUCTIONS TO BIDDERS (ITB)**

|  |  |  |  |
| --- | --- | --- | --- |
| INSTRUCTIONS TO BIDDERS | | | |
| **TABLES OF CLAUSES** | | | |
| **A. GENERAL** |  | **D. SUBMISSION OF BIDS** |  |
| 1. Scope of Bid  2. Source of Funds  3. Eligible Bidders  4. Qualification of the Bidder  5. Cost of Bidding  6. Site Visit  **B. BIDDING DOCUMENTS**  7. Content of Bidding Documents  8. Clarification of Bidding Documents  9. Amendment of Bidding documents  **C. PREPARATION OF BIDS**  10. Language of the Bid  11. Documents Comprising the Bid  12. Bid Prices  13. Currencies of Bid and Payment  14. Bid Validity  15. Bid Security  16. Alternative Proposals by Bidders  17. Format and Signing of Bid |  | 18. Sealing and Marking of Bids  19. Deadline for Submission of Bids  20. Late Bids  21. Modification and Withdrawal of Bids  **E. BID OPENING AND EVALUATION**  22. Bid Opening  23. Process to be Confidential  24. Clarification of Bids  25. Examination of Bids and Determination of Responsiveness  26. Correction of Errors  27. Evaluation and Comparison of Bids  **F. AWARD OF CONTRACT**  28. Award Criteria  29. Employer’s Right to Accept any Bid and to Reject any or all Bids.  30. Notification of Award & Signing of Agreement  31. Performance Security  32. Mode of payment  33. Corrupt or Fraudulent Practices  34. Quality assurance plan  35.**Time line for execution of substation and line works** |  |

**A. GENERAL**

1. **SCOPE OF BID**

The Bidders should submit Bids for the works detailed in the table given in IFB.

* 1. The successful Bidder shall be expected to complete the works by the intended completion date specified in the Contract data.

1. **SOURCE OF FUNDS**

**2.1** The work is being taken up by TGSPDCL presently.

1. **ELIGIBLE BIDDERS**
   1. This Invitation for Bids is **open to all** bidders.
   2. Any materials, equipment, and services to be used in the performance of the Contract shall have their origin in India.
   3. All Bidders shall provide in section 9, Forms of Bid and Qualification Information, a Statement that the Bidder is not associated, nor has been associated in the past, directly or indirectly, with the Consultant or any other entity that has prepared the design, specifications, and other documents fothe Project or being proposed as project Manager for the Contract. A firm that has been engaged by the Borrower to provide consulting services for the preparation or supervision of the works, and any of its affiliates shall not be eligible to Bid.
   4. Government-owned enterprises in the Employer’s country may only participate if they are legally and financially autonomous, operate under commercial law and are not a dependent agency of the Employer.
   5. Bidders who are under a declaration of ineligibility for corrupt and fraudulent practices issued by TGSPDCL in accordance with sub-clause 33 are not eligible.
2. **QUALIFICATION OF THE BIDDER**
   1. All Bidders shall provide in Section 9, Forms of Bid and Qualification Information, a preliminary description of proposed work method and schedule, including drawings and charts, as necessary.
   2. All Bidders shall include the following information and documents with their Bids in Section 9**compulsorily**. Otherwise the Bids will be evaluated based on the information available in the Bid.
3. Copies of original documents defining the constitution or legal status, place of registration, and principal place of business, written power of attorney of the signatory of the Bid to commit the Bidder.
4. Total monetary value of construction work performed for each of the last **seven years**.
5. Experience in works of a similar nature as specified in and size for each of the last seven years, and details of works under way or contractually committed; and clients who may be contacted for further information on those contracts;
6. Major items of construction equipment proposed to carry out the Contract;
7. Reports on the financial standing of the Bidder, such as profit and loss statements and auditor’s reports for the past seven years;
8. Evidence of adequacy of working capital for this contract (access to letters of credit and availability of other financial resources);
9. Authority to seek references from the Bidder’s bankers;
10. Performance certificate for the works executed shall be furnished.
11. The proposed methodology of construction, backed with their construction equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of achieving the completion of work as per milestones specified within the stipulated period of completion.
12. Financial turnover should be supported by Income Tax return submitted to the Income Tax Department by the contractor.

**4.3 C)**

**Note 1:Bidder should furnish** the **details of the workers to be engaged in the agreement of the subject work along with the breakup of wages** including EPF and ESI contribution individually, which forms the part of corresponding agreements as per the Employees Provident Fund & Miscellaneous Provisions Act, 1952 at the time of entering of agreement.

**Note 2:**

**i) To prevent the post implication complaints against standard of cable laying works, certain points are included in the schedule of works while awarding the cable laying contract and all the payments are subjected to fulfillment of the following points.**

**a. Video shoot of cable laying works which demonstrate the UG cable trench depth and jointing works.**

**b. GIS coordinates and tagging of starting of cable, joints of cable and ending of cable. Auto CAD drawings of cable path is to be maintained.**

**c. Smart RFID Markers (The Permanent marking system) for UG cables to identify the cable path at the time of repair/maintenance.**

**ii) “ Assigning Geo tagging to the proposed assets created” such as substations, HT lines, LT lines and release of service as mandatory condition in all the forthcoming works Agreements/Specifications with immediate effect**

* 1. Even though the Bidders meet the above qualifying criteria, they are subject to be **disqualified**

**and blacklisted** if they have:

1. made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and**/or**

b) record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completions or financial failures etc.

**4.5** All the materials to be utilized for the project should be subjected for inspection before dispatch. The Cost of the Inspection shall be borne by the Bidder. The contractor shall intimate the Employer, the bar chart for execution of works, enabling the CE/ Medchal Zone Plan/ TGSPDCL/Hyderabad to arrange for inspection of such works. The original invoices of purchases must be enclosed along with the bill for payment.

**4.6** The Bidders have to furnish an undertaking in the prescribed format given in Section-9 disclosing their **relationship** with the officers/Chief Engineers of TRANSCO/ DISCOM failing which the tenders will be rejected. Any false information furnished in the declaration will render the contract liable for termination as well as recovery of damages.

**4.7** Notwithstanding anything stated above the Employer reserves the right to assess capability and capacity of the Bidder to successfully execute the work covered under the package within stipulated completion period. This assessment shall inter-alia include (i) document verification (ii) Bidder’s work/ manufacturing facilities (iii) manufacturing capacity, details of work executed, works on hand, anticipated in future in addition to the works involved in present Bid (iv) details of plant and machinery, manufacturing and testing facilities, manpower and financial resources (v) details of quality systems in place (vi) past experience and performance (vii) customer feedback (viii) banker’s feedback etc.

**5. COST OF BIDDING**

5.1 The Bidder shall bear all costs associated with the preparation and submission of the Bid, and the Employer shall in no case be responsible and liable for those costs.

**6. SITE VISIT**

**6.1** The Bidder, at the Bidder’s own responsibility and risk is required to visit & examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder’s own expense.

**B. BIDDING DOCUMENTS**

**7. CONTENT OF BIDDING DOCUMENTS**

**7.1** The set of Bidding documents comprises the documents listed in the table below and addenda issued in accordance with Clause 9.

Section Invitation for Bids

1. Instruction to Bidders
2. Qualification Requirement
3. Contract Data
4. General Conditions of Contract
5. Technical Specifications
6. Quality assurance plan
7. Schedule of quantities and prices
8. Safety Measures
9. Forms of Bid, Qualification Information and Forms of Securities

**8. CLARIFICATION ON BIDDING DOCUMENTS**

8.1 A prospective Bidder requiring any clarification of the Bidding documents may notify the Employer in writing or Email or Fax at the Employer’s address indicated in the invitation to Bid. The Employer will respond to any request for clarification, which he received earlier than 7 days prior to the deadline for submission of Bids. Copies of the Employer’s response will be forwarded to all prospective Bidders through e-procurement platform and also in TGSPDCL website, including a description of the enquiry but without identifying its source.

**9. AMENDMENT OF BIDDING DOCUMENTS**

**9.1** Before the deadline for submission of Bids, the Employer may modify the Bidding document by issuing addenda. The same will be communicated through e- procurement platform.

* 1. Any addendum thus issued shall be part & parcel of the Bidding document and shall be

communicated through e-procurement platform and also in TGSPDCL website.

* 1. To give prospective Bidders reasonable time in which addendum can be taken into account in preparing their Bids, the Employer shall extend as necessary deadline for submission of Bids, in accordance with Sub - Clause 19.2 and the same will be communicated through e-procurement platform.

C. PREPARATION OF BIDS

10. LANGUAGE OF THE BID

**10.1** All documents relating to the Bid shall be in the English language

**11. DOCUMENTS COMPRISING THE BID**

* 1. The Bid submitted by the Bidder shall comprise the following in sealed covers superscribing **Specification No., Bid security details, validity, Caste certificate** (in case bid reserved for specific community) etc. and these shall be placed in another sealed cover.

1. Bid Security as per clause 15 of ITB (Section-1)
2. Technical Bid information (in the format indicated in Section 9and any other materials required to be completed and submitted by Bidders in accordance with these instructions. The documents listed under Sections 3, 6 and 9 mentioned in Sub-Clause 7.1 of section-I shall be filled in without exception.

**12. BID PRICES**

* 1. The contract shall be for the whole works as described in Sub-Clause 1.1.
     1. **The Bidder has to quote his rate which shall be inclusive of all costs of inspection and testing of equipment/material by the nominated representative of the employer for each batch of equipment/material manufacture on e-procurement site.**
     2. **All duties, taxes and other levies payable by the contractor under the contract, or for any other cause are excluded from the estimated prices, the Bidder shall verify the correctness and quote his price.**

**12.2 N.A**

**12.3 Any variations in the statutory levies of taxes & duties shall be to the Bidder’s Account only.**

**12.4 The rates and prices quoted by the Bidder shall be firm.**

**12.4 The rates and prices quoted by the Bidder shall be firm.**

**13. CURRENCIES OF BID AND PAYMENT**

**13.1** In Indian Rupees only.

**14. BID VALIDITY**

* 1. Bids shall remain valid for a period not less than **Thirty days (30)** after the deadline date of Bid submission specified in Clause 19. **“A Bid valid for a shorter period shall be rejected by the Employer as non-responsive.”**
  2. In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the Bidders to extend the period of validity for a specified additional period. The request and the Bidder’s responses shall be made in writing or by **e-mail** or **FAX**. A Bidder may refuse the request without forfeiting his Bid security. A Bidder agreeing to the request will not be required or permitted to modify his Bid, but will be required to extend the validity of his Bid security for a period of the extension, and in compliance with Clause 15 in all respects.

**15. BID SECURITY**

**15.1** Bid security @ 2% of ECV in the form of Online/Demand Draft/BG, DD in favor of TGSPDCL payable at Hyderabad & the Bidders may furnish a B.G in original in favour of Chief Engineer/ ................../TGSPDCL duly mentioning the Specification No. of the bid & Name of the work from any Scheduled or Nationalized Banks & the validity should not be less than 135 days from the date of bid opening.

**(As per CGM/Fin Memo.No. 45/23, Dt.16-06-2023)**

**Note:**

**Exemption of EMD for SC/ST Category Reserved tenders, as per T.O.O. (CE/Civil) Ms. No. 511, Dt. 03-01-2020 & Sp.O.O. (Projects) Ms.No.521, Dt.24-06-2020**

**i. Exemption of EMD shall be for the works costing up to 1.00 crore (ECV).**

**ii. However, in order to provide level playing field to all, EMD will be recovered from running bills after expenditure of 25% of the concerned works. This will also inculcate the responsibility for completion of the works.**

**The Bonafideness of SC/ ST Contractors shall be considered based on the SC/ ST Certificate issued by the Mandal Tahasildar. Fax/photocopies of the Bid security will not be accepted and will be rejected. The fact of having enclosed bid security by DD/BG along with the Bid should be clearly super scribed on the Bid envelope.**

**.**

**15.2 Any security other than the type of Bid security mentioned above will not be accepted.**

15.3 Any Bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 15.1 and 15.2 above shall be rejected by the Employer as non-responsive.

* 1. The Bid Security of the unsuccessful Bidder shall be returned within 28 days of the

end of the Bid validity period specified in Sub-Clause 14.1.

**15.5** The Bid Security of the successful Bidder will be discharged when the Bidder has signed the Agreement and furnished the required performance Security.

**15.6** The Bid Security may be forfeited

1. if the Bidder withdraws the Bid after Bid opening during the period of Bid validity:
2. if the Bidder does not accept the correction of the Bid Price, pursuant to Clause 26; or
3. in the case of a successful Bidder, if the Bidder fails within the specified time limit to
4. sign the Agreement or
5. furnish the required performance Security.

**16. ALTERNATIVE PROPOSALS BY BIDDERS**

**16.1** Bidders shall submit offers that comply with the requirements of the Bidding documents, including the basic technical design as indicated in the drawing and specifications. Alternatives will not be considered.

**17. FORMAT AND SIGNING OF BID**

**17.1** The Bidder shall prepare one original and one copy of the documents comprising the Bid as described in Clause 11 of these Instructions to Bidders bound with the volume containing the Forms of Bid, and clearly marked “ORIGINAL” and “COPY” as appropriate. In the event of discrepancy between them, the original shall prevail.

* 1. The original and copy of the Bid shall be typed or written in indelible ink and shall

be signed by a person or person duly authorized to sign on behalf of the Bidder, pursuant to Sub-Clauses 4.4. All pages of the Bid where entries or amendments have been made shall be initialed by the person or persons signing the Bid.

* 1. The Bid shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the Bidder, in which case such corrections shall be initialled by the person or persons signing the Bid.
  2. The Bidder shall furnish information as described in the form of Bid on

Commissions or gratuities, if any, paid or to be paid to agents relating to this Bid and to contract execution if the Bidder is awarded the contract.

##### **D. SUBMISSION OF BIDS**

1. **SEALING AND MARKING OF BIDS**
   1. The Bidder shall seal the original and copy of the Bid in separate envelopes, duly marking the envelopes as “ORIGINAL” and “COPY”. These envelopes (called as inner envelopes) shall then be put inside one outer envelope.
   2. The inner and outer envelopes shall be addressed to the Employer at the following address:

**The Chief Engineer/ Operation,**

**Medchal Zone,**

**TGSPDCL, Mint Compound,**

**Hyderabad -500004**

and bear the following identification:

* Bid for System Improvement Project work in …………
* Bid security details
* Caste certificate if reserved category
* Bid Reference No.SKL (insert number)
* Do not open before (time and date for Bid opening, as per Clause 19)
  1. In addition to the identification required in Sub-Clause 18.2, the inner envelopes shall indicate the name and address of the Bidder to enable the Bid to be returned unopened incase it is declared late, pursuant to Clause 20

**18.4** If the outer envelope is not sealed and marked as above, the Employer shall assume no responsibility for the misplacement or premature opening of the Bid.

**19. DEADLINE FOR SUBMISSION OF THE BIDS**

**19.1** Bids (**Hard Copy of EMD**) must be received by the Employer at the address specified above not later than **12:00hrs on next working day of the** Bid Submission closing date as given in the notice inviting Bid details above.

In the event of the specified date for the submission of Bids declared a holiday for the Employer, the Bids will be received up-to the appointed time on the next working day.

**19.2** The Employer may extend the deadline for submission of Bids by issuing an amendment in accordance with Clause 9, in which case all rights and obligations of the Employer and the Bidders previously subject to the original deadline will then be subject to the new deadline.

1. **Late Bids**: Hard copies received after the specified date & time, prescribed in Clause 19 even though the Bidder uploads the Bid in the e-procurement platform will be summarily rejected.

**21. MODIFICATION AND WITHDRAWAL OF BIDS**

**21.1** Bidders may modify or withdraw their Bids by giving notice in writing before the deadline prescribed in Clause 19.

**21.2** Each Bidder’s modification or withdrawal notice shall be prepared, sealed, marked, and delivered in accordance with clause 17 & 18, with the outer and inner envelopes additionally marked “MODIFICATION” or “WITHDRAWAL” as appropriate.

**21.3** No Bid may be modified after the deadline for submission of Bids.

**21.4** Withdrawal or modification of a Bid between the deadline for submission of Bids and the expiration of the original period of Bid validity specified in Clause 14.1 above or as extended pursuant to Clause 14.2 may result in the forfeiture of the Bid security pursuant to Clause 15.

**21.5** Bidders may only offer discounts to, or otherwise modify the prices of their Bids by submitting Bid modifications in accordance with this clause are included in the original Bid submission.

### **E. BID OPENING AND EVALUATION**

**22. BID OPENING**

**22.1** The Employer will open all the Bids received (except those received late), including modification made pursuant to Clause 21, in the presence of the Bidders or their representatives who choose to attend at the time on the date and the place specified. In the event of the specified date of Bid opening being declared a holiday for the Employer, the Bids will be opened at the appointed time and location on the next working day.

**22.2** Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause 21 shall not be opened.

* 1. The Bidder’s names, the Bid prices, the total amount of each Bid and of any alternative Bid (if alternatives have been requested or permitted), any discounts, Bid modification and withdrawals, the presence or absence of Bid security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the time of Bid opening, Any Bid price, discount, or alternative Bid price which is not read out and recorded at Bid opening will not be taken into account in Bid evaluation.
  2. The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with Sub-Clause 22.3.

**23. PROCESS TO BE CONFIDENTIAL**

**23.1** Information relating to the examination, clarification, evaluation, and comparison of Bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any effort by a Bidder to influence the Employer’s processing of Bids or award decisions may result in the rejection of his Bid.

**24. CLARIFICATION OF BIDS**

**24.1** To assist in the examination, evaluation, and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakup of unit rates. The request for clarification andthe response shall be in writing or by cable, but no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 26.

**24.2** Subject to sub-Clause 24.1, no Bidder shall contact the Employer on any matter relating to its Bid from the time of the Bidding opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Employer, he should do so in writing.

* 1. Any effort by the Bidder to influence the Employer in the Bid evaluation, Bid comparison or contract award decisions may result in the rejection of the Bid.

**25. EXAMINATION OF BIDS AND DETERMINATION OF RESPONSIVENESS**

**25.1** Prior to the detailed evaluation of Bids, the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clause 3; (b) has been properly signed; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the Bidding documents.

* 1. A substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the Bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Bidding documents, the Employer’s rights or the Bidder’s obligations under the Contract, or (c) whose rectification would affects unfairly the competitive position of other Bidders presenting substantially responsive Bids.
  2. If a Bid is not substantially responsive, it will be rejected by the Employer, and may

not subsequently be made responsive by correction or withdrawal of the non-confirming deviation or reservation.

**26. CORRECTION OF ERRORS**

**26.1** Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:

1. Where there is a discrepancy between the rates in figures and in words, the rate in words will govern, and
2. Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity the unit rate as quoted will govern.
   1. The amount stated in the Bid will be adjusted by the Employer in accordance with

the above procedure for the correction of errors and with the concurrence of the Bidder, shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount the Bid will be rejected, and the Bid security may be forfeited in accordance with Sub-Clause 15.6 (b).

**27. EVALUATION AND COMPARISION OF BIDS**

* 1. The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause 25.
  2. In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid

Price by adjusting the Bids price as follows:

1. making any correction for errors pursuant to Clause 26; or
2. making an appropriate adjustment for any other acceptable variations, deviations andmaking appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub Clause 21.5
   1. The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Other factors which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Bid evaluation.
   2. If the Bid of the successful Bidder is **seriously unbalanced in relation to the**

**Engineer’sestimate** of the cost of work to be performed under the contract, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 31.1 increased at the expense of the successful Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

### **F. AWARD OF CONTRACT**

1. **AWARD CRITERIA**
   1. Subject to Clause 31, the Employer will award the Contract to the Bidder whose Bid

has been determined to be substantially responsive to the Bidding documents and who has offered the lowest evaluated Bid Price, provided that such Bidder has been determined to be (a)eligible in accordance with the provisions of Clause 3, (b)qualified in accordance with the provisions of clause 4.

**29.EMPLOYER’S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR**

**ALL BIDS**

* 1. Notwithstanding Clause 28, the Employer reserves the right to accept or reject any

Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer’s action.

* 1. Bidders who have on hand/ executing **3Nos. LOI/Agreement for erection of new 33/11kV SS including structure and connected 33kV & 11kV line works in any of the TGSPDCL Zones (MP, RR, Metro, Mater plan& Rural)**  is not eligible to participate in the Bid.Further, substation works which are under site dispute & switching station SS will also be counted as on-hand.

.

**30. NOTIFICATION OF AWARD AND SIGNING OF AGREEMENT**

* 1. The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid period by e-mail or by speed post. This letter (hereinafter in the Conditions of Contract called the “Letter of Intent”) will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the works by the contractor as prescribed by the Contract (hereinafter and in the Contract called the” Contract Price”).
  2. The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause 31 and signing of agreement.
  3. The contract agreement will incorporate all agreements between the Employer and the successful Bidder. It will be signed by the Employer and sent to the successful Bidder, within 28 days following the notification of award along with the Letter of Acceptance. The LOI will be sent to the successful bidder through email. The date of sending e mail will be taken as base date and the successful bidder will enter into agreement immediately. If the bidder fails to do so, the EMD will be forfeited.
  4. Upon the furnishing by the successful Bidder of the performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.
  5. **The Bidder shall produce TIN (Tax Payer Identification Number) before issue of Letter of Acceptance.**

1. **PERFORMANCE SECURITY**
   1. Immediately from the receipt of the Letter of Acceptance, the Successful Bidder shall deliver to the Employer a Performance Security in any of the forms given below for an amount equivalent to 5% of the Contract price plus additional security for unbalanced Bids:

- shall be valid until a date 28 day from the date of expiry of Defects Liability period and the additional security for unbalanced Bids shall be valid until a date 28days from the date of issue of the certificate of completion.

-form given in section-9 or

-Bank draft, in favour of **Chief Engineer/Operation/ Medchal Zone / TGSPDCL / Gr.Hyderabad payable at Hyderabad** drawn on any scheduled Bank/Nationalized Bank.

* 1. If the performance security is provided by the successful Bidder in the form of a Bank Guarantee, it shall be issued by a Nationalized Bank/Scheduled Bank and acceptable to the Employer.
  2. Failure of the successful Bidder to comply with the requirements of Sub-Clause 31.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security.
  3. If the rates quoted is less than 90% of the estimated rates, then the successful Bidder has to give full performance guarantee for the amount which is less by 90% in addition to 5% standard performance security.

**32.** **MODE OF PAYMENT:**

32.1 All payments shall be made on or after Ninety (90) days of receipt of contractor’s invoice complete in all respects and supported by the requisite documents and fulfillment of stipulated conditions, if any. All the payment shall be released to the contractor through the Banks by crediting to his account.

32.2 All invoices under the contract shall be raised by the contractor on TGSPDCL and all payments shall be made to the contractor by Chief Engineer/ Operation/Medchal Zone on behalf of TGSPDCL.

**33. CORRUPT OR FRAUDULENT PRACTICES.**

1. TGSPDCL Bidders/ Contractors/ Contractors observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, TGSPDCL:
2. Defines, for the purposes of this provision, the terms set forth as follows:
   * 1. “Corrupt Practice” means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the work awarding process or in contract execution, and
     2. “Fraudulent Practice” means a misrepresentation of facts in order to influence work awarding process or the execution of a contract to the detriment of the Employer and includes collusive practice among Bidders (prior to or after Bid submission) designed to establish Bid prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition.
3. Will reject a proposal for award if it determines that the Bidder recommended for award is involved in corrupt or fraudulent practices in competing for the contract in question.
4. Will declare a firm ineligible, either indefinitely or for a stated period of time, if it at any time the firm is engaged in corrupt or fraudulent practices in competing for, or in executing a Bank-financed contract.

**34. QUALITY ASSURANCE PLAN:**

34.1 The quality assurance plan of contractor shall be generally in accordance with ISO-9000/IS-14000. This information shall be furnished with his Bids as per section-6, failing which his Bid shall be liable for rejection.

1. **TIME LINE FOR EXECUTION OF SUB STATION AND LINE WORKS:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Phase - I (Erection of 33/11 KV Sub-Station yard & installation of PTR's, VCB's etc.,)** | | | | | | |
| **Progress of work** | **Start Day** | **End Day** | | **Duration** | |
| Advance material procurement at Site by construction wing | Immediate | 18.01.2025 | | 10 | Days |
| Site cleaning & levelling, Installation of borewell with pumpset | Date of LOI | 2days after LOI | | 2 | Days |
| **Progress of work** | **Start Day** | **End Day** | | **Duration** | |
| Construction of Fencing/Compound wall & Gate | After site cleaning | 10th day from LOI | | 8 | Days |
| Erection of infra structure | After site cleaning | 12Days from LOI | | 10 | Days |
| Construction of plinths of PTR's & VCB's and construction of retaining wall | After 12days of LOI date | 27th Day from LOI | | 15 | Days |
| 11KV lines and 33KV works (At least one source) | Date of LOI | 30days from LOI | | 30 | Days |
| Control cabling, commissioning, testing of 33/11 KV Sub-Station with temporary control room | 30days from LOI | 45days from LOI | | 15 | Days |
| **Phase - II (Construction of control room, compound wall, gates etc.,)** | | | | | | |
| **Progress of work** | **Start Day** | | **End Day** | **Duration** | |
| Construction of control room & facilities | 25th day from date of LOI | | 65days from LOI | 40 | Days |
| Miscellaneous Civil works | 25th day from date of LOI | | 65days from LOI | 40 | Days |

**Penalty :** Materials will be arranged as per the timelines specified in Clause (35) by the Department and if work is delayed for the reasons from contractor side, penalty will be imposed as per rules in vogue.

SECTION -2

**QUALIFICATION REQUIREMENT**

**QUALIFICATION REQUIREMENT**

**To qualify for award of the contract, each Bidder in his name as a prime contractorshould have in the last seven years the qualification requirement given in Clause No. 4.3 of Instructions to bidders as above.**

**SECTION 3**

**CONTRACT DATA**

##### CONTRACT DATA

**Item marked “N/A” do not apply in this Contract.**

The following documents are also part of the Contract:

Clause

###### Reference

* + - * + The Schedule of Operating and Maintenance Manuals (51)
        + The Schedule of Other Contractors (8)
        + The Schedule of Key Personnel (9)

The Borrower TGSPDCL (1.1)

Loan given by PFC. (1.1)

The above insertions should correspond to the information provided in the Invitation of Bids.

The Employer is

Name And Address :

The Chief Engineer

Medchal Zone, TGSPDCL,

Mint Compound, Hyderabad –500004.

**Name of authorized Representative**: Divisional Engineer/Construction/ Habsiguda Circle.

The Engineer is

**Name:** Assistant Divisional Engineer/Construction/ Habsiguda Circle.

**Address:** TGSPDCL/Hyderabad

The name and identification number of the Contract is Bid No.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Insert name and number as indicated in the Invitation for Bids (or Prequalification, if any) (1.1)

The Works consist of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Brief Summary, including relationship to other contracts under the Project)

The Start Date shall be Date of Handing over of site (1.1)

The Intended completion Date for the whole of

The Work is as per the time line in clause No:35

The following documents also part of the Contract: (2.3)

The Contractor shall submit a revised Program for the Works

immediately after delivery of the Letter of Acceptance. (25)

The Site Possession Dates shall be : (21)

Section 1}

Section 2} Within a month after entering into Agreement

Section 3}

The Site is located at ………………… (1)

And is defined in drawings Nos…………….

The Defects Liability Period is 180 days from the date of issue of completion certificate (32)

The minimum insurance cover for physical property, injury (41)

And death if Five (lakhs) per occurrence with the number of occurrences

Limited to four. After each occurrence, contractor will pay additional premium

Necessary to make insurance valid for four occurrences always.

The following events shall also be Compensation Events: (25)

1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The period between program updates shall be 30 days. (25)

The amount to be withheld for late submission of an updated Program shall be Rs.25000/-

(27)

The language of the Contract documents in English (3)

The law which applies to the Contract is the law of India (3)

The currency of the Contract is Indian Rupees. (43)

Institution whose arbitration procedures shall be used: (24)

The proportion of payments retained (retention money) shall be 5% from each bill subject to a maximum of 5 % of contract value (44)

The liquidated damages for the whole of the works are at Rs.0.05% on the estimated cost per day (amount) per day and that for the milestone are as under:

The maximum amount of liquidated damages for the whole of the works is ten percent of final contract price. (45)

SECTION – 4

**GENERAL CONDITIONS OF CONTRACT**

**GENERALCONDITIONS OF CONTRACT**

**TABLE OF CONTENTS**

|  |  |  |  |
| --- | --- | --- | --- |
| **A. GENERAL** | **Page**  **No.** | **C. QUALITY CONTROL** | **Page**  **No.** |
| 1. Definitions | 34 | 30. Identifying Defects | 40 |
| 2. Interpretation | 35 | 31. Tests | 40 |
| 3. Language and Law | 36 | 32. Correction of Defects | 40 |
| 4. Engineer’s Decisions | 36 | 33. Uncorrected Defects | 40 |
| 5. Delegation | 36 |  |  |
| 6. Communications | 36 | **D. COST CONTROL** |  |
| 7. Other Contractors | 36 | 34. Quantities and Prices | 41 |
| 8. Personnel | 36 | 35. Changes in the Quantities | 41 |
| 9. Employer’s & Contractor’s Risks | 36 | 36. Variations | 41 |
| 10. Employer’s Risks | 36 | 37. Payments for Variations | 41 |
| 11. Contractor’s Risks | 37 | 38. Cash Flow Forecasts | 42 |
| 12. Insurance | 37 | 39. Payment Certificates | 42 |
| 13. Site Investigation Reports | 37 | 40. Payments | 42 |
| 14. Queries about the Contract Data | 37 | 41. Compensation Events  42. Tax | 42  43 |
| 15. Contractor to Construct the Works | 37 | 43. Currencies | 43 |
| 16. The Works to be completed  by the Intended Completion Date | 37 | 44. Retention  45. Liquidated Damages | 43  43 |
| 17. Approval by the Engineer | 38 | 46. Securities | 44 |
| 18. Safety | 38 | 47. Cost of Repairs | 44 |
| 19. Discoveries | 38 |  |  |
| 20. Possession of the Site | 38 | **E. FINISHING THE CONTRACT** |  |
| 21. Access to the Site | 38 |  |  |
| 22. Instructions | 38 | 48. Completion | 44 |
| 23. Disputes | 38 | 49. Taking Over | 44 |
| 24. Procedure for Disputes | 38 | 50. Final Account | 44 |
|  |  | 51. Operating and Maintenance Manuals | 45 |
| **B. TIME CONTROL** |  | 52. Termination  53. Payment upon Termination | 45  46 |
| 25. program | 39 | 54. Property | 46 |
| 26. Extension of the Intended Completion Date | 39 | 55. Release of Performance | 46 |
| 27. Delays Ordered by the Meetings | 39 | 56.Suspension of loan or credit by Financier | 46 |
| 28. Management Meetings | 39 | **F. SPECIAL CONDITIONS OF CONTRACT** | 47 |
| 29. Early Warning | 40 |  |  |

**F. SPECIAL CONDITIONS OF CONTRACT**

**TABLE OF CONTENTS**

|  |  |
| --- | --- |
| **S. NO.** | **ITEM** |
| 1. | DESCRIPTION |
| 1.1A | RESPONSIBILITY FOR EXECUTION OF THE CONTRACT |
| 1.1B | NOTICES |
| 2. | WORKING HOURS |
| 3. | EXTRA SHIFTS AND OVER TIME WORK |
| 4. | ACCIDENTS |
| 5. | INDEMNITIES |
| 6. | LICENSE |
| 7. | TRANSPORT ARRANGEMENT |
| 8. | MACHINERY TOOLS AND TACKLES |
| 9. | SAFETY PRECAUTIONS |
| 10. | FIRE PRECAUTIONS |
| 11. | WORKING AREA AND CLEANLINESS |
| 12. | SITE DISCIPLINE |
| 13. | SITE OFFICE AND SITE STORES |
| 14. | APPROVAL OF INSTALLATION BY GOVERNMENT  AUTHORITIES (CEIG) |
| 15. | MEASUREMENT OR WORK |
| 16. | INCOME TAX |
| 17. | TERMINATION OF CONTRACT FOR BOARDS CONVENIENCE |
| 18. | LABOUR |
| 19. | COMPLIANCE WITH LABOUR REGULATIONS |
| 20. | ARBITRATION |
| 21. | RESPONSIBILITY FOR EXECUTION OF THE CONTRACT |

**CONDITIONS OF CONTRACT**

##### **GENERAL**

1. **DEFINITIONS**
   1. Terms which are defined in the Contract Data are also defined in the Conditions of contract but keep their defined meanings. Capital initials are used to identify defined terms.

Compensation Events are those defined in Clause 41 hereunder.

The Completion Date is the date of completion of the Works as certified by the Engineer in accordance with Clause 48

The Contract is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.3 below.

The Contract Data defines the documents and other information, which comprise the Contract.

The Contractor is a person or corporate body whose Bid to carry out the Works has been accepted by the Employer.

The Contractor’s Bid is the completed Bidding documents submitted by the Contractor to the Employer.

The Contract Price is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; months are calendar months.

A defect is any part of the Works not completed in accordance with the Contract.

The Defects Liability period is the period named in the Contract Data and calculated from the Completion Date.

The Employer is the party who will employ the Contractor to carry out the Works.

The Engineer is the person named in the Contract Data (or any other competent person appointed and notified to the contractor to act in replacement of the Engineer) who is responsible for supervising the Contractor, administering the Contract, certifying payments due to the Contractor, issuing and valuing variations to the contract, awarding extensions of time, and valuing the Compensation Events.

Equipment is the Contractor’s machinery and vehicles brought temporarily to the Site to construct the Works.

The initial Contract Price is the Contract Price listed in the Employer’s Letter of Acceptance.

Charging Date: It is the date on which all the works awarded are completed in full shape and handed over to the Employer or the Engineer.

The Intended Completion Date is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Engineer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works, which is to have a mechanical, electrical, electronic or chemical or biological function.

The Site is the area defined as such in the Contract Data.

Site Investigations Reports are those which were included in the Bidding documents and are factual interpretative reports about the surface and sub-surface conditions at the site.

Specifications mean the Specification of the Works included in the Contract and any modification or addition made or approved by the Engineer.

The Start Date is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

Temporary Works are works designed, constructed, installed, and removed by the Contractor, which are needed for construction or installation of the Works.

A Variation is an instruction given by the Engineer, which varies the Works.

The Works are what the Contract requires the contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

1. **INTERPRETATION**
   1. In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Engineer will provide instructions clarifying queries about the Conditions of Contract.
   2. If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the works (other than references to the Completion Date and Intended Completion date for the whole of the Works).
   3. The documents forming the Contract shall be interpreted in the following order of priority:
2. Agreement
3. Letter of Acceptance, notice to proceed with the works
4. Contractor’s Bid
5. Contract Data
6. Conditions of Contract
7. Specifications
8. Drawings
9. Price Bid document where quantities and their estimated values are mentioned.
10. Any other document listed in the Contract Data as forming part of the Contract.
11. Amendments/ Pre-Bid decision, if any.

**3. LANGUAGE AND LAW**

* 1. The language of the Contract and the law governing the Contract are stated in the Contract Data.

**4. ENGINEERS DECISIONS**

4.1 Except where otherwise specifically stated, the Engineer will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

1. **DELEGATION**
   1. The Engineer may delegate any of his duties and responsibilities to other people except to the Adjudicator after notifying the Contractor and may cancel any delegation after notifying the contractor.
2. **COMMUNICATIONS**
   1. Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

**7 OTHER CONTRACTORS**

7.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors. The Contractor shall as referred in the Contract data, also provide facilities and services for them as described in the Schedule. The employer may modify the schedule of other contractor and shall notify the contractor of any such modification.

**8. PERSONNEL**

* 1. The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the Contract Data to carry out the functions stated in the Schedule to other personnel approved by the Engineer. The Engineer will approve any purposed replacement of Key personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.
  2. If the Engineer asks the Contractor to remove a person who is a member of the Contractor’s staff or his work force stating the reasons the Contractor shall ensure that the person leaves the site within seven days and has no further connection with the work in the Contract.

**9. EMPLOYER’S AND CONTRACTORS RISKS**

9.1 The Employer carries the risks which this Contract states are Employer’s risks, and the Contractor carries the risks which this Contract states are Contractor’s risks.

1. **EMPLOYER’S RISKS**
   1. The Employer is responsible for the exceptional risks which are (a) in so far as they directly affect the execution of the Works in the Employer’s country, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor’s employees), and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive, or (b) a cause due solely to the design of the Works, other than the Contractor’s design.
2. **CONTRACTOR’S RISKS**
   1. All risks of loss of or damage to physical property and of personal injury and death, which arise during and in consequence of the performance of the Contract and other than excepted risks, are the responsibility of the Contractor.
3. **INSURANCE**
   1. The Contractor shall provide, **in the joint names of the Employer and the Contractor**, insurance cover from the start Date to the end of the Defects Liability Period, in the amounts and deductibles stated in the Contract Data for the following events which are due to the Contractor’s risks:
4. Loss of or damage to the Works, Plant and Materials;
5. Loss of or damage to Equipment
6. Loss of or damage of property (except the Work, Plant, Materials and Equipment) in connection with the Contract; and
7. Personal injury or death.
   1. Policies and certificates for insurances shall be delivered by the Contractor to the Engineer for the Engineer’s approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.
   2. If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.
   3. Alterations to the terms of insurance shall not be made without the approval of the Engineer.
   4. Both parties shall comply with any conditions of the insurance policies.
8. **SITE INVESTIGATION REPORTS**
   1. The Contractor, in preparing the Bid, shall rely on any site Investigation Reports referred to in the Contract Data, supplemented by any information available to the Bidder.
9. **QUERIES ABOUT THE CONTRACT DATA**
   1. The Engineer will clarify queries on the Contract Data.
10. **CONTRACTOR TO CONSTRUCT THE WORKS**
    1. The Contractor shall construct and install the Works in accordance with the Specifications and Drawings.
11. **THE WORKS TO BE COMPLETED BY THE INTENDED COMPLETION DATE**
    1. The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor as updated with the approval of the Engineer and complete them by the intended completion Date.
12. **APPROVAL BY THE ENGINEER**
    1. The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Engineer, who is to approve them if they comply with the Specifications and Drawings.
    2. The Contractor shall be responsible for design of Temporary Works.
    3. The Engineer’s approval shall not alter the Contractor’s responsibility for design of the Temporary Works.
    4. All Drawings prepared by the Contractor for the execution of the temporary or permanent Works are subject to prior approval by the Engineer before their use.
13. **SAFETY**
    1. The Contractor shall be responsible for the safety of all activities on the Site.
14. **DISCOVERIES**
    1. Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Engineer of such discoveries and carry out the Engineer’s instructions for dealing with them.
15. **POSSESSION OF THE SITE**
    1. The Employer shall give possession of all parts of the Site to the Contractor by the date stated in the Contract Data, for execution of works.
16. **ACCESS TO THE SITE**
    1. The Contractor shall allow the Engineer and any person authorized by the Engineer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured/fabricated/assembled for the works.
17. **INSTRUCTIONS**
    1. The Contractor shall carry out all instructions of the Engineer which comply with the applicable laws where the Site is located.
    2. The Contractor shall permit the bank to inspect the Contractor’s accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the Bank, if so required by the Bank.
18. **DISPUTES**
    1. If the Contractor believes that a decision taken by the Engineer was whether outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred **to theArbitrator within 14 days of the notification of the Engineer’s decision**.
19. **PROCEDURE FOR DISPUTES**
    1. The arbitration shall be conducted in accordance with the arbitration procedure published by the institution named and, in the place, shown in the Contract Data.

**B. TIME CONTROL**

1. **PROGRAM**
   1. **The Bidder should prepare the month wise programme schedule to complete the proposed work with in specified time line and submit along with the Bid. The Bidder must invariably stick on to the programme submitted, if contract is awarded. No deviations will be entertained in this regard. The schedule programme submitted by the Bidder will also be considered as part and part of the agreement.**
   2. Within the time stated in the Contract Data the Contractor shall submit to the Engineer for approval a program showing the general methods, arrangements, order, and timing **for all the activities in the Works along with monthly cash flow forecast.**
   3. An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.
   4. The Contractor shall submit to the Engineer, for approval, an updated program at intervals no longer than the period stated in the Contract Data. If the Contractor does not submit an updated program within this period, the Engineer may withhold the amount stated in the Contract Data from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue program has been submitted.
   5. The Engineer’s approval of the Program shall not alter the Contractor’s obligations. The Contractor may revise the Program and submit it to the Engineer again at any time. A revised Program is to show the effect of variations and Compensations Events.
2. **EXTENSION OF THE INTENDED COMPLETION DATE**
   1. The Engineer shall extend the Intended Completion Date if a Compensation Event occurs or a variation is issued which makes it impossible for Completion to be achieved by the intended Completion Date without the Contractor taking steps to accelerate the remaining work and which would cause the Contractor to incur additional cost.
   2. The Engineer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Engineer for a decision upon the effect of a Compensation Event or variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with delay, the delay by this failure shall not be considered in assessing the new intended Completion Date.
3. **DELAYS ORDERED BY THE MEETINGS**
   1. The Engineer may instruct the Contractor to delay the start or progress of any activity within the Works.
4. **MANAGEMENT MEETINGS**
   1. Either the Engineer or the Contractor may require the other to attend management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.
   2. The Engineer shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for

actions to be taken is to be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attend the meeting.

1. **EARLY WARNING**
   1. The Contractor is to warn the Engineer at the earliest opportunity of specific likely future events of circumstances that may adversely affect the quality of the work, increase the Contract Price or delay the execution of works. The Engineer may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate is to be provided by the Contractor as soon as reasonably possible.
   2. The Contractor shall cooperate with the Engineer in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Engineer.

**C.QUALITY CONTROL**

1. **IDENTIFYING DEFECTS**
   1. The Engineer shall check the Contractor’s work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor’s responsibilities. The Engineer may instruct the Contractor to search for a Defect and to uncover and test any work that the Engineer considers may have a Defect.
   2. TheEngineer concerned of the department shall counter check the quality of work before taking over the works prior to charging apart from this, a 3rd party inspection shall be done (other than department).
2. **TESTS**

If the Engineer instructs the contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

31.1 **PREDISPATCH INSPECTION OF MATERIALS and TESTS for Galvanized towers**

31.2.a The material has to be certified before dispatch of materials to the site by field Engineer not below the rank of Divisional Engineer.

31.2.b The steel used for the fabrication of towers should be procured from ISI trade mark companies such as Tata steel, sail steel, vizag steel , Jindal steel, etc. to be certified by the field Engineer not below the rank of Divisional Engineer.

1. **CORRECTION OF DEFECTS**
   1. The Engineer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability period shall be extended for as long as Defects remain to be corrected.

32.2 Every time notice of a Defect is given; the Contractor shall correct the notified defect within the length of time specified by the Engineer’s notice.

**33 UNCORRECTED DEFECTS**

33.1 If the Contractor has not corrected a Defect within the time specified in the Engineer’s, the Engineer will assess the cost of having the Defect corrected, and the Contractor will pay this amount and it will be recovered from his future bills.

**D.COST CONTROL**

1. **QUANTITIES AND PRICES**
   1. The schedule-A (price Bid) shall contain quantities covered under all items for the supply, construction, installation, testing, and commissioning work to be done by the Contractor.
   2. The schedule-A (price Bid) is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the schedule-A (price Bid) for each item accordingly, for the actual executed quantity only.

**35 CHANGES IN THE QUANTITIES**

35.1 If the final quantity of the work done differs from the quantity in the Schedule-A for the particular item by more than 25 percent provided the change not exceeds 1% of Initial Contract Price, the Engineer shall adjust the rate to allow for the change.

* 1. The Engineer shall not adjust rates from changes in quantities if thereby the initial Contract Price is exceeded by more than **10** percent, except with the Prior approval of the Employer.
  2. If requested by the Engineer, the Contractor shall provide the Engineer with a detailed cost break up of any rate in the schedule-A, or cost data.

**36 VARIATIONS**

36.1 All variations shall be included in updated program produced by the Contractor.

**37 PAYMENTS FOR VARIATIONS**

37.1 The Contractor shall provide the Engineer with a quotation for carrying out the Variation when requested to do so by the Engineer. The Engineer shall assess the quotation, which shall be given within seven days of the request or within any longer period stated by the Engineer and before the Variation is ordered.

* 1. If the work in the Variation corresponds with an item description in the schedules and if, in the opinion of the Engineer, the quantity of work above the limit stated in Sub Clause 35.1 or the timings of its execution do not cause the cost per unit of quantity the rate in the schedule-A shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the schedules, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.
  2. Out of the Rate/Unit & lump sum rates the contractor shall be paid for the lowest price i.e. which ever is less.
  3. If the Contractor’s quotation is unreasonable, the Engineer may order the variation and make a change to the Contract Price, which shall be based on Engineer’s own forecast of the effects of the Variation on the Contractor’s costs.
  4. If the Engineer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as Compensation Event.

1. **CASH FLOW FORECASTS**
   1. When the Program is updated, the Contractor is to provide the Engineer with an updated cash flow forecast.
2. **PAYMENT CERTIFICATES**
   1. The Contractor shall submit to the Engineer monthly statements of the estimated value of work completed less the cumulative amount certified previously.
   2. The Engineer shall check the Contractor’s monthly statement within 14 days and certify the amount to be paid to the Contractor after taking into account any credit or debit for the month in question in respect of materials for the works in the relevant amounts.
   3. The value of work executed shall be determined by the Engineer.
   4. The value of work executed shall comprise the value of the quantities of the items in the schedule-A completed.
   5. The value of work executed shall include the valuation of Variations and Compensation Events.
   6. The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
3. **PAYMENTS**
   1. Payments shall be adjusted for deductions, retention and other recoveries in terms of

the contract and deduction at source of taxes as applicable under the law. The Employer shall

pay the Contractor the amounts certified by the Engineer on or after 30 days of the date of each certificate.

* 1. **Items of the Works for which no rate or price has been entered, it will not be paid for by the Employer and shall be treated as deemed to be covered by other rates and prices in the Contract.**

1. **COMPENSATION EVENTS**
   1. The following are Compensation Events unless they are caused by the Contractor:
2. The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.
3. The Employer modifies the schedule of other contractors in a way, which affects the work of the contractor under the contract.
4. The Engineer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.
5. The Engineer instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects.
6. Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of Letter of Acceptance from the information issued to Bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.
7. The Employer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or addition works required for safety or other reasons.
8. Other contractors, public authorities, utilities or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.
9. The effect on the Contractor of any of the Employer’s Risks.
10. The Engineer unreasonably delays issuing a Certificate of Completion.

(j) Other Compensation Events listed in the Contract Data or mentioned in the Contract if any.

* 1. If a Compensation Event would cause additional cost or would prevent the work being completed before the intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Engineer shall decide whether and by how much the Contract Price shall be increased and whether by how much the Intended Completion Date shall be extended.
  2. As soon as information demonstrating the effect of each Compensation Event upon the Contractor’s forecast cost has been provided by the Contractor, it is to be assessed by the Engineer and the Contract Price shall be adjusted accordingly. If the Contractor’s forecast is deemed unreasonable, the Engineer shall adjust the Contract Price based on Engineer’s own forecast. The Engineer will assume that the Contractor will react competently and promptly to the event.
  3. The Contractor shall not be entitled to compensation to the extent the Employer’s interest are adversely affected by the Contractor not having given early warning or not having cooperated with the Engineer.

1. **TAX**
   1. Goods and services tax (GST) as applicable **(prevailing now and applicable as and when amended)**
2. **CURRENCIES**
   1. All payments shall be made in Indian Rupees.

**44. RETENTION**

44.1 The Employer shall retain 10% from each payment due to the Contractor as stated in the Contract Data, subject to a maximum of 5% of contract value.

44.2 On Completion of the whole of the Works and on submitting all Operation and Maintenance Manuals, 50% of the total amount retained is returned to the Contractor and balance 50% after Defects Notice Period and the Employer has certified that all Defects notified by him to the Contractor before the end Defect Liability period have been corrected.

**45. LIQUIDATED DAMAGES**

45.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the contract Data until Completion of the whole of the Works.

45.2 On completion of the whole of the Works 50% of the total amount retained is paid to the Contractor.

45.3 The Contractor shall pay liquidated damages to the Employer at the rate per week stated in the Contract Data for each week that the Completion Date is later than the intended Completion Date (for the whole of the works or milestone as stated in the contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor’s liabilities.

45.4 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate.

**46. SECURITIES**

* 1. The Performance Security (including additional security for unbalanced Bids) shall be

provided to the Employer not later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer and denominated in Indian Rupees. The Performance Security shall be valid until a date 28 days from the date of expiry of Defects Liability period and the additional security for unbalanced Bids shall be valid until a date 28days from the date of issue of the certificate of completion.

**47. COST OF REPAIRS**

* 1. Loss of damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of Defects correction periods shall be remedied by the Contractor at the Contractor’s cost if the loss or damage arises from the Contractor’s acts or omissions.

**E. FINISHING THE CONTRACT**

1. **COMPLETION**

48.1 The Contractor shall request the Engineer to issue a Certificate of Completion of the Works and the Engineer will do so upon deciding that the work is completed in all respects.

**49. TAKING OVER**

* 1. The Employer shall take over the Site and the Works **within seven days of the Engineer issuing a certificate of completion.**

**50. FINAL ACCOUNT**

* 1. The Contractor shall supply to the Engineer a detailed account of the total amount that the Contractor considers payable under the contract before the end of the Defects Liability Period. The Engineer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 56 working days of receiving the Contractor’s account if it is correct and complete. If it is not, the Engineer shall issue within 56 working days a schedule that states that scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Engineer shall decide on the amount payable to the Contractor and issue a payment certificate, within 56 working days of receiving the Contractor’s revised account.

**51. OPERATING AND MAINTENANCE MANUALS**

* 1. If “as built” Drawings and/or operating and maintenance manuals are required, the

Contractor shall supply them by the dates stated in the Contract Data.

51.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract Data, or they do not receive the Engineer’s approval, the Engineer shall withhold the amount stated in the Contract Data from payment due to the Contractor.

1. **TERMINATION**
   1. The Employer or the Contractor may terminate the Contract if the either party causes a fundamental breach of the Contract.
   2. Fundamental breaches of Contract include but shall not be limited to the following.
2. The Contractor stops work for **28 days** when no stoppage of work is shown on the current programme and the stoppage has not been authorized by the Engineer.
3. The Engineer instructs the Contractor to delay the progress of the Works and the instruction is not withdrawn within **28 days.**
4. The Employer or the Contractor is made bankrupt or goes into liquidation other than for reconstruction or amalgamation.
5. A payment certified by the Engineer is not paid by the Employer to the Contractor within **the time lines** of the date of the Engineer’s certificate:
6. The Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer.
7. The Contractor does not maintain a security which is required;
8. The Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and
9. If the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.

For the purpose of this paragraph: “corrupt practice” means the offering, giving receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. “Fraudulent Practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower and includes collusive practice among Bidders (prior to or after Bid submission) designed to establish Bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition.

* 1. When either party to the Contract gives notices of a breach of contract to the Engineer for a cause other than those listed under Sub Clause 52.2 above, the Engineer shall decide whether the breach is fundamental or not.
  2. Notwithstanding the above, the Employer may terminate the Contract for convenience.
  3. If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

1. **PAYMENT UPON TERMINATION**
   1. If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer shall issue a certificate for the value of the work done up to the date of the issue of the certificate, less other recoveries due in terms of the contract, less taxes due to the deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the differences shall be a debt payable to the Employer.
   2. If the Contract is terminated at the Employer’s convenience or because of a fundamental breach of contract by the Employer, the Engineer shall issue a certificate for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor’s personnel employed solely on the works, and the Contractor’s costs of protecting and securing the Works and less advance payments received up to the date of the Certificate, less other recoveries due in terms of the contract and less taxes due to be deducted at source as per applicable law.
2. **PROPERTY**
   1. All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor’s default.
3. **RELEASE FROM PERFORMANCE**

55.1 If the Contract is frustrated by the outbreak of war or by another event entirely outside the control of either the Employer or the Contractor the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made.

1. **SUSPENSION OF LOAN OR CREDIT BY FINANCIER** 
   1. In the event that the Financier suspends the Loan or Credit to the Employer, from which part of the payments to the Contractor are being made:

(a) The Employer is obligated to notify the Contractor of such suspension within 7 days of having received the Financier’s suspension notice.

(b) Under this condition the Employer will have the option of continuing the balance works or terminating of agreement.

**F. SPECIAL CONDITIONS OF CONTRACT**

1. **DESCRIPTION**

The Contractor shall, at all times during the continuance of the contract, comply fully with all existing Acts, regulations and bye laws including all statutory amendments and reenactments of State or Central Government and other local authorities and any other enactments, notifications and acts that may be passed in future either by the State or the Central government or local authority, including Indian Workmen’s Compensation Act, 1923. Contract Labour (Regulation and Abolition) Act 1970, the Child Labour Prohibition and Regulation Act 1986, and Equal Remuneration Act 1976, Factories Act, Minimum Wages Act 1948, Provident Fund Regulations, Employees Provident Fund Act 1952 EPF Act 1996 and related acts passed from time to time. Schemes made under the Same Act the Buildings and other construction workers (Regulation of Employment and condition of Service) Act 1996, the Cess Act 1996 and also applicable Labour Regulations, Health and Sanitary Arrangement for Workmen, Insurance and other benefits and shall keep Employer indemnified in case any action is commenced by Competent authorities for contravention by the Contractor.

If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated above on the part of the Contractor, the Engineer shall have the right to deduct from any amounts due to the Contractor, his amount of Performance Security or recover from the Contractor personally any sum required or estimated to be required for making good the loss or damage suffered by the employer, responsibility in connection with the employees of the contractor, who shall, in no case, be treated as the employees of the Employer at any point of time.

**1.1 A RESPONSIBILITY FOR EXECUTION OF THE CONTRACT (CLAUSE 15 OF G.C.C.)**

The Contractor shall carry out the entire work according to sound engineering practices. The responsibility lies with the Contractor for the proper execution of the erection work according to existing laws and by laws at the time of contract execution. The Contractor shall confirm in respects to the requirements to CEIG (Chief Electrical Inspector to Government) as and when required by them. However, the Contractor shall have to follow the instructions of the Employer or his authorized representative in respect of the following.

1. Progress reports to be submitted from time to time.
2. Progress and completion of the work according to the time schedule.
3. Execution of contract works to the Purchaser’s entire satisfaction.
4. Submitting the details regarding the name of the responsible persons for execution of this contract.
5. Preparing, submission and getting approval of the complete electrical system of the power plant including the switch yard from the CEIG will be contractor’s responsibility.

**1.1. B. NOTICES:**

* + 1. All Certificates, notices or written orders to be given by the Employer to the Contractor under the terms of the contract shall be served by sending by post to or delivering the same to Contractor’s principal place of business, or such other address as the Contractor shall nominate for this purpose.
    2. All notices to be given to the TGSPDCL or to the Engineer under the terms of the Contract shall be served by sending by post or delivering the same to the respective addressee nominated for that purpose.

The Employer’s address is

Chief Engineer/ Operation,

Medchal Zone, TGSPDCL,

Mint Compound,

Hyderabad-500063.

The Engineer’s address is as given in the above CONTRACT DATA.

**2. WORKING HOURS**

Before commencement of work, the contractor shall inform in writing, the normal working hours for his staff and workers. These hours be as far as possible in consonance with the Employer’s working hours for better coordination.

All the staff and workers should positively leave the site premises after these hours, except for authorized watch and ward personnel, approved by the employer.

1. **EXTRA SHIFT & OVERTIME WORK**

At the commencement of work, the Contractor shall arrange for a general shift, as per working hours.

If, at a later date the employer feels that extra shift should be started to complete work allotted to the contractor within the time stipulated or to make up for any past delays. The contractor shall arrange it.

1. **ACCIDENTS (CLAUSE 12 OF G.C.C.)**

The employer will not be responsible for any damages or compensation payable inconsequence of an accident or injuries to any of the Contractor’s personnel or any third party.

The contractor shall insure at his cost-against any such eventuality as per rules in force and submit the documentary evidence of the Insurance Policy taken, positively prior to commencement of work at site and should keep policy valid by paying premium and other changes will handing over of the plant.

In case of any accidents at or near the site in connection with the execution of work, the contractor shall with in 24 hours, make a detailed report of accident and submit the same to the purchaser in the form provided by the purchaser.

The contractor shall also report such accidents to the competent authority as laid down by the existing rules and regulations and inform the Employer regarding the same.

**Insurance coverage for all items shall be at the risk of the contractor.**

**5**. **INDEMNITIES**

5.1 The contractor is liable for and indemnifies the TGSPDCL against losses, expenses and claims for loss or damage to physical property, personal injury and death caused by his own acts or omissions.

5.2 The contractor claiming indemnity is to take all reasonable steps to mitigate the lower damage will occur.

5.3 The contractor indemnifies the TGSPDCL against claims to damages caused by the movements of his equipment or temporary works.

* 1. The Contractor shall submit an “Indemnity Bond” to the TGSPDCL incorporating the above points before taking up the execution of the work.

1. **LICENSE**

The contractor shall have valid contractor’s license from the Electrical Inspector of the State, and he shall maintain its validity for the complete duration of the contract.

1. **TRANSPORT ARRANGEMENT**

The contractor shall make the transport arrangement at his cost for his staff and workers to site.

1. **MACHINERY, TOOLS & TACKLES**

The Contractor shall provide the required machinery/equipment, accessories, necessary tools and tackles, instruments, and all the normal consumable materials required for the satisfactory execution of this contract. The Contractor shall arrange for cranes for unloading and erection purpose, if required.

Gate Pass for Materials:

All tools, tackles, construction materials, welding materials etc., will be taken inside the site limits only after registration with security personnel. Also any material will be taken out only on valid gate pass issued by purchaser’s representative after checking the proper “IN” gate passes. The contractor shall have to preserve the “IN” gate passes obtained from security when every /any material is route inside the site to enable taking back the balance/excess materials, Tools and Tackles after completion of works.

1. **SAFETY PRECAUTIONS (CLAUSE 18 OF G.C.C.)**

All the safety measures to avoid accidents shall be followed strictly in accordance with the safety rules and regulation laid down by the government authorities.

The Contractor shall take all safety precautions and shall provide proper scaffolding, life-belts, ladder, shock proof helmets & earth rods etc. to avoid accidents and to ensure safety, of not only his personnel but also the safety of the staff and workers of other contractors working at the same site.

The contractor shall take necessary precautions to ensure that no part of the building/structure damage or disfigured due to negligence on his part while carrying out the work. In case of excess damage, the same shall be made good by the contractor immediately at his own cost.

Re-commissioning on energized equipment shall be carried out with proper safety permits issued by the Purchaser/Competent authorities. When required to work at heights or at hazardous location areas, the contractor shall carryout the same with utmost care and all safety precautions.

1. **FIRE PRECAUTIONS (CLAUSE 18 OF G.C.C.)**

The contractor shall strictly instruct his site staff and workers to abide by the regulations in force at the site regarding all precautions to be taken to avoid fire hazards.

1. **WORKING AREA & CLEANLINESS**

The Contractor shall keep the site of work in a clean and sanitary condition. After the completion of the entire work, the contractor shall arrange to remove all the temporary structures, surplus materials, dirt, debris, etc. from the site and finished work shall be handed over the employer in a clean and complete shape.

1. **SITE DISCIPLINE**

Strict discipline shall be observed by all the contractor’s personnel inside the premises of the site. The contractor and his personnel shall abide by all the rules and regulations of the Employer, Disciplinary action shall be taken against the Contractor/his personnel and their services liable to be terminated, if found quarrelling/ violating the rules.

1. **SITE OFFICE & SITE STORES**

The Contractor will make necessary arrangements for erection of his site office and site stores after getting written permission from the employer to erect such temporary structure at his own cost. Temporary power supply will be provided at one point at the nearest switch room. The power consumption charges will have to be borne by the Contractor. However, non-availability of the Crane does not leave the contractor off his responsibilities. The contractor is permitted to make use of water source available in any sub-station sites for construction purpose.

Transport of water from the source to the working areas will be contractor’s responsibility.

1. **APPROVAL OF INSTALLATION BY GOVERNMENT AUTHORITIES (CEIG)**

Wherever approval of government authorities is required, as per existing rules and regulations, the Contractor shall obtain the same.

1. **MEASUREMENT (CLAUSE 39 OF G.C.C.)**

The Engineer shall, except as otherwise stated ascertain and determine by measurement the value in terms of the contract of work done in accordance with the contract. He shall, when required any part or parts of the works to be measured, give notice to the contractor’s authorized agent or representative, who shall forth with attend or send a qualified agent to assist the Engineer or the Engineer’s Representative in making such measurement, and shall furnish all particulars required by either of them. Should the contractor not attend or neglect or omit to send such agent, then the measurement of the work. For the purpose of measuring such permanent work as is to be measured by records and drawings, the Engineer’s representative shall prepare records and drawings month by month of such work and the contractor, as and when called upon to do so in writing, shall within fourteen days, attend to examine and agree such records and drawings, they shall be taken to be correct. If, after examination of such records, and drawings, they shall nevertheless be taken to be correct, unless the contractor shall, within Fourteen days of such examination, lodge with the Engineer’s Representative, for decision by the Engineer, notice in writing of the respects in which such records and drawings are claimed by him to be incorrect. Payments will be made to the contractor by cheque at monthly intervals. The contractor shall submit his bills for work accomplished and measured by Engineer on or before the last day of month.

1. **INCOME TAX (CLAUSE 42 OF G.C.C.)**
2. Deductions will be made towards Income Tax at source by the TGSPDCL as directed by Income Tax Department.

b) The Contractor’s staff, personnel and labour will be liable to pay personnel income taxes in India in respect of such of their salaries and wages as are chargeable under the laws and regulations for the time being in force, and the contractor shall perform such duties in regard to such deductions there of as may be imposed on him by such laws and regulations.

1. **TERMINATION OF CONTRACT FOR TGSPDCL CONVENIECE (CLAUSE 52 OF G.C.C.)**

The TGSPDCL shall be entitled to terminate this contract at any time for the TGSPDCL convenience after giving 30 days prior notice to the contractor with a copy to the Engineer.

1. **LABOUR**

The Contractor shall, unless otherwise provided in the contract, make his own arrangements, for the engagements of all staff and labour, local, or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such information respecting Contractor’s Equipment as the Engineer may require.

1. **COMPLIANCE WITH LABOUR REGULATIONS**

During continuance of the Contract, the Contractor shall abide at all times by all existing labour enactment’s and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that are applicable to construction industry are given below. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules /regulations including amendments, if any, on the part of the Contractor, the Engineer/Employer shall have the right to deduct any money due to the contractor including his amount of performance security. The Employer/Engineer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor in no case shall be treated as the employees of the Employer at any point of time.

SALIENT FEATURES OF SOME MAJOR LABOUR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUTION WORK.

1. **Workmen Compensation Act 1923**: - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
2. **Payment of Gratuity Act 1972**: - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years service or more or on death the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
3. **Employees P. F. and Miscellaneous Provision Act 1952**: The Act for monthly contributions by the employer plus workers @10% or 8.33%. the benefits payable under the Act are:
4. Pension or family pension retirement or death, as the case may be

Deposit linked insurance on the death in harness of the worker.

Payment of P.F. accumulation on retirement /death etc.

1. **Maternity Benefits Act 1951**: -The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
2. **Contract labour (Regulation &Abolition) Act 1970**: - The Act provides for certain welfare measures to be provided b y the contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the principal Employer by Law. The Principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ 20 or more contract labour.
3. **Minimum Wages Act 1948**: - The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provision of the Act if the employment is a scheduled employment. Constructions of Buildings, Roads and Runways are scheduled employments.
4. **Payment of Wages Act 1936**: - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
5. **Equal Remuneration Act 1979**: - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against Female employees in the matters of transfers, training and promotions etc.
6. **Payment of Bonus Act 1965**: - The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs.3500/- per month or less. The bonus to be paid to employees getting Rs.2500/- per month or above up to Rs.3500/- per month shall be worked out by taking wages as Rs.2500/- per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.
7. **Industrial Disputes Act 1947**: - The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations or lock-out becomes illegal and what are the requirements of laying off or retrenching the employees or closing down the establishments.
8. **Industrial Employment (Standing Orders) Act 1946**: - It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central government to 50). The Act provides for laying down rules governing the conditions of employment by the Employment on matters provided in the Act and get the same certified by the designated Authority.
9. **Trade Union Act 1926**: - The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.

m) **Child Labour (prohibition & Regulation) Act 1986**: - The Act prohibits employment of children below 14 years of age in certain occupations and process and provides for regulation of employment of children in all other occupations and processes. Employment of Child Labour is prohibited in Building and Construction Industry.

n) **Inter-State Migrant Workmen’s (Regulation of Employment & Conditions of Service) Act 1979**:- The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.

o) **The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996**: All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as Canteens, First- Aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

p) **Factories Act 1948**: - The Act lays down the procedure for approval at plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

1. **ARBITRATION (GCC CLAUSE 24.1)**

The Procedure for arbitration will be as laid down Indian Arbitration and conciliation act 1996.

1. **Responsibility for execution of the Contract:**

The contractor shall carryout the entire work according to sound Engineering practices. The responsibility lies with the contractor for proper execution of work according to existing laws and bylaws. The contractor shall have to follow the instructions of the Employer or Engineer – In – Charge.

a) Progress reports shall be furnished fortnightly.

b) The details of project manager and site supervisors.

c) Inspection of supports, conductor and other equipment at manufacturer’s site by the Employer.

d) Approval test certificates before dispatch the material /equipment to site.

e) Proper storage of material / equipment.

f) “As Built” drawings and schedules shall be submitted with in 15 days of completion of the work.

1. Operating manuals and operating instructions shall be furnished**.**

**22.** All the statutory clearances required for execution of works from various agency will be made available to the Bidder by TGSPDCL.

SECTION – 5

**TECHNICAL SPECIFICATIONS**

A.CIVIL TECHINCAL SPECIFICATION

A.CIVIL TECHINCAL SPECIFICATION

General :-

The Specification for various works should conform to the relevant clauses of the APSS and the special specifications included in the tender schedule. If there is any difference between the two, the later will be applicable. If for any item of work, detailed specifications are not indicated either in these technical specifications or in the APSS then, that work shall be carried out as per the relevant Indian Standard specifications (latest edition).

Type of Construction:-

b. The building is proposed to be constructed using RCC framed structure (multistoried). The superstructure will be with brick masonry of 230mm thick or as per approved drawings and as directed by Engineer in charge.

**1. TENDER DRAWINGS:**

a) The following tender drawings for civil works are attached with the Bid document to give the idea of nature of work to Bidders.

b) Tender drawings attached are preliminary and meant for **Bid purpose only**. **They shall not be considered as final drawings.**

**IS- STANDARD:**

The civil works shall be in general conform to the following standards: -

IS: 269 Specification for ordinary rapid hardening and low heat Portland cement.

IS: 383 Specification for coarse and fine aggregate from natural sources for concrete.

IS: 1199 Method of sampling and analysis of concrete.

IS: 3025 Method of sampling and test (physical and chemical water used in industry).

IS: 456 Code of practice for plain and reinforced concrete (latest revision).

IS: 432 Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement (part-I & II).

IS: 1139 Specification for hot rolled mild steel and medium tensile steel deformed bars for concrete reinforcement.

IS: 1566 Specification for plain and hard drawn steel wire fabricator concrete reinforcement.

IS: 1785 Specification for plain and hard drawn steel wire for pre-stressed concrete (part-II).

IS: 1786 Specification for cold twisted steel bars for concrete reinforcement.

IS: 2090 Specification for high tensile steel bars used in pre-stressed concrete.

IS: 4990 Specification for plywood for concrete shuttering work.

IS: 2645 Specification or integral cement water proofing compounds.

IS: 4461 Cold worked steel bars for the reinforcement of concrete.

IS: 2514 Specification for concrete vibrating tables.

IS: 802 Code of practice for the design and construction of transmission line towers (part-I, II & III).

IS: 200 Method of measurement of building and civil engineering (part-I) work: part-I: Earthwork.

IS: 3764 Safety code for excavation work.

IS: 4701 Code of practice for earthwork on canals.

IS: 2502 Code of practice for bending and fixing of bars for concrete reinforcement.

IS: 1838 Performed fillers for expansion joints concrete non-extruding and resilient type (bitumen impregnated filler).

IS: 2386 Specific gravity, density, voids, absorption and (part-III) buckling.

IS: 2505 General requirements for concrete vibrators, immersion type.

IS: 2506 Screen board concrete vibrators.

IS: 3370 Code of practice for concrete structures for the storage of liquids.

IS: 3350 Methods of tests for routine control for water used in industry.

IS: 4456 Form vibrators for concrete.

IS: 9103 Admixtures for concrete.

IS: 517 Methods of test for strength of concrete.

IS: 4091 Code of practice for the design and construction of foundation for transmission lines.

IS: 1893 Code of practice for seismic loads and designs.

IS: 800 Code of practice for structural steel is building.

Note: The APSS is available on sale at government of A.P, printing press.

2.0 LEVELLING OF SITE: -

The site is to be levelled all-round the building area including removal of vegetation. The Ground also shall be lowered or raised to the required level if necessary with excavated earth or as directed by Engineer at site.

3.0 EXCAVATION: -

Excavation shall include careful removal of all materials of whatever nature and whether dry or wet, necessary for the construction of work, and leveling site exactly in accordance with lines, levels, grades and curves shown in the plans or as directed by the Engineer-in-charge. It shall be taken to exact widths and levels of the lowest step of foundation /footing/floor and the sides shall be left to plumb where the nature of the soil permits. Any shoring, strutting and timbering or cutting of extra widths of trenches required for providing working space shall be done by the contractor and the same shall be deemed to have been included in the quoted rate. The contractor shall notify the Engineer-in-charge before starting excavation and take cross section levels (for purposes of measurements) jointly with the Engineer-in-charge before the Ground is disturbed. The bottom of the foundation shall be leveled both longitudinally and transversely stepped as directed, the contractor shall provide suitable arrangements to prevent surface water from any source entering the foundation pits at his own cost.

No blasting shall be permitted for excavation of foundations without prior permission of the Engineer-in-charge. The contractor shall not undertake any concreting in foundation until the excavation pit is approved by the Engineer-in-charge. The rate quoted for excavation shall include bailing or pumping of water which may accumulate in the excavation during the process of work either from seepage, rain or any other cause. The excavation shall be kept away from water. All materials excavated from the foundation of whatever kind they shall be placed at a distance of more than 1.5M from the edge of the foundation or as directed by the Engineer-in-charge. All excavated material shall remain the properties of the TGSPDCL. Material suitable for filling or other use shall be stacked in places as directed by Engineer-in-charge.

Surplus earth and soil which are not useful shall be removed and conveyed as directed by Engineer-in-charge.

The quoted rate shall include clearing of site, setting out and works required for excavation, cost of excavation, pumping and bailing out rain water/surface water accumulated in the excavated pit, stacking of excavated earth, shoring, removal and disposal of surplus excavated soil from the construction site if any, with initial leads and lifts, labour charges, including hire charges of machinery ,tools& plants ,insurance, all incidental charges etc. complete for finished item of work as directed by Engineer-in-charge.

**4.0 ANTI-TERMITE TREATMENT:-**

SCOPE: The scope of work is to set up a chemical barrier against attack by subterranean termites.

GENERAL: All work shall in general, be executed as specified in IS:6313 Part-II,IS:6333 Part II,IS:6433:1978,IS 2682:1984 and as per approved specification of the agency having special know-how for the job. All necessary work to ensure uniform distribution and proper penetration of treating solution shall be done according to the instruction of the Engineer-in-charge. Soil treatment shall not be done when it is raining or when the soil is wet with rain or subsoil water. Once formed, the treated soil barrier shall not be disturbed.

CHEMICALS AND RATE OF APPLICATION:

Any of the following chemicals (conforming to relevant Indian Standards) in water emulsion shall be applied by pressure pumps uniformly over the area treated:-

Chemicals Concentration by weight percent.

Dieldrin (IS:1052-1962) 0.5

Aldrin (IS:1306-1958) 0.5

Chlordane (IS:2863-1964) 1.0

Heptachlor 0.5

ACCEPTANCE CRITERIA: The contractor shall give a 1 year service guarantee in writing supplemented by a separate and unilateral guarantee from the specialized agency for the job to keep the building treated free of termites for the specified period at no extra cost to the purchaser.

I.S. CODE: Relevant code applicable for this specification: IS:6317(Part-II)-1971: Code of practice for Anti-termite Measures in buildings.

5.0     FOUNDATIONS

     CC (1:4:8) using 40mm HBG metal shall be laid as leveling course under footings UG sump, storm water drain, septic tank. The CC work shall be executed as per specification numbers 402 of APSS.

The quoted rate shall include cost of all materials, all operations, labour charges, tools, tackles, machinery, curing, dewatering, water leads ,all leads and lifts and the incidental charges connected with the work etc. complete for finished item of work as directed by the Engineer-in-charge.

6.0 CRS MASONRY FOR FOUNDATIONS AND BASEMENT:-

The foundations and basement at stilt floor rooms and Retaining wall shall be constructed with CRS. masonry using hard broken granite stones in CM (1:6).

The quoted rate shall include cost of all materials, all operations, including dewatering if required, labour charges tools, tackles, machinery, curing, water leads, all leads and lifts and other incidental charges connected with the work etc. complete for finished item of work and as directed by the Engineer-in-charge.

a) SCOPE: The contractor shall furnish all labour, materials and equipment required for the construction of all stone masonry work required as mentioned in this section as per drawings and specifications.

b) MATERIALS: Stones shall be obtained from the quarries to be approved by the engineer and shall conform to IS:1597 (Part-I). Stones shall be of uniform colour and texture, hard, durable, tough, and the best quality of its respective kind. These shall be free from decay, sand holes, veins, flaws cracks and other defects. These shall be carried to such a way as to be most suitable for one particular class of work for which these are required. Stone not suited for the particular class of work removed from the site be the contractor.

c) LAYING:

The stones shall be laid on their broadest face.

        Stratified stones shall be laid on their natural bed i.e., with the strata perpendicular to the pressure. The course shall be built perpendicular to the pressure. Where there is to be variation in the depth of courses, larger stones are to be placed in the lower courses, the thickness of courses decreasing gradually towards the top of the wall. To give sufficient lateral bond, a stone in any course should overlap the stone in the course below i.e., joints parallel to the pressure in two adjoining courses should not lie too closely in the same vertical line To give sufficient transverse bond, the prescribed number of headers must extend from front to back of thin walls or from outside to the interior of thick walls.At all angle junctions of walls, the stones at each alternative course shall be so carried into each of the respective walls as to unite the work thoroughly. Where breaks are unavoidable in carrying up the continuously in horizontal courses, sufficient long steps shall be left to join the old and new work.If it is necessary to move a stone after it has been placed on the mortar bed, it should be lifted clear and rest and not made to slide over stones already laid.

d) WATERING**:**

To prevent absorption of water from the mortar, the stones shall be sufficiently well wetted before laying. All masonry shall be kept watered for three weeks from the date of building in place unless otherwise instructed by the engineer. At the close of the day's work or for other period of cessation of the work, the top of all unfinished masonry is to be kept well flooded. Should the mortar perish ie., become dry, white or powder through neglect of watering the work shall be pulled and rebuilt at the contractor's expense. All masonry shall be washed down on completion of all stains. Mortar and Materials to Conform to Standard Specification : The mortar to be used for each class of masonry shall conform to the particular standard specification for that class of mortar and the standard specification for the materials used.

7.0 REFILLING THE FOUNDATIONS &BASEMENT :

Refilling the foundations & basement is to be done with useful available sand/excavated soils and as directed by the Engineer-in-charge.

Filling shall be done after the concrete or masonry in the foundation has fully set and its curing is completed. It shall be done in such a manner as not to cause undue thrust/impact on any part of the structure.

Back filling around completed foundations shall be done to the required lines and levels/depths including any trimming of surfaces as may be necessary. This will be done with selected and approved excavated useful soil as directed by Engineer-in-charge. The refilling shall be done in horizontal layers of thickness not exceeding 15cm, free from pockets with careful watering, ramming and rolling etc. to obtain necessary level of compaction.

The contractor shall not fill in and around any work until it has been approved by Engineer-in-charge.

The quoted rate shall include cost of excavated useful soil, carrying up to directed locations, placing, watering, compacting in layers, trimming and dressing to finished surface and disposal of surplus material if any.

8.0 BRICK MASONRY:

The superstructure of the building shall be constructed in all thickness with brick masonry in CM (1:6) using second class bricks of approved quality from approved source having minimum crushing strength of 40 kg/cm2 and water absorption not exceeding 20 % by weight.

a) **Scope:**

The contractor shall furnish all labour, materials and equipment required for the construction for all brick masonry work as shown in the construction drawings.

b) **Bricks:**

Light weight bricks conforming to IS code shall be of uniform colour, strength and size with minimum crushing strength of kg/cm². The bricks shall have smooth surfaces with corners straight; they shall not be twisted or chipped; when broken they shall reveal a fine, uniform, no vitreous grain; they shall emit ringing sound when tapped with a hammer; they shall absorb water on immersion (not more than one sixth of its original weight after soaking for 15 minutes) and dry sufficiently quickly. The bricks shall not show any sign of efflorescence after soaking and drying in shade. If the bricks show any sort of efflorescence the contractor shall do the necessary treatment at his own cost to the satisfaction of the engineer.

All bricks shall be subjected to inspection and approval and representative samples shall be submitted before ordering out. Contractor shall submit sample of bricks and arrange to test these bricks in approved laboratory and submit the test results for approval prior to commencement of work.

c) **Mortar:**

Mortar shall be prepared with the materials as specified in this specification and the mortar shall conform to IS:2250. The type of mortar to be used shall be in proportion specified in Schedule ‑'A'.

d) **Brick Works:**

**Soaking of Bricks :**

Bricks required for masonry in cement mortar shall be wetted to saturation point by prolonged immersion, but never by spraying. The cessation of bubbles, when the bricks are immersed in water, shall be an indication of thorough soaking of bricks. The soaked bricks shall be kept on wooden plank to avoid earth being smeared on them.

e) **Laying:**

Brick work shall be laid with best skill and the greatest care and diligence. Each brick shall be pressed on the layer of the specified mortar so that this spreads all around it and fill the joints which shall never be more than 10 mm nor less than 5 mm wide. Mortar ingredients shall be of proper grain size to permit joints within these limits.

The whole of the brick work shall be built in English bond unless otherwise directed. No four brick courses shall rise more than 25 mm over above the same laid dry. No brick bats shall be used excess where required as closures The bricks shall be thoroughly bedded on cement mortar during each layer. After every third course reinforcing steel consisting of 2Nos. of 6mm dia mild steel bars shall be provided and these shall be anchored to the structural steel as directed by the Engineer. However, the reinforcement steel shall be separately paid for at their quoted rates for reinforcement.

The work will be done in a proper manner in the first instance only and no grouting shall be resorted to. String courses, cornices and mouldings shall not generally be provided unless as shown on the drawings or as directed by the engineer. The architectural features and treatment if required as per the drawings or as may be finalized before execution and such items whether in large or small quantities and any shape and size, shall have to be provided by the contractor at the rates in relevant items of the bill of quantities. The contractor shall not be eligible to claim any extra rate on this account. The brick work must be laid true to line and level with horizontal courses and vertical perpendicular faces and corners etc.

f) **Non‑Bearing Walls:**

Non‑bearing walls (dividing walls) shall be built of choice bricks, for both header and stretcher courses. No broken bricks or bricks with chipped corners will be accepted.

g) **Curing:**

Green work shall be protected from rain by suitable covering. Brick work in cement mortar shall be kept constantly moist on all the faces for a minimum period of ten (10) days. The top of masonry work shall be left flooded at the close of the day.

h) **Measurements:**

Masonry work in general shall be geometrically measured by volume . The volume of the walls shall be reduced for all voids, hollows, recess and openings of net area more than half a square meter, without accounting for flares, that is discounting only the volume obtained multiplying the net span of the opening in rough by thickness of the wall the depth of the recess, assuming that the volume of flares and splays shall cover the higher skill required in their construction. The provision, during construction of recess and holes for passage of pipes as designed and previously arranged and ordered, shall not entitle the contractor to any compensation. The plinth level shall be taken as 0.00 level of the respective building. The unit rate shall include supply of materials, transport, mortar of required proportion and curing.

All the measurements are to be done as per IS:1200 (relevant parts) for the items not covered above.

Contractor shall submit sample of bricks and arrange to test these bricks in approved laboratory and submit the test results for approval prior to commencement of work .

Bricks required for masonry in cement mortar shall be thoroughly soaked in clean water before use for at least six hours and until air bubbles ceases to come out. The soaked bricks shall be kept on wooden plank or brick platform to avoid earth being smeared on them.

Only skilled and experienced masons shall be employed for laying the brick masonry. Brick work shall be laid in English bond unless otherwise specified. Half or cut bricks shall not be used except as closures when needed to complete the bond. Each course shall be perfectly straight horizontally and transversely. The walls shall be taken up truly plumb. The level of the brickwork in vertical walls shall be checked up every one meter interval.

All iron fixtures, pipes, conduits, drain sleeves, bolts, hold fasts of doors and windows etc. which are required to be built in wall shall be embedded in cement mortar or in cement concrete as specified, in their correct position, as the work proceeds.

Brick masonry shall be in CM(1:4) for partitions in rooms.

The quoted rate shall include the supply of all materials, including conveyance seigniorage charges labour, tools, tackle, plant and equipment, scaffolding, shuttering, pocking the concrete and temporary works, curing with all leads and lifts and all other incidental charges required to complete the work in accordance with the standard specification. No deductions shall be made for openings less than 0.1 m² in area and for fixtures up to 0.05 m² in area.

i) **Applicable Codes and Specifications:**

The following codes, standards and specifications are made a part of this specification, All standards, tentative specifications, specifications, codes of practice referred to herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern.

IS : 1077 : Common burnt clay building bricks

IS : 3102 : Classification of burnt clay bricks

IS : 2180 : Burnt clay building bricks ‑ heavy duty

IS : 3495 : Method of sampling and testing clay building bricks

IS : 2691 : Burnt clay facing bricks

IS : 2212 : Code of practice for brick work

**9.PLAIN AND REINFORCED CEMENT CONCRETE WORKS :**

**9.1 SCOPE** :

This section of the specification covers the technical requirements for forming, placing and finishing of concrete, plain and reinforced cement concrete for all structures and their foundations at all levels and elevations e.g. buildings, walls, cable tunnels, cable ducts, foundations and footings, pits, posts, drains, water tanks as per approved drawings, manholes, etc., as required to complete the job as per the approved drawings. All concrete works as indicated in the scope of this contract shall be carried out as per these specifications.

a) This specification shall also apply to the extent it has been referred to or applicable with the special requirements of structures covered in scope of IS: 456. IS: 456 shall form a part of these specifications and shall be complied with unless permitted otherwise. For any particular aspect not covered by these code, appropriate IS code, specifications and/or replacement by any International Code of practice as may be specified by the Engineer shall be followed. All codes and Standards shall conform to its latest revisions.

b) Nominal Mix and Design mix :

1:2:4, 1:3:6 and 1:4:8 shall be of Nominal Mix , M20 and above shall be of Design Mix. The mix proportions for all grades of concrete shall be designed to obtain strengths for respective grades of concrete. Preliminary tests as specified in the IS: 456 and required by the purchaser, shall be carried out sufficiently ahead of the actual commencement of the work with different grades of concrete made from representative samples of aggregates and cement expected to be used on the job to ascertain the ratios by weight of cement to total quantities of fine and coarse aggregate and the water cement ratio required to produce a concrete of specified strength and desired workability.

The contractor at his cost at an approved testing laboratory shall carry out the mix designs.

Whenever the sources of fine and course aggregates and/or brand of cement is changed, the tests shall again be carried out on the materials for ascertaining their suitability and the Mix Design shall also be carried out and this mix shall be used subject to the approval of the Executive Engineer.

The cement @ 350 kg/m³ of M20 grade concrete is considered for the estimate of this work. Tenderers are required to quote their rates keeping in view of the cement quantity as above. However, the actual utilization of cement will be as per the design mix. Excess/Less usage than the provision of 350 kg will be either reimbursed or recovered @ Rs. /- per M.T irrespective of other ingredients.

**9.2 GENERAL REQUIREMENTS**:

9.2.1 WORK TO BE PROVIDED BY THE CONTRACTOR**:**

The work to be provided for by the Contractor, unless otherwise specified shall include but not be limited to the following:

* 1. Furnish all labour, supervision, services including facilities as may be required under statutory labour regulations, materials, forms, templates, supports, scaffolds, approaches, aids, construction equipment, tools and plants, transportations, etc. required for the completion of work as per approved drawings.
  2. Except where it is excluded from the Scope of Contract, Contractor shall prepare progressively and submit for approval detailed drawings and Bar Bending Schedules for reinforcement bars showing the positions and details of spacers, supports, chairs, hangers etc.
  3. Design and prepare working drawings of formworks, scaffolds, supports, etc. and submit for approval.
  4. Submit for approval shop drawings for various inserts, anchors, anchor bolts, pipe sleeves, embedment, hangers, openings, frames etc.
  5. Submit for approval detailed drawings of supports, templates, hangers, etc. required for installation of various embedments like inserts, anchor bolts, pipe sleeves, frames, joint seals, frames, openings etc.
  6. Submit for approval detailed schemes of all operations required for executing the work, e.g. Material handling, Concrete mixing, placement of concrete, compaction, curing, services, approaches, etc.
  7. Design and submit for approval concrete mix designs required to be adopted on the job.
  8. Furnish samples and submit for approval results of tests of various properties of the following:

i) The various ingredients of concrete

ii) Concrete

iii) Embedment

iv) Joint seals

* 1. Provide all incidental items not shown or specified in particular but reasonably implied or necessary for successful completion of the work in accordance with the drawings, specifications and schedule of items.
  2. For supply of certain materials normally manufactured by specialist firms, the contractor may have to produce, if directed by the Engineer, a guarantee in approved proforma for satisfactory performance for one year as may be specified, binding both the manufacturers and the contractor, jointly and severally.

1. SAMPLES:

Samples of the following materials and any other materials proposed to be used, shall be submitted as directed by the Engineer, in sufficient quantities free of cost, for approval. Approved samples will be preserved by the Engineer for future reference. The approval of the Engineer shall not, in any way, relieve the contractor of his responsibility of supplying materials of specified qualities:

i) Coarse and fine aggregates.

ii) Admixtures.

* + 1. Plywood for formwork.

1. DESIGN MIX:

Design mix as per Clauses 11.2.1 (g) of this specification giving proportions of the ingredients, sources of aggregates and cement, along with accompanying test results of trial mixes as per relevant I.S., is to be submitted to the Engineer for his approval before it can be used on the works.

1. **Detailed Drawings and Bar Bending Schedules:**

**Detailed working drawings and Bar Bending Schedules in accordance with this specification.**

1. Inspection Reports: Inspection Reports in respect of formwork and reinforcement and any other item of work as may be desired by the Engineer in accordance with Clause 11.2.4 of this specification.
2. Test Reports: Reports of tests of various materials and concrete as required under Clause 21.0 SAMPLING & TESTING of this specification.
3. Any other data that may be required as per this specification.
   * 1. **MATERIALS :**

a) **Cement:**

Cement shall conform to IS: 269. The contractor shall be fully satisfied with the quality and properties of cement used irrespective of its source and/or supply.

b) **Admixtures:**

All concrete shall be designed for normal rate of setting and hardening at normal temperature. Variations in temperature and humidity under different climatic conditions will affect the rate of setting and hardening, which will, in turn, affect the workability and quality of the concrete. Admixtures may be permitted to be used in accordance with IS:456 to modify the rate of hardening , to improve workability or as an aid to control concrete quality.

The Executive Engineer shall have the authority at any time, and from time to time to order the addition of any air entering agent or other admixtures, to any mix of concrete in such proportionate quantity or mode, as he may specify and the contractor shall comply with the same without any extra cost.

c) **Aggregates:**

All the aggregates shall conform to IS:383. The natural aggregates shall be chemically inert, strong, hard, durable, of limited porosity, free from adherent coatings, clay lumps, coal and coal residues and shall contain no organic or other admixtures that may cause corrosion of reinforcement or impair the strength or durability of concrete. The limits of the content of deleterious materials in aggregate are indicated below.

Limits of the content of Deleterious Materials

(Percent by weight of aggregate)

Deleterious Fine aggregates Coarse aggregates

Substances ‑‑‑‑‑‑‑‑-------‑‑‑‑‑‑‑---- -------‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑-----

Crushed Uncrushed Crushed Uncrushed

Coal & lignite 1.00 1.00 1.00 1.00

Clay lumps 1.00 1.00 1.00 1.00

Soft fragments ‑ ‑ 3.00 ‑

Material passing 3.00 3.00 3.00 3.00

75 micron IS sieve

Shale 1.00 ‑‑‑

Approved natural sand and crushed stone for structural concrete and well washed, thoroughly cleaned and graded natural gravel, for lean and backfill cement concrete shall be used as aggregate. Representative samples of selected aggregates shall be tested at the contractor's cost for sieve analysis from time to time as required by the engineer for approval.

i) **Fine Aggregates:**

Fine aggregate (sand) shall be clean, sharp, coarse sand with a fineness modules between 2.2 and 3.2 (fineness modulus is the sum of cumulative percentages retained on the IS sieves given below for gradation divided by 100). The contractor shall check and ensure that local sand will satisfy this requirement and if necessary shall include for and supply materials from other sources which comply with the specifications, it shall be graded as follows.

IS sieve P e r c e n t a g e p a s s i n g f o r

designation Grading Grading Grading

Zone ‑I Zone ‑ II Zone ‑III

10 mm 100 100 100

4.75 mm 90‑100 90‑100 90‑100

2.36 mm 60‑95 75‑100 85‑100

IS sieve P e r c e n t a g e p a s s i n g f o r

designation Grading Grading Grading

Zone ‑I Zone ‑ II Zone ‑III

1.18 mm 30‑70 55‑90 75‑100

600 microns 15‑34 35‑59 60‑79

300 microns 5‑20 8‑30 12‑40

150 microns 0‑10 0‑10 0‑10

The objectionable foreign matter in sand shall be removed by screening or washing or both as required.

ii) **Coarse Aggregate:** The coarse aggregate (crushed stone) shall conform to the following grading limits.

**Grading Limits:**

IS sieve Percentage retained for grade aggregate

designation 40 mm 20 mm 17 mm 12.5 mm

80 mm ‑ ‑ ‑ ‑

40 mm 0‑5 0 0 0

20 mm 30‑70 0‑5 0 0

17 mm ‑ ‑ 0‑10 ‑

12.5 mm ‑ ‑ ‑ 0‑10

10 mm 65‑90 45‑75 30‑70 15‑60

4.75 mm 95‑100 90‑100 90‑100 90‑100

The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, if present, shall be only in such quantities that will not, in the opinion of engineer, affect adversely the strength and durability of concrete. The maximum size of the aggregate shall be as specified in the drawings/specifications. The maximum size of coarse aggregate

shall be the maximum size specified, but in no case greater than 1/4 of the minimum thickness of the member provided that the concrete can be placed without difficulty so as to surround all reinforcement throughout and fill the corners of the form. For heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover to the reinforcement whichever is smaller.

**Crushing Value:**

The aggregate crushing value, when determined in accordance with IS:2386 (Part IV) shall not exceed forty five (45) percent for aggregate used for concrete other than for wearing surfaces and thirty (30) percent for concrete for wearing surfaces, such as roads, pavements and floor finishes.

**Impact Value:**

As an alternative the aggregate impact value may be determined in accordance with the methods specified in IS:2386 (Part IV). The impact value shall not exceed forty five (45) percent by weight for aggregate used for concrete other than for wearing surfaces and thirty (30) percent by weight for concrete for wearing surfaces, such as roads, pavements and floor finishes.

**Abrasion Value:**

Unless otherwise agreed to between the purchaser and the supplier, the abrasion value of aggregates, when tested in accordance with the method specified in IS:2386 (Part IV), using Los Angeles Machine, shall not exceed the following values :

A. For aggregates to be used in Thirty (30)

concrete for wearing surfaces percent

B. For aggregate to be used in Fifty (50)

other concrete (structural) percent

The amount of fine particles occurring in the free state or as loose adherents shall not exceed 1% when determined by laboratory sedimentation tests as per IS:2386. After 24 hours immersion in water, a previously dried sample shall not have gained more than 10% of its even dry weight in air, as determined by IS:2386. Should at any time the engineer have reason to consider any aggregate defective or of poor quality, then irrespective of any previous approval or tests, representative samples of such materials shall be immediately tested and until the results of such tests prove the material to be satisfactory, it shall not be used for any work. The contractor shall not be entitled to any claim of any nature on this account. The cost of these tests (including collection of samples and transportation) shall be borne by the contractor.

d) **Reinforcing Steel:**

Reinforcement shall consist of any of the following types but shall conform to requirements shown on the drawings and should be corrosion resistant.

‑ Plain mild steel bars, Grade I (IS:432 Part I & IS:226)

‑ Cold twisted or deformed bars (IS:1786) Grade Fe 415

‑ Mild steel and medium tensile steel deformed bars(IS:1139)

‑ Medium tensile steel bars (IS:432 Part I & IS:961)

- Hard drawn steel wire mesh, fabric (IS:1566 & IS:432 Part II)

- Structural steel sections and plates shall conform IS : 226 and IS : 2062.

i) All steel shall be of grade I quality unless specifically permitted by the engineer. No rerolled scrap steel bars, pitted or otherwise defective bars shall be used. The contractor shall check and ensure that appropriate reinforcement bars are used for the work. **Otherwise necessary tests shall be made by the contractor at his own cost to ensure that quality and physical properties of materials used, conform to the specifications.** No complaints or claims shall be entertained on this account.

ii) All reinforcing materials, before their final use shall be free from loose mill scale, rust, dust, oily or bituminous coating or any other injurious adherents.

iii) Pitted and otherwise defective bars and rerolled scrap steel bars shall not be used.

The contractor shall procure in time as necessary and check measure the reinforcing materials required for the continuous scheduled progress of work till the completion.

iv) The reinforcement shall not be placed in direct contact with the Ground but stacked on timber sleepers or such similar arrangement. The reinforcement shall be coated with cement slurry before stacking to prevent scale and rust. Fabricated reinforcement shall be carefully stored to prevent damage, distortion, corrosion and deterioration.

v) Welding may be permitted with the written approval of the engineer, provided the carbon content of steel used is less than 0.3 per cent. Welding so permitted shall be in accordance with IS:317. Tack welding of reinforcement bars as shown in drawings may be necessary. Substitution of different size bars will be permitted only when authorized by the engineer.

vi) No part of the reinforcement, irrespective of whether the concrete work is under construction or completed, shall be used for conducting electrical currents. Electrical Grounding connections shall be carefully isolated from reinforcement.

vii) The number and size of all steel bars, ties, stirrups and other members of the reinforcement shall be in exact accordance with the drawings and the rods shall be bent cold by the gradual and uniform application of force to the shapes and dimensions given in the bar bending schedule supplied by the engineer. These schedules shall conform to IS:1566.

viii) Bars which have been bent wrongly shall not be straightened, rebent and used without the permission of the engineer.

ix) Reinforcement shall be suitably supported by steel or concrete spacers, care being taken during the concreting operation to maintain the concrete cover specified. All hooks links and stirrups shall be such that the bars when tied together are properly braced. If possible, the reinforcement shall be fabricated with frames or mats before being fixed in the forms. Good quality ductile binding wire of 18 gauge shall be used to fix and secure the reinforcement so that no bars will be disturbed or displaced when the concrete is placed.Alternatively welding may be carried out to secure and fix the reinforcement instead of binding wire. No concreting shall be commenced until the bars have been properly fixed and tied at their specified location and have been inspected and approved by the engineer.

**9.3 WATER:**

Water for all work shall be fresh, clean and free from injurious or deleterious materials and conforming to IS:3025. The contractor shall provide at his own cost for distribution, storage, filtration and / or treatment, as necessary of the required quality of water. Quality of water to be used in concrete shall be such as to obtain the consistency specified. This quality of water shall be subject to approval by the engineer on the basis of test finding and shall in no case be changed without permission. The suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS:456.

**9.4 GAUGING WATER:**

The general arrangements for the supply of water for mixing concrete shall be to the satisfaction of the engineer who will determine the quantity of water to be used to the mix according to the degree of moisture in the aggregate. The quantity of water thus determined shall be accurately measured for each separate mixing in a suitable container.

**9.5 WORK TEST SHALL BE PERFORMED ACCORDING TO THE FOLLOWING SCHEDULE**:

**Six (6) cubes of 15 cm sides for every 150 m³ of concrete or for a shift of eight hours of concreting, of which three** (3) shall be tested at **seven (7)** days and three (3) at twenty eight (28) days. Concrete shall be considered unsatisfactory if the average strength of three ‑ 28 days cubes is below the value. However, only one of the three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength.

Samples shall be taken while concrete is being poured in the presence of representatives appointed by the engineer and the contractor. Proper record of work test shall be maintained and signed jointly. The preliminary test and works tests shall be at the contractor's expense.

Unless otherwise specified, the contractor shall provide all sand, coarse aggregate, cement and concrete required for testing and all handling, transport and all other services entitled in supplying the samples to the testing laboratory . The cost of the supply of materials and facilities shall be deemed to be included in the quoted rates.

**9.6 CONSISTENCY AND WORKABILITY OF THE CONCRETE:**

9.6.1 Consistency and workability of concrete shall be checked by measuring the slump of a truncated cone of concrete straight from the mixer under normal working conditions. The conical mould shall be of metal, 300 mm high ‑ 100 mm & 200 mm in diameter at the top and base respectively.

9.6.2 **Moulds shall be prepared by the contractor**.

To maintain the consistency of concrete, slump test as per IS-1199 shall be carried out at contractor’s cost every two hours during work progress or at intervals established by the Engineer, in addition to the slump test to be carried out while making cubes. The table below gives the general slump range to be followed for various types of construction unless otherwise shown in drawings or instructed by the engineer.

Various types of construction Slump mm

Max. Min.

Reinforced walls and footings 80 30

Plain footings, caissons and 75 25

substructure walls

Slabs, beams and reinforced walls 100 25

Various types of construction Slump mm

Max. Min.

Pumps and other misc.equipment foundations 75 25

Building columns 100 25

Pavements 50 25

Heavy mass construction 50 25

The workability test by means of compaction factor tests as per IS:1199 shall also be carried out by the contractor at his cost.

**9.7 OPTIONAL TESTS:**

**[**

The engineer, if he so desires, may order tests to be carried out on cement, sand, coarse aggregate, water in accordance with the relevant Indian Standards.

Tests on cement shall include

(i) Fineness test

(ii) Test for normal consistency

(iii) Test for setting time

(iv) Test for soundness

(v) Test for tensile strength

(vi) Test for compressive strength

(vii) Test for heatof hydration (by experiment and by calculations) in accordance with IS:269.

Tests on sand shall include

(i) Sieve test

(ii) Test for organic impurities

(iii) Decantation test for determining clay and silt content

(iv) Specific gravity test

(v) Test for unit weight and bulkage factor

(vi) Test for sieve analysis and fineness modulus

Tests on coarse aggregate shall include

(i) Sieve analysis

(ii) Specific gravity and unit weight of dry, loose and rodded aggregate

(iii) Soundness and alkali aggregate reactivity

(iv) Petrographic examination

(v) Deleterious materials and organic impurities

(vi) Test for aggregate crushing value.

Any or all these tests would normally be ordered to be carried out only if the engineer feels the materials are not in accordance to the specification or if the specified concrete strengths are not obtained and shall be performed by the contractor at an approved testing laboratory at his cost.

If the work cubes do not give the stipulated strengths the engineer reserves the right to ask contractor to dismantle such portions of the work which in his opinion are unacceptable and redo the work to standard stipulated at contractor's cost. The contract price for concrete shall be all inclusive, including making preliminary mix design and test cubes, works cubes, testing them as per specification, slump tests, optional tests etc., complete.

**9.8 STORAGE**:

a) GENERAL**:** All materials shall be so stored as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged or is otherwise considered defective by the Engineer, shall not be used for concrete and shall be removed from site immediately, failing which, the Engineer shall be at liberty to get the materials removed and the cost incurred thereof shall be realized from the contractor's dues. The Contractor shall maintain up to date accounts of receipt, issue and balance (stack wise) of all materials. Storage of materials shall conform to IS: 4082. General storage shall be carried out by the contractor in a manner affording convenient access for identification and inspection at all time. The storage facilities shall be subject to approval of the Engineer‑in‑charge.

b) CEMENT:Sufficient space for storage, with open passages between stacks, shall be arranged by the Contractor to the satisfaction of the Engineer. Cement shall be stored off the Ground in dry, weather proof, leak proof, well ventilated ware‑houses at the works in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter.Cement shall be stored in easily countable stacks with consignment identification marks. Consignments shall be used in the order of their receipts at site. Sub‑standard or partly set cement shall not be used and shall be removed from the site, with the knowledge of the Engineer, as soon as it is detected. Cement hold in storage for a period of 90 days or longer shall be tested at an approved laboratory before being put to use.

c) AGGREGATES : Aggregates shall be stored by the contractor in areas floored with tightly laid wooden planks or other approved hard, smooth and clean surface, in a manner precluding intrusion or foreign material. Each size shall be kept separated with wooden or steel or concrete or masonry bulk‑heads or in separate stacks and sufficient care shall be taken to prevent the material at the edges of the stockpiles from getting intermixed. Stacks of fine and coarse aggregates shall be kept sufficiently apart with proper arrangement of drainage. The aggregates shall be stored in easily measurable stacks of suitable depths as may be directed by the Engineer.

1. REINFORCEMENT: Reinforcing steel shall be stored consignment wise and size wise off the Ground and under cover, in a manner to prevent object ionic changes in original surface characteristics. It shall be protected from rusting, oil, grease and distortions. If necessary, the reinforcing steel may be coated with cement wash before stacking to prevent scale and rust at no extra cost to the purchaser. The stacks shall be easily measurable. Steel needed for immediate use shall only be removed from storage. Reinforcement shall be stored in separate piles or racks above grade.

**9.9 QUALITY CONTROL**:

Contractor shall establish and maintain quality control for different items of work and materials as may be directed by the Engineer to assure compliance with contract requirements and maintain and submit to the Engineer records of the same. The quality control operation shall include but not be limited to the following items of work:

a) Admixture: Type, quantity, physical and chemical properties that affect strength, workability and durability of concrete. For air entraining admixtures, dosage to be adjusted to maintain air contents within desirable limits.

b) Aggregate: Physical, chemical and mineralogical qualities. Grading, moisture content and impurities.

c) Water: Impurities tests.

d) Cement: Tests to satisfy relevant IS Specifications (only association with purchaser's tests, if the supply is made by purchaser).

e) Formwork: Material, shapes, dimensions, lines, elevations, surface finish, adequacy of form, ties, bracing & shoring and coating.

f) Reinforcement: Shapes, dimensions, and length of splices, clearances, ties and supports. Quality and requirement of welded splices. Material tests or certificates to satisfy relevant IS Specification (if contractor's supply).

g) Grades of concrete: Usage and mix design, testing of all properties.

h) Batching & Mixing: Types and capacity of plant, concrete mixers and transportation Equipment.

i) Joints: Locations of joints, water stops and filler materials. Dimension of joints, quality and shape of joint material and splices.

j) Embedded and Anchorage items: Material, shape, location, and setting.

k) Placing: Preparation, rate of pouring, weather limitations, time intervals between mixing and placing and between two successive lifts, covering over dry or wet surfaces, cleaning and preparation of surfaces on which concrete is to be placed,

application of mortar/slurry for proper bond, prevention of cold joint, types of chutes or conveyors.

l) Compaction: Number of vibrators, their prime mover, frequency and amplitude of vibration, diameter and weight of vibrators, duration of vibration, hand‑spreading, rodding and tamping.

m) Setting of base and beaming plates: Lines, elevations and bedding mortar.

n) Concrete finishes: Repairs of surface defects, screening, floating, steel trowel ling and brooming, special finishes.

o) Curing: Methods and length of Copies of records and tests for the items noted above, as well as, records of corrective action taken shall be submitted to the Engineer for approval as may be desired.

**9.10 INSTALLATION**:

All installation requirements shall be in accordance with IS:456 and as supplemented or modified herein or by other best possible standards where the specific requirements mentioned in this section of the specification do not cover all the aspects to the full satisfaction of the Engineer.

**9.11 GRADES OF CONCRETE**:

A) Concrete shall be either ordinary or controlled and in grades designated M‑10, M‑15, and M‑20 as specified in IS: 456 (latest edition). In addition, nominal mixes of 1:2:4; 1:3:6 and 1:4:8 of nominal size aggregate of 20 mm maximum or as indicated on drawings, by volume or any other mix as per requirement shall be used where specified.

B) CONTROLLED CONCRETE:

* 1. General: Controlled concrete shall be used on all concrete works, except where specified.
  2. Mix Proportions: The mix proportions for all grades of concrete shall be designed to obtain strength corresponding to the values specified in IS: 456 for respective grade of concrete. Preliminary tests, as specified in the IS code or as required by the Engineer‑in‑charge, shall be carried out sufficiently ahead of the actual commencement of the work with different grades of concrete made from representative sample of aggregates and cement expected to be used on the job to ascertain the water cement ratio required to produce a concrete having specified strength and sufficient workability to enable it to be well consolidated and to be worked into corners of shuttering and around the reinforcement.

C) MIXES DESIGN CRITERIA: Concrete mixes will be designed by the Contractor to achieve the strength, durability and workability necessary for the job, by the most economical use of the various ingredients. In general, the design will keep in view the following considerations:‑

a) Consistent with the various other requirements of the mix, the quantity of water should be kept at the lowest possible level.

b) The nominal maximum size of coarse aggregate shall be as large as possible within the limits specified.

* 1. The various fractions of coarse and fine aggregates should be mixed in such a proportion as to produce the best possible combined internal grading giving the densest and most workable mix.

d) The finished concrete should have adequate durability in all condition, to withstand satisfactorily the weather and other destruction agencies that it is expected to be subjected to in actual service. The requirement of adequate structural strength is catered for by the choice of proper grade of concrete by the Engineer. The Contractor will strictly abide by the same in his design of concrete mix installation .Not withstanding anything mentioned in various tables given in IS:456 giving specific values and degrees of workability for different condition of concrete placing, minimum cement content and maximum water cement ratio for concrete exposed to sulphate attack and for concrete to ensure durability under different condition of exposure, strength requirement for different grades of concrete, proportion for nominal mix concrete, the following tables in the specification are included. For identical condition if values given in the tables shown herein below are different from those mentioned in IS: 456, the values as indicated in the table shown herein below shall prevail.

**TABLE ‑ II**

**MINIMUM CEMENT CONTENT SPECIFIED FOR DIFFERENT GRADES OF CONCRETE**

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑----------------------------------------

Grade of Minimum Cement Content/m³

Concrete Concrete of finished

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑-------------------------------------------

M –20 (design mix) 330 kg

M – 25 (design mix) 360 kg

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑-----------------------------------------

1. The minimum cement contents mentioned in Table III are for average conditions. The Engineer‑in‑charge shall have the right to revise the minimum cement content.

In this connection the Contractor shall abide by the following conditions.

* 1. The contractor shall design the mixes for 10% (Ten per cent) higher strength over and above those specified in Table I under Clause 11.11(C), for the various grades of concrete and different slump requirements.
  2. Sufficient number of trial mixes (to be decided by the Engineer) will be taken at the laboratory for the various designs and graphs of w/c ratio Vs crushing strengths at various ages will be plotted.
  3. All tests will be done in presence of the Engineer who shall be the final authority to decide upon the adoption of any revised minimum cement content. The contractor will always be responsible to produce quality concrete of the required grade as per the acceptance criteria of IS:456.
  4. The Engineer will always have the unquestionable right to revise the minimum cement content as decided above, if, in his opinion, there is any chance of deterioration of quality on account of use of lower cement content or any other reason.

At least four trial batches are to be made and 7 test cubes taken for each batch noting the slump of each mix. The cubes shall then be properly cured and two cubes for each mix shall be tested in a testing laboratory approved by the Engineer‑in-Charge at 7 days and others at 28 days for obtaining the compressive strength. The test reports shall be submitted to the Engineer‑in‑Charge. The cost of the mix design and testing shall be borne by the Contractor. All tests shall be done in the presence of Engineer‑in‑Charge.

Concrete tests specimens shall be made, cured and tested in conformation with IS: 517 (latest edition). These tests shall be conducted at approved laboratory. The modules and materials for cubes shall be supplied by the contractor who shall also arrange to transport the cubes/cylinders to laboratory at his cost.

The reports for each tentative concrete mix submitted for review shall include the following information.

i) Slump on which the design is based.

ii) Total liters of water per cubic meter.

iii) Water cement ratio.

iv) Ratio of fine to total aggregates.

v) Weight (surface dry) of each aggregate per cubic meter.

vi) Quantity of each admixture.

vii) Air content, if any.

viii) Compressive strength based on 7 days and 28 days compression tests.

ix) Time of initial set.

x) Time of final set.

xi) Weight of cement used in the mix.

1. On the basis of the above reports, a proportion of mix by weight and water cement ratio shall be approved by the Engineer‑in‑Charge which will be expected to give the required strength, consistency and workability and the proportions so decided for different grades of concrete shall be adhered to during all concreting operations. If however, at any time, the Engineer‑in‑Charge feels that the quality of material being used has changed from those used for preliminary mix design, the Contractor shall have to run similar trial mixes to ascertain the mix proportions and water cement ratio for obtaining the desired strength and consistency. The design mix particulars shall indicate by means of graphs and curves etc. the extent of variation in the grading of aggregate, which can be allowed.
2. In designing the mix proportions of concrete, the quantity of both cement and aggregate shall be determined by weight. The Engineer‑in‑charge may allow the quantity of aggregates to be determined by equivalent volume basis after the relationship between the weight and volume is well established by trial and the same shall be verified frequently. Water shall be either measured by volume in calibrated tanks of weighed. All measuring equipments shall be maintained in a clean and serviceable condition, and their accuracy periodically checked.
3. To keep the water cement ratio to the designed value, allowance shall be made for the moisture contents in both fine and coarse aggregates and determination of the same shall be made as frequently as directed by the Engineer‑in‑Charge. The determination of moisture contents shall be according to IS: 2386 (Part‑III).
4. It will be within the competency of the Engineer‑in‑Charge to reduce the number of trial batches and the number of test specimens mentioned above. Further the Engineer‑in‑Charge can also allow adoption of the mixes already tried and found satisfactory, with similar materials, for other jobs at the same site without any fresh design of mix.

D) STRENGTH REQUIREMENTS:

i) The mix proportions for all grades of concrete shall be designed to produce the grade of concrete having the required workability and a characteristic strength not less than the value given in Table‑I vide Cl.11.11(C).

ii) Should the work strength of concrete fall below the specified strength, the Engineer shall decide:

to reject the work, in which case the contractor shall replace the defective work with concrete of required strength and bear all costs for dismantling and replacing including the cost of associated form work, reinforcement, embedded parts and associated work.

(Or)

to accept the work at a reduced rate, in which case the unit rate payable for substandard work will be reduced by the owner directly in proportion to the work strength as compared to the specified strength. The owner may, in addition, require other tests performed on the respective structural member so accepted prior to its acceptance with or without necessary/corrective measures and in each such case the contractor shall bear all costs for all such tests or corrective measures, besides the reduction in the unit rates as specified herein.

Concrete of strength below fifteen (15) percent of the specified strength will not be accepted.

iii) With permission of the Engineer‑in‑charge, for any of the above mentioned grades of concrete, if the water quantity has to be increased in special cases, cement shall also be increased proportionately to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment for the additional cement will be made.

E) DURABILITY REQUIREMENT:

Tables 19 & 20 of IS:456 give the maximum water‑cement ratio permissible from the point of view of durability of concrete subjected to adverse exposure to weather, sulphate attacks, and contact with harmful chemicals. Impermeability may also be a important consideration.

Whenever the water‑cement ratio dictated by durability consideration is lower than that required from strength criterion, the former shall be adopted. However, water cement ratio, from the point of view of durability as well as from strength consideration, should meet the requirements given in Table No.II.

**TABLE‑V**

**LIMITS OF CONSISTENCY**

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑---------------------------------------

Degree of Slump in mm with Standard Use for which concrete is suitable

Workability Cone as per IS: 1199

Min. Max ‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑

Very low 0 25 Large Mass concrete structure with heavy

compaction equipments, roads and like

Low 25 50 Un-congested wide and shallow RCC

structures

Medium 50 100 Deep but wide RCC with congestion or

reinforcement and inserts

High 100 150 Very narrow and deep RCC structures with inserts congestion due to reinforcement and

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑----------------------------------------

(Note: Notwithstanding anything mentioned above, the slump to be obtained for work in progress shall be as per direction of the Engineer).

The workability of concrete shall be checked at frequent intervals by slump tests. Alternatively where facilities exist or if required by the Engineer, the compacting factor test in accordance with IS:1199 and Clause 6 of IS:456 shall be carried out.

F) BATCHING:

i) In proportioning concrete, the quantity of both cement and aggregate should be determined by weight, where the weight of cement is determined on the basis of weight of cement per bag, a responsible number of bags should be weighed periodically to check the net weight. Where the cement is weighed on the site and not in bags it should be weighed separately from the aggregates. Water should be either measured by volume in calibrated tanks or weighed. Any solid admixture that may be added, may be measured by weight, liquid and paste admixture by volume or weight. Batching plant where used should conform to IS:4925‑1968. All measuring equipment should be maintained in a clean serviceable condition, and their accuracy periodically checked.

ii) Except where it can be shown to the satisfaction of the Engineer‑in‑charge that supply on properly graded aggregate of uniform quality can be maintained over the period of work, the grading of aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportion when required, different sizes being stocked in separate stock files. The grading of coarse and fine aggregate should be checked frequently for a given job being determined by the Engineer‑in‑charge to ensure that the specified grading is maintained.

iii) Change from weigh batching to volume batching may be done only after obtaining the specific permission of Engineer‑in‑charge in writing.

iv) The amount of the added water shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates, IS:2386 (Part‑III) may be referred to. To allow for the variation in their moisture content, suitable adjustments in the weights of aggregate shall be made. In the absence of exact data, only in the case of Nominal Mixes, the amount of surface water may be estimated from the values given in Table‑C.

**TABLE‑C**

**SURFACE WATER CARRIED BY AGGREGATE**

Aggregate Approximate Qty. of surface water

Percent by Mass Liter M

Very wet sand 7.5 120

Moderately wet sand 5.0 80

Moist sand 2.5 40

Moist gravel or crushed rock 1.25‑2.5 20‑40

No substitutions in materials used on the work or alterations in the established proportions, except as permitted in Clauses 11.11(F)(iii) & (iv) shall be made without additional tests to show that the quality and strength of concrete are satisfactory.

**9.12 WORKMANSHIP**:

A) GENERAL:

All workmanship shall be according to the latest and best possible standards. Before starting a pour the Contractor shall obtain the approval of the Engineer‑in‑Charge in a "Pour Card" maintained for this purpose. He shall obtain complete instructions about the material and proportion to be used, slump, workability, quantity of water per unit of cement, number of test cubes to be taken, type of finishing to be done, any admixture to be added, any limitation on size of pour and stopping of premature pours.

B) MIXING OF CONCRETE:

All control/design mix concrete shall be mixed at a single central batching plant situated within the area allocation for the Contractor's particular use as shown on the drawings. The plant shall have mechanically operated mixer of an approved size and type capable of ensuring a uniform distribution of the materials throughout the mass. The entire batch shall be discharged before recharging.

The proportions of the fine and coarse aggregate, cement and water shall be as determined by the mix design or according to fixed proportions in case of nominal mix concrete and shall always be approved by the Engineer‑in‑Charge. The quantities of the cement, fine and coarse aggregates shall be determined by weight, the water shall be measured accurately after giving proper allowance for surface water present in the aggregate for which regular check shall be made by the Contractor.

The water shall not be added to the mix until all the cement and aggregates constituting the batch are already in the drum and dry mix for at least one minute. Mixing of each batch shall be continued until there is a uniform distribution of the materials and the mixing done for less than two (2) minutes and at least forty (40) revolutions after all the materials and water are in the drum. When absorbent aggregates are used or when the mix is very dry, the mixing time shall be extended as may be directed by the Engineer-in‑Charge. Mixers shall not be loaded above their rated capacity as it prevents thorough mixing. If there is segregation after unloading form the mixer the concrete should be remixed.

Before beginning a run of concrete all partially set or hardened concrete and foreign material shall be removed from the inner surfaces of mixing and conveying equipment. The first batch of concrete, through a cleaned mixer, for use in the works, shall contain 10% additional cement at no extra cost to the owner, to allow for loss in the drum.

C) CONVEYING CONCRETE:

a) Concrete shall be handled and conveyed from the place of mixing to the place of laying as rapidly as practicable by approved means and placed and compacted in the final position before the initial setting of the cement starts. Concrete should be conveyed in such a way as will prevent segregation or loss of any of the ingredients. For long distance haulage, agitator cars of approved design will be used. If, in spite of all precautions, segregation does occur during transport, the concrete shall be properly remixed before placement. During very hot or cold weather, if directed by the Engineer, concrete shall be transported in deep containers which will reduce the rate of loss of water by evaporation or loss of heat. If necessary, the container may have to be covered and insulated. Conveying equipments for concrete shall be well maintained and thoroughly cleaned before commencement of concrete mixing. Such equipments shall be kept free from set concrete. Concrete shall not be delivered by spout or troughs nor dumped into carriers with a free fall from the mixer of more than 1 nut.

b) No concrete shall be placed except in the presence of the Engineer‑in‑Charge or his authorized representative. Concrete which is not placed in accordance with the specifications or which is of inferior quality as determined by the Engineer‑in Charge, shall be removed and replaced by the Contractor, the entire cost of which shall be borne by the contractor.

c) Before any concrete is placed, the entire placing programme consisting of equipment, layout, proposed procedure and methods shall be submitted in writing to the Engineer‑in‑Charge for approval and no concrete shall be placed until his approval has been received.

d) Concrete shall be conveyed to the point of final deposit by methods which will prevent the separation or loss of the ingredients. Concrete shall be deposited in its final position without moving it laterally in the forms for a distance in excess of 1.5 meters.

D) Placing and Compacting Concrete:

a) Where specifically covered, the relevant IS Code will be followed for the procedure of surface preparation, placement, consolidation, curing, finishes, repairs and maintenance of concrete. If, however, there is no specific provision in the relevant IS Code for any particular aspect of work, any other standard code of practice, as may be specified by the Engineer, will be adopted. Concrete may have to be placed against the following types of surfaces:

1. Earth foundation
2. Rock foundation

iii) Formwork

iv) Construction joint in concrete or masonry.

The surface on or against which concrete is to be placed has to be cleaned thoroughly. Rock or old construction joint has to be roughened by wire brushing, chipping, sand blasting or any other approved means for proper bond. All cuttings, dirt, oil, foreign and deleterious material, laitance, etc. are to be removed by air water jetting or water at high pressure. Earth foundation on which direct placement of concrete is allowed, will be rammed and consolidated as directed by the Engineer such that it does not crumble and get mixed up with the concrete during or after placement, before it has sufficiently set and hardened.

b) Formwork, reinforcement, preparation of surface, embedment, joint seals etc., shall be approved in writing by the Engineer before concrete is placed. As far as possible, concrete shall be placed in the formwork by means approved by the Engineer and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 1500 mm shall have to be approved by the Engineer.

c) Rock foundation or construction joint will be kept moist for at least 72 hours prior to placement. Concrete will be placed always against moist surface but never on pools of water. In case the foundation cannot be dewatered completely, special procedure and precaution, as directed by the Engineer will have to be adopted.

d) Formwork will be cleaned thoroughly and smeared lightly with form oil or grease of approved quality just prior to placement. Before concrete is placed, forms, reinforcement, anchor bolts and embedment shall be rigidly secured in proper position. Concrete shall be deposited in its final position without segregation, rehandling or following or loss of liquid from concrete. The interval between adding the water to the dry materials in the mixer and the completion of the final placing inclusive of compaction of the concrete shall be well within the initial setting time for the particular cement in use or as directed by the Engineer‑in‑charge.

e) A layer of mortar of thickness 12 mm of the same or less w/c ratio and the same proportion as that of the concrete being placed and cement slurry will be spread thoroughly on the rock foundation or construction joint just prior to placement of concrete. The cost of application of such cement slurry and mortar will be deemed to be included in the unit rate of concrete.

f) To ensure bond and water tightness between old concrete surface and the concrete to be placed, the surface should be cleaned and roughened by "initial green out" by wire brushing or chipping. The initial green cutting may be done after 6 hours of placing concrete in order to facilitate the work. Before plastering, the surface shall be thoroughly hacked. The bonding of old and new concrete should be done by applying the cement slur after thoroughly watering the old concrete surface and removing all free particles.

g) The placing of concrete shall be a continuous operation with no interruption in excess of 30 minutes between the placing of continuous portions of concrete.

h) After concrete has been placed, it shall be spread, if necessary and thoroughly compacted by approved mechanical vibration to maximum subsidence without segregation and thoroughly worked around shape. To secure maximum density and eliminate formation of air pockets, the concrete shall be thoroughly vibrated and worked around all reinforcement, embedded facilities and into corners or forms during and immediately after placing. Unless other methods are authorised by the Engineer‑in‑charge, mechanical vibrators conforming to IS: 2505, IS: 2506, IS: 2514 and IS: 4656 (all latest edition) shall be used for this purpose, the type and operation of which is subject to the approval of the Engineer‑in‑charge. The extent of vibration shall be through the entire depth and width of each new layer. Duration of vibration shall be sufficient to accomplish thorough compaction and complete embedment of reinforcement. Due to vibration , the tendency for large aggregate to gravitate to lower elevations shall not relieve the contractor from his responsibility of obtaining a uniform density throughout the mass. Excess cement paste thus formed at the top of each layer shall be removed before the succeeding layer is deposited.Vibrators shall not be used for pushing concrete into adjoining areas. Vibrators must be operated by experienced workmen and the work carried out as per relevant IS Code of Practice. In thin members with heavy congestion of reinforcement or other embedment, where effective use of internal vibrator is, in the opinion of the Engineer, doubtful, in addition to immersion vibrators the contractor may have to employ form vibrators conforming to IS:4656. For slabs and other similar structures, the contractor will additionally employ screed vibrator as per IS:2506. Hand tamping may be allowed in rare cases, subject to the approval of the Engineer. Care must be taken to ensure that the inserts, fixtures, reinforcement and formwork are not displaced or distorted during placing and consolidation of concrete. Contractor shall provide proper equipment or methods for compaction of concrete or covers or other similar areas where conventional methods would not be adequate.

i) Immersion type vibration shall be provided at the rate of at least one 65 mm unit per cu.m. per hour together with at least one stand by vibrator of the appropriate size. Vibrators shall be inserted in the concrete at a sufficient number of places so that their fields of influence overlap and shall not be used to work the concrete along with forms or screeds. Vibrators shall be withdrawn causing segregation; surface laitance or leakage through the forms shall be avoided. Where electrically operated vibrators are used, diesel or petrol driven stand by vibrators shall be available for carrying on uninterrupted vibration in case of a power failure.

j) Concrete to be vibrated shall be placed in level layers of suitable thickness not greater than the effective length of the vibrator needle. The concrete at the surface shall not be distributed as horizontally as possible, the vibration shall not be done in the neighbourhood of slopes. The internal vibrator shall not be used to spread the concrete for filling. It is advisable to deposit concrete well in advance of the point of vibration. When the concrete is being continuously deposited to a uniform depth along a member, vibrator shall not be operated too near to the free end of the advancing concrete, usually not within 1.20 meters of it. Every effort shall be made to keep the surface of the previously placed layer of concrete alive so that the succeeding layer can be amalgamated with it by vibration process. Following points shall be kept in mind while vibrating concrete.

k) The concrete shall be placed in shallow layers consistent with the method being used to place and vibrate the concrete. Usually concrete shall be placed in thickness not more than 300 mm and on initial placing in thickness not more than 150 mm.

l) The vibrator head shall be dipped through filling which is to be consolidated to further depth of 10 to 20 mm in the lowest layer which has already been consolidated.

m) Vibration shall be carefully controlled, the internal vibrator being systematically inserted at points minimum 450 mm and maintained in position for a fixed time. Immersion for periods of 5 to 15 seconds should normally be sufficient. The limit of action is judged by surface appearance. The surface shall neither be honey combed nor shall it contain excess mortar.

n) The vibrator shall be inserted vertically, with inclined or haphazard insertion it will be impossible to regulate the degree of compaction in all portions of the concrete. Care shall be taken to prevent contact of immersion vibrators with form work, reinforcement steel and finished surfaces. Immersion vibrators shall not come in contact with reinforcement steel if initial set of concrete around it has started.

o) The vibrator shall be allowed to penetrate on its own accord and should be withdrawn quite slowly, at the rate of about 75 mm per second, whilst still running, so as to allow the redistribution of the concrete in its wake.

p) The rate of placement of concrete shall be such that no cold joint is formed and fresh concrete is placed always against green concrete that is still plastic and workable. No concrete shall be placed in open, is to be attempted unless sufficient tarpaulins or other similar protective arrangement for completely covering the still green concrete from rain is kept at the site of placement. If there has been any sign of washing of cement and sand, the entire affected concrete shall be removed immediately. Suitable precautions shall be taken in advance to guard against rains before leaving the fresh concrete unattended. No accumulation of water shall be permitted on or around freshly laid concrete.

q) Slabs, beams and similar members shall be poured in one operation, unless otherwise instructed by the Engineer. In special circumstances with the approval of the Engineer‑in charge, these can be poured in horizontal layers not exceeding fifty (50) cm. in depth. When poured in layers, it must be ensured that the under layer, is not already hardened. Bleeding of under layer if any, shall be effectively removed. Moulding, throating, drip course, etc. shall be poured as shown on the drawings or as directed by the Engineer. Holes shall be provided, and bolts, sleeves, anchors, fastenings or other fixtures shall be embedded in concrete as shown on the drawings or as directed by the Engineer. Any deviation there from shall be set right by the Contractor at his own expense as instructed by the Engineer.

r) Concrete shall be deposited in a manner to prevent displacing facilities or reinforcement above the level of the fresh concrete, and the formation of seams or planes of weakness within the sections. Each layer shall be deposited as close to its final position as practicable in order to prevent segregation.

s) In case the forms or supports get displaced during or immediately after the placement and bring the concrete surface out of alignment beyond tolerance limits, the Engineer may direct to remove the portion and reconstruct or repair the same at the Contractor's expense.

t) The Engineer shall decide upon the time interval between two placements of concrete of different ages coming in contact with each other, taking in consideration the degree of maturity of the older concrete, shrinkage, heat dissipation and the ability of the older concrete to withstand the load imposed upon it by the fresh placement.

u) Once the concrete is deposited, consolidated and finished in its final position, it shall not be disturbed.

v) Whenever vibration has to be applied externally the design of formwork and the disposition of vibrators shall receive special consideration to ensure efficient compaction and to avoid surface blemishes. After initial set of concrete the forms shall not be jarred and no strain or vibration equipment shall be placed on the ends of projecting reinforcement.

w) Concrete shall not ordinarily be placed under water. In unavoidable cases, such concreting shall be done only with the specific approval of procedure and application by the Engineer‑in‑charge. The concrete shall contain at least 10 percent more cement than that required for the same mix placed in the dry, the quality of extra cement varying with condition of placing. The relevant clauses of IS:456 (latest edition) should be adhered to 11.12(D)(w). Retamping of concrete or mortar which has partially hardened shall not be permitted.

x) It is imperative that all excavations prepared for concrete construction be maintained free of water until such concrete work is completed. The contractor shall make provisions and furnish equipment as required for such dewatering, subject to approval by the Engineer‑in‑charge. Water used for flushing concrete placing equipment shall be discharged clear of the concrete and forms.

y) Contractor shall keep an accurate record of the date on which the concrete is cast for each part of work and date on which the forms are removed.

E) COLD WEATHER CONCRETING:

When conditions are such that the ambient temperature may be expected to be 4.5 °C or below during the placing and curing period, the work shall conform to the requirement of Clause 13 of IS:456 and IS:7861.

F) HOT WEATHER CONCRETING:

When depositing concrete in very hot weather, the contractor shall take all precautions as per IS:7861 and stagger the work in the cooler parts of the day to ensure that the temperature of wet concrete used in massive structures does not exceed 38 °C while placing. Positive temperature control by pre-cooling, post cooling or any other method, if required, will be specified and paid for separately.

**9.13 CONSTRUCTION JOINTS**:

i) The locations and details of construction joints must be got approved from the Engineer‑in‑charge before concrete is poured. Concreting shall be carried continuously up to construction joints.

ii) At least two hours must lapse after depositing concrete in the columns or walls before depositing in beams, girders or slabs supported thereon. Beams, girders, brackets and haunches shall be considered as part of the floor system and shall be placed monolithically therewith.

iii) Construction joints in foundations of equipment shall not be provided without specific concurrence of the Engineer‑in‑charge.

iv) It is always desirable to complete any concrete structure by continuous pouring in one operation. However, due to practical limitation of methods and equipment and certain design considerations, construction joints are formed by discontinuing concrete at certain predetermined stages. These joints will be formed in a manner specified in the drawings/instruction. Vertical construction joints will be made with rigid stop board forms having slots for allowing passage of reinforcement rods and any other embedment and fixtures that may be shown of desired by the Engineer‑in‑charge keep and/or dowel bars shall be provided at the construction joints. For water retaining structures and leak proof buildings suitable and approved water stops may be installed at the construction joints as per Clause 12.4 of IS: 456. Where the location of the joints are not specified, it will be in accordance with the following:‑

1. In a column, the joint shall be formed 75 mm below the lowest soffit of the beam framing into it.
2. Concrete in a beam shall preferably be placed without a joint, but if provision of a joint is unavoidable, the joint shall be inclined as given in the relevant standards.
3. Joint in a suspended floor slab shall be vertical and between 1/4th to 1/3rdof the span from its ends and at right angles to the principal reinforcement.
4. Feather‑edges in concrete shall be avoided while forming a joint.
5. A construction joint should preferably be placed in a low stress zone and at right angles to the direction of the principal stress.
6. In case the contractor proposes to have a construction joint anywhere to facilitate his work, the proposal should be submitted well in advance to the Engineer for study and approval without which no construction joint will be allowed.
7. When the work has to be resumed on a surface that has hardened, such surface shall be roughened. It shall then be swept clean, thoroughly wetted, and covered with a 15 mm layer of mortar composed of cement and sand in the ratio of 1:1.

This 15 mm layer of mortar shall be freshly mixed and placed immediately before the placing of the concrete. The new concrete shall be worked against the prepared surface before the slurry sets. Special care shall be taken to see that the first layer of concrete placed after a construction joint is thoroughly rammed against the existing layer. Old joints during pour shall be treated with 1:1 freshly made cement sand slurry only after removing all loose materials.

vi) Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of particles of aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm in thickness and shall be well rammed against old work, particular attention paid to concrete and close spots.

**9.14 REPAIRS & FINISHES OF CONCRETE**:

A) Adequate and sound concrete surfaces, whether formed or unformed, can be obtained by employing a concrete mix of proper design, competent formwork, appropriate methods of handling, placing and consolidation by experienced workmen.

B) All concrete surface either cast‑in‑site or pre‑cast shall have even, clean finish, free from honey combs, air bubbles, fins or other blemishes.

C) Unsound concrete resulting from improper mix design, incompetent methods, equipment and formwork, poor workmanship and protection will not be accepted and will have to be dismantled, removed and replaced by sound concrete at the Contractor's cost. The Engineer may, at his sole discretion, allow retaining concrete with minor defects provided the Contractor is able to repair it by approved methods at no extra cost to the Purchaser. All concrete work shall be inspected by the Contractor immediately after the forms are removed and he will promptly report occurrence of any defects to the Engineer. All repair works will be carried out as per the instructions and in the presence of the Engineer or his representative. Generally, repair work will consist of any or all of the following operations:‑

1. Sack rubbing with mortar and stoning with carborundum stone.
2. Cutting away the defective concrete to the required depth and shape.
3. Cleaning of reinforcement and embedment.
4. Roughening by sand blasting or chipping.
5. Installing additional reinforcement/welded mesh fabric.
6. Dry packing with stiff mortar.
7. Plastering, grunting, shotereting etc.
8. Placing and compacting concrete in the void left by cutting out defective concrete.
9. Grouting with cement sand slurry of 1:1 mix.

D) The requirement of finishes of formed surfaces are given separately under Clause 13.6 of this specification. The Contractor is to include in his quoted rate for concrete, the provision of normal finishes in unformed surfaces which can be achieved by screening, floating, toweling etc., as and where required by the Engineer without any extra cost to the Purchaser. A few typical and common cases of treatment of concrete surface are cited below.

a) Except where a special finish is called form all exposed concrete shall be finished as follows.

b) All fins and other projections shall be neatly chipped, rubbed down and made smooth; form oil shall be entirely removed by stiff fiber brushes. The use of acid shall not be permitted. All exposed corners shall be slightly rounded or chamfered.

Air holes, cavities and similar imperfections shall be first saturated with water and filled with a mortar mixture of composition as that used in the concrete. After initial set of mortar the surface shall be rubbed down with burlap. A stucco coat shall be allowed to be applied to the surface.

c) i) Floor:

Whenever a non integral floor finish is indicated, the surface of reinforcement concrete slab shall be struck off at the specified levels and slopes and shall be finished with a wooden float fairly smooth removing all laitance. No over‑toweling, to obtain a very smooth surface, shall be done, as it will prevent adequate bond with the subsequent finish. If desired by the Engineer, the surface shall be scored and marked without any extra cost to the Purchaser to provide better bond. Where monolithic finish is specified or required, concrete shall be compacted and struck off at the specified levels and slopes with a screed, preferably a vibrating type and then floated with a wooden float. Steel trowel ling is then started after the moisture film and shine have disappeared from the surface and after the concrete has hardened enough to prevent excess of fines and water to rise to the surface but not hard enough to prevent proper finishing of aberrations. Steel trowel ling properly done will flatten and smoothen sandy surface left by wooden floats and produce a dense surface free from blemishes ripples and trowel marks. A fine textured surface that is not slick and can be used where there is likelihood of spillage of oil or water can be obtained by trowel ling the surface lightly with a circular motion after initial trowel ling keeping the steel trowel flat on the surface. To provide a better grip the Engineer may instruct marking the floor in a regular geometric pattern after initial trowel ling.

ii) Beams, columns & walls:

If on such or any other concrete structure it is intended to apply plaster or such concrete surfaces against which brickwork or other allied works are to be built, the contractor shall hack the surface adequately as soon as the form is stripped off so that proper bond can develop. Pattern, adequacy and details of such hacking shall meet with the approval of the Engineer, who shall be informed to inspect such surfaces before they are covered up.

d) Concrete surfaces to be subsequently plastered or where brickwork shall be built against it shall be adequately hacked as soon as the form is stripped off so that proper bond can develop.

**9.15 CURING OF CONCRETE**:

A) Curing shall be as per this specification and IS: 456. Unless otherwise specified all concrete shall be moist cured by keeping all exposed surfaces, edges and corners continuously moist for at least twenty one days after being placed, by spraying, ponding or covering with waterproof paper or moisture retaining fabric.

B) Newly placed concrete shall be protected by approved means from rain, sun and wind. Concrete placed below the Ground level shall be protected against contamination from falling earth during and after placing. Concrete placed in Ground containing deleterious substances, shall be protected from contact with such Ground, or with water draining from such Ground, during placing of concrete and for a period of at least three days or as otherwise instructed by the Engineer. The Ground water around newly poured concrete shall be kept to an approved level by pumping out or other adequate means of drainage to prevent floatation or flooding. Steps, as approved by the Engineer, shall be taken to protect immature concrete from damage by debris, excessive loadings, vibration, abrasion, mixing with earth or other deleterious materials, etc. that may impair the strength and durability of the concrete.

As soon as the concrete has hardened sufficiently, it shall be covered either with sand, Hessian, canvas burlap or similar materials which will hold moisture for long period and prevent loss of moisture from concrete and kept continuously wet for at least 18 (eighteen) days after final setting. Curing by continuous sprinkling of water will be allowed if the Engineer is satisfied with the adequacy of the arrangements made by the Contractor.

Curing of concrete shall start after 8 hours of placement and in hot weather within 4 hours of placement of exposed faces. During the first 24 hours, the concrete shall be cured by use of wet burlap or such other means to cover the concrete surfaces. In very hot weather, precaution shall be taken to see that the temperature of wet concrete does not exceed 38 deg. C while placing.

Concrete slabs and floors shall be cured by flooding with water of minimum 25 mm depth for the period mentioned above. Approved curing compounds may be used in lieu of moist curing with the permission of the Engineer‑in‑charge. Such compounds shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set.

The contractor shall remain extremely vigilant and employ proper equipment and workers under able supervision for curing. The Engineer's decision regarding the adequacy of curing is final. In case any lapse on the part of the contractor is noticed by the Engineer, he will inform the contractor or his supervisor verbally or in writing to correct the deficiency in curing. If no satisfactory action is taken by the contractor within 3 (three) hours of issuance of such instruction, the Engineer will be at liberty either to employ sufficient means through any agency to make good the deficiency and recover the cost thereof from the contractor, or pay for the part where adequate curing was noticed at a reduced rate, entirely at the discretion of the Engineer.

C) WASH WATER:

Wash water shall be removed in a manner to prevent running down and staining of concrete surfaces which will be exposed at the completion of the work. Should unsightly wash water streak develop on the exposed surfaces, they shall be removed and water has to be lead to a suitable place as directed by Engineer‑ in charge.

**9.16 METHOD OF MEASUREMENT:**

A) Actual volume of work as executed as per drawing issued, whichever is less, shall be measured in cubic meter correct up to second place of decimal. Deductions for openings, conduits, pipes, ducts, pockets, chases etc. shall be made, provided they are larger than 0.1 m² in area (for each opening unto and less than 0.1 m² in area the formwork shall not be paid for separately).

B) No deduction shall be made for embedded fixtures including reinforcements, sleeves, anchor bolts and similar items.

.

**9.17 SAMPLING & TESTING IN FIELD**:

A) Grading Test:

Grading tests on coarse and fine aggregates shall be carried out at intervals specified by the Engineer‑in‑ charge.

B) Slump Test or Concrete:

At least one slump test shall be made for every compressive strength test carried out. More frequent test shall be made if there is a distinct change in work conditions, or if required by the Engineer ‑in charge

C) Strength test of concrete:

a) Samples of concrete shall be taken at the direction of the Engineer‑in‑charge in the field in accordance with IS: 1199 "Methodist of sampling and analysis of concrete".

b) These shall be tested for strength and consistency at an approved Government laboratory as specified by the Engineer‑in‑charge in accordance with IS:517. The moulds and material for cubes and cylinders shall be supplied by the contractor who shall also arrange to transport the cubes/cylinders to laboratory at his cost. Actual cost of the testing shall be borne by the contractor.

c) The acceptance criteria for the compressive strength shall be as per IS: 456. Only the slump indicated for the approved design mix shall be adopted. However, larger slumps than those indicated in approved design mix, of concrete of a specified grade (strength) may be necessary to get a workable consistency for concrete in case of beams, columns and other heavily reinforced members. No extra payment shall be made for extra cement that may have to be added in such cases to get the concrete of the same specified grade (strength) with larger slumps. The decision of Engineer‑in‑charge regarding the degree of consistency of the amount of slump shall be final.

d) Samples shall be cured under laboratory conditions, except when in the opinion of the Engineer‑in‑charge extreme weather condition may prevail at which time the Engineer‑in‑charge may require curing under job conditions.

e) If the test strength of the laboratory controlled cubes/cylinders for any portion of the concrete work falls below the compressive strength specified, the Engineer‑in‑charge shall have the right to order a change in the proportion or the water content for the remaining portion of the structure.

f) If the test strength of the job cured cubes/cylinders falls below the specified strength, the Engineer‑in‑charge shall have the right to require provision for temperature and moisture control during curing as necessary to secure the required strength and may require retests in accordance with "Standard method of securing, preparing and testing specimens from hardened concrete for compressive and flexural strength or order load tests to be made on the portion of the building so affected. All such tests shall be made contractor's expenses.

g) When the cubes tested reveal a strength lower than those specified, the acceptance criteria for such concrete shall be decided as stipulated in IS:456 (latest edition). The Engineer‑in‑charge shall also reserve the right to reject whole or any part of the work. In case of acceptance of such works the standard deviations shall be worked out and examined by the Engineer‑in‑charge and if he is satisfied, only then such work can be accepted at the reduced rate. The amount to be deducted shall be decided by the Engineer‑in‑charge.

h) For the purposes of statistical analysis any cube result, which in the opinion of Engineer‑in‑charge is due to improper sampling, molding or testing shall be discarded and a dummy result shall be substituted. The value of the cubes from the same grade of concrete tested immediately before and after the discarded value.

i) The contractor shall prepare and submit to the Engineer‑in charge a sample form to be used during the batching and mixing of the concrete. The form shall provide for entries to be made which will indicate the quantity of each material placed in each mixer, the mixer identification number, the batch number, the duration of time the batch was mixed, and the name or initials of the person recording the information.

j) The contractor is responsible for recording the required information for each batch of concrete and for submitting the required number of copies of completed form to the Engineer‑in charge.

k) Strict quality control shall be exercised in all concreting works and the acceptance criteria of concrete shall be in accordance with IS: 456‑2000.However, in exceptional circumstances the Engineer‑in‑charge may, at his discretion, accept a concrete of lower strength than specified and which is otherwise acceptable according to IS: 456‑2000.

l) Failure of the concrete to meet the early age strengths at 7 days shall be considered a failure of the concrete to meet the strength requirements and the Engineer‑in‑charge in such instances shall have the right to stop construction. The early age strength shall be the mean strength at the specified age minus 2 times standard deviation for the specified age as given in clause 11.21 (B) .

m) Concrete work found unsuitable for acceptance shall be dismantled and replacement is to be done as per specification by the contractor. No payment for the dismantled concrete, the relevant form work and reinforcement embedded fixtures, etc. wasted in the dismantled portion shall be made. In the course of dismantled, if any damage is done to the embedded items or adjacent structures, the same shall be made good, free of charge by the contractor to the satisfaction of the Engineer‑in‑charge.

n) The dimension of concrete as cast when compared with those on the drawings shall be within the tolerances specified on IS Code. No reduction will be permitted in the cover to reinforcement because of a specified negative tolerance in a concrete section.

o) Only the slump indicated in the approved design mix shall be adopted. However larger slumps than those specified grade (strength) may be necessary to get a workable constituency for concrete in case of beams, columns and other heavily reinforced members. No extra payment shall be made for extra cement that may have to be added in such cases to get the concrete of the same specified grade (strength) with larger slumps. The decision of Engineer‑in‑charge regarding the degree of constancy or the amount of slump shall be final.

**9.18 FREQUENCY OF SAMPLING:**

The minimum frequency of sampling of concrete for each grade shall be in accordance the following:

Quantity of concrete Number of samples

in the WORK M3

1 ‑ 5 1

6 –15 2

17‑ 30 3  31‑50 4

51 and above 4 Plus one additional sample for each additional 50 M3 or part thereof.

A) Test Specimens: Six test specimens shall be made from each sample first testing three at 7 days & after three at 28 days.

B) Test Strength of Sample: The test strength of the sample shall be the average of the strength of three specimens. The individual variation should not be more than + 15 per cent of the average.

**9.19 STANDARD DEVIATION**:

A) STANDARD DEVIATION BASED ON TEST RESULTS:

1. Number of test results: The total of test results required to constitute and acceptable record for calculating of standard deviation shall be not less than 30. Attempts should be made to obtain the 30 test results, as early as possible, when a mix is used for the first time.
2. Standard deviation to be brought up to date: The calculation of the standard deviation shall be brought up to date after every change of mix design and at least once a month.
3. Concrete of each grade shall be analyzed separately to determine its standard deviations.

B) Assumed Standard Deviation: Where sufficient test results for a particular grade of concrete are not available, the value of standard deviation given in Table D may be assumed.

T A B L E ‑ D

ASSUMED STANDARD DEVIATION

Grade of concreteAssumed Standard Deviation N/mm2

M‑10 2.3

M‑15 3.5

M‑20 4.6

However, when adequate past records for a similar grade exist and justify to the designer a value of standard deviation different from that shown in Table‑D, it shall be permissible to use that value.

C) IS Codes:

Important relevant IS for this Section:

IS: 456 Code of practice for plain and reinforced concrete.

IS: 1199 Methods of sampling and analysis of concrete.

IS: 1838 Preformed fillers for expansion joints in concrete nonextruding and resilient type (bitumen impregnated filler).

IS: 2386 Part III: Specific gravity, density, voids, absorption and buckling.

IS: 2505 General requirements for concrete vibrators, immersion type.

IS: 2506 Screed board concrete vibrators.

IS: 2514 Concrete vibrating tables.

IS: 3025 Methods of sampling and test (physical and chemical) for water used in industry.

IS: 3370 Code of practice for concrete structure for the storage of liquids.

IS: 3350 Methods of tests for routine control for water used in industry.

IS: 4656 Form vibrators for concrete.

IS: 517 Methods of test for strength of concrete.

**10.0 TECHNICAL SPECIFICATION FOR REINFORCEMENT:**

A) SCOPE:

This section of the specification shall cover furnishing of working drawings with barbending schedule and the furnishing, cleaning, bending placing with arrangements for chairs, supports and suitable covers if reinforcement steel plain or deformed for all reinforced concrete works, below and above Ground level for complete pits as per drawings and specification.

B) Contractor shall supply, fabricate and place reinforcement to shapes and dimensions, as per IS:2502 "Code of Practice for bending and fixing bars for concrete reinforcement" and as indicated in approved drawings of the contractor.

C) MATERIALS:

Mild steel round bars, cold twisted and deformed bars as medium tensile or high yield strength steel confirming to IS:432 and IS:1786‑1979, plain hard drawn steel wire fabric etc will be used as reinforcement as per drawings and directions. Reinforcement accessories shall also be supplied by the contractor in the rates quoted for reinforcement.

D) BAR BENDING SCHEDULES**:**

The contractor shall submit to the Engineer for approval Bar Bending Schedules with working drawings in triplicate, showing clearly the arrangements proposed by the contractor, within one month of receipt of the Letter of Intent or of the receipt of the relevant approved design of the drawings, whichever is later. Upon receipt of the Engineer's final approval of the Bar Bending Schedule and drawings, the contractor shall submit 6 (six) prints of the final drawings with one reproducible print after incorporating necessary modifications or corrections, for final record and distribution. Approval of such detailed drawings by the Engineer shall not relieve the contractor of his responsibility for correctness nor of any of his obligations to meet the other requirements of the contract. Any adjustments in reinforcement to suit field conditions and construction joints other than shown on approved drawings shall be subject to approval of Engineer‑in‑charge/consultant. The payment for above is deemed to have been included in the rates quoted for reinforcement item. The contractor shall adhere strictly to requirements for a concrete cover over steel reinforcement, projection of bars for bending with future extensions, reinforcement, mesh reinforcement and other items to connection with proper placing.

E) CLEANING**:**

All steel for reinforcement shall be free from loose scales, oil, grease, paint or other harmful matters immediately before placing the concrete.

F) BENDING:

a) Unless otherwise specified, reinforcing steel shall be bent in accordance with the procedure specified in IS: 2502 or as approved by the Engineer. Bends and shapes shall comply strictly with the dimensions corresponding to the approved Bar Bending Schedules. Bar Bending Schedules shall be rechecked by the contractor before any bending is done and he shall be entirely responsible for its correctness. Bars correctly bent shall only be used.

b) No reinforcement shall be bent when already in position in the work, without approval of the Engineer, whether or not it is partially embedded in concrete. Bars shall not be straightened in a manner that will injure the material. Re-bending bars shall be bent by machine or other approved means producing a gradual and even motion. All the bars shall be cold bent unless otherwise approved. Bending hot at a cherryred heat (not exceeding 845 deg. C) may be allowed under very exceptional circumstances except for bars whose strength depends on cold working. Bars bent hot shall not be cooled by quenching. Bars shall be properly lagged for easy identification.

c) In no case shall the clear distance between bars be less than the diameter of the bar not less than one third of the max. size of coarse aggregate. Reinforcement shall be bent in accordance with procedure specified in IS:2502 code of practice for bending and fixing of bars for concrete reinforcement and shall not be straightened in manner that will injure the material.

d) Expanded portion of reinforcement bars must not be subjected to impact or rough handling and workers will not be permitted to climb on bar extensions until the concrete has sufficient strength so that no movement of the bar in the concrete is possible.

e) Where reinforcement bars are bent at site at construction joints and afterwards bent back into their original positions. Care should be taken to ensure that at no time is the radius of the bend less than 4x bar diameters for plain mild steel or 6 x bar diameters for deformed bars. Care shall also be taken when bending back bars, to ensure that the concrete around the bar is not damaged.

G) SPLICING:

a) All reinforcement shall be furnished in the full length indicated on the drawing. Splicing of the bars except where shown on the drawings will not be permitted without the written permission of the Engineer‑in‑charge.

b) At a compression splice each pair of lapped bars may be in contact but the minimum clear spacing between the splice and the adjacent splice shall be that specified for adjacent single bars.

H) PLACING IN POSITION:

a) All reinforcements shall be accurately fixed and maintained in position as shown on the drawings by such approved and adequate means like mild steel chairs and/or concrete spacer blocks irrespective of whether such supports are payable or not. Bars intended to be contact at crossing points, shall be securely tied together at all such points by No.20 G annealed soft iron wire or by tack welding in case of Bar larger than 25 mm dia., as may be directed by the Engineer. Binders shall tightly embrace the bars with which they are intended to be in contact and shall be securely held. The vertical distance between successive layers of bars shall be maintained by provision of mild steel spacer bars. They should be spaced such that the main bars do not sag perceptibly between adjacent spacers. Before actual placing, the contractor shall study the drawings thoroughly and inform the Engineer in case he feels that placement of certain bars is not possible due to congestion. In such cases he should not start placing any bar before obtaining clearance from the Engineer.

b) The reinforcement accessories shall be furnished by the contractor. The wire shall be of annealed iron wire quality. Bar supports, charis, spreaders, spacers and bolsters shall be sufficiently heavy to support the reinforcement steel properly and shall be approved by the Engineer‑in‑charge. No separate payment shall be made on account of the above and the unit rate shall be inclusive of the cost of binding wire, bar supports, chairs bolsters, spacers etc. However when steel is supplied by the owner/purchaser a detailed record of the above shall be kept for purpose of only calculating the theoretical consumption but not for payment.

I) WELDING:

a) Normal bond laps in reinforcement may be placed by lap or butt-welding reinforcement bars, if asked by the Engineer, under certain conditions. The work should be done with suitable safeguards in accordance with relevant Indian Standards & IS:2751 for welding of mild steel bars used in reinforced concrete construction as per IS: 2751 and IS:456. Welded mesh fabrics conforming to IS: 1566 may also be used if specified in the Schedule of items and drawings.

b) Field welding of reinforcing bars will not be permitted without the written consent of the Engineer‑in‑charge. Where welding is permitted it must be at suitable staggered locations. Tests shall be made to prove that joints are of the full strength of bards connected. Welding of reinforcement shall be done in accordance with the recommendation of IS:2751. This clause applies to main and distribution steel only.

c) In those places where welded reinforcement chairs, spacer trusses etc. are necessary like in deep raft etc. and have been detailed in the drawing, any welding necessary for fabrication of such trusses chair etc. is deemed to have been covered under the rates for reinforcement and such spacer, chairs, trusses etc. shall be measured and paid under the relevant reinforcement item. If any steel plates are used as gussets in fabrication of these chairs, trusses the same shall be payable under insert item.

J) CONTROL:

a) The placing of reinforcements shall be completed well in advance of concrete pouring. Immediately before pouring, the reinforcement shall be examined by the Engineer for accuracy of placement and cleanliness. Necessary corrections as directed by him shall be carried out. Laps and anchorage lengths of reinforcing bars shall be in accordance with IS:456, unless otherwise specified. If the bars in a lap are not of the same diameter, the smaller will guide the lap length. The laps shall be staggered as far as practicable and as directed by the Engineer and not more than 50% of the bars shall be lapped at a particular section. Arrangements for placing concrete shall be such that reinforcement in position does not have to bear extra load and get disturbed.

b) Covers for Reinforcement**:**

The cover for concrete over the reinforcements shall be as shown on the approved drawings unless otherwise directed by the Engineer. Care should be taken to ensure that projecting ends of ties and other embedded metal do not encroach into the concrete cover. Where concrete blocks are used for ensuring the cover and positioning reinforcement, they shall be made of mortar not leaner than 1 (one) part cement to 2 (two) parts sand by volume and cured in a pond for at least 14 (fourteen) days. The type, shape, size and location of the concrete blocks shall be as approved by the Engineer. Their strength shall correspond to the strength of concrete proposed for the structure. Where such cover blocks are used, all cover, spacers shall be secured firmly so that they are not disturbed during vibration.

c) Tolerances:

Unless otherwise specified by the Engineer‑in‑charge, reinforcement shall be placed within the following tolerances as specified in Clause 11.3 of IS: 456‑2000:

* + 1. For effective depth 200 mm or less + 10 mm

(b) For effective depth more that 200 mm + 15 mm

The cover shall in no case be reduced by more than one third of specified cover or 5 mm whichever is less.

K) STORAGE:

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑

Storage Place of storing Remarks

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑

A. Cement to be stored in a place of Test of compression

easy access for proper inspection strength should be

and identification. It should be done by the project

placed in a weather-proof building, authorities and result

so that loss due to dampness should be intimated to

and other causes and is minimum. the contractor from time

to time.

B. Reinforcement Reinforcement procured by the Steel shall not contain

bidder are to be stored diameter- excess rust or cracks

wise in such a place to permit etc.

easy identification. The area should

be such that water does not accumulate

and reinforcement do not get distorted.

It should not be stacked directly

over Ground or near any harmful

materials. It should be cleaned of

excessive rust before use.

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑

L) ACCEPTANCE CRITERIA:

Reinforcements shall be checked for cleanliness, proper bending, binding, placing and securing in position with provision for proper cover.

M) METHOD OF MEASUREMENTS:

a) Bar or any other type of reinforcement used like hard drawn steel wire fabric etc. for reinforced concrete shall be measured by weight in tonnes. The weight shall be arrived at by multiplying the actual or theoretical length measured along standard hooks, cranks, bends, authorized laps etc. whichever is less by the sectional weights. Claims if any for payment for this item shall be submitted with supporting document giving the schedule of bars with sketches. **The sectional weight to be adopted shall be IS Sectional weight.**

b) Standard hooks, cranks, bends, authorized laps etc. shall be measured.

c) Separator pieces between two or more layers of steel shall not be measured.

d) No payment shall be made for lap welding or butt welding if permitted, Supports, chairs, hangers, etc. of height 300 mm and less, required for keeping the steel in position unless otherwise specified in the contact. For supporting horizontal reinforcement at heights larger than 300 mm, support drawings shall be prepared by the contractor and payment shall be made for the supports as approved by the Engineer‑in‑charge, or as actually placed, whichever is less, at the same rate as for reinforcement.

e) No extra payment will be paid for modification of already embedded reinforcement, if required due to faulty fabrication or placement.

f) Dowels neither shown in the drawings nor instructed by the Engineer‑in‑charge, but required for construction facilities and/or sequences, shall not be measured.

**11.0 TECHNICAL SPECIFICATION FOR FORMWORK:**

11.1 The section of the specification covers the technical requirements for furnishing form work/shuttering for plain & reinforcement concrete works for all structures all levels including buildings, foundations, trenches, tunnels, rail tracks, water storage tanks etc. as required for complete job, as per approved construction drawings under this contract.

11.1.1 If it is so desired by the Engineer‑in‑charge, the contractor shall prepare, before commencement of the actual work, design and drawings for formwork and centering and get them approved by the Engineer‑in‑ charge. The formwork shall conform to the shape, lines and dimensions as shown on the drawings.

11.1.2 Materials used for the form work inclusive of the supports and centering shall be capable of withstanding the working load and remain undistorted throughout the period it is left in service.

11.1.3 Formwork shall be composed of steel and/or best quality shuttering wood of non‑absorbent type. Timber shall be free from significant knots and shall be of medium grain as far as possible and hard woods shall be used as caps and wedges under or over posts. Plywood or equivalent shall be used where specified to obtain smooth surfaces, for exposed, concrete work. Struts shall generally be mild steel tubes, and strong Sal ball is 150 mm in diameter or above. Bamboos, small diameter balls, etc. shall not be used unless approved by the Engineer‑in‑charge in specific cases

11.1.4 Supports or props should not bear on an unproved lower suspended floor or beam unless calculations are submitted to the Engineer‑in‑charge to confirm the strength of the lower floor or beam and no propping shall be taken out until the Engineer‑in‑charge's approval has been given.

11.1.5 The centering shall be true and rigid and thoroughly braced both horizontally and diagonally. The forms shall be sufficiently strong to carry without undue deformation, the dead weight of the concrete as a liquid as well as working load.

Where the concrete is vibrated, the form work shall be strong enough to withstand the effects of vibration, without appreciable deflection, bulging, distortion or loosening of its components. The joints in the formwork shall be sufficiently tight to prevent any leakage or mortar. The formwork shall be such as to ensure a smooth uniform surface free form honeycombs, air bubbles, bulges, fins and other blemishes. Any blemish or defect founding the surface of the concrete must be brought to the notice of the Engineer‑in‑ charge immediately and rectified free of charge as directed by him. To achieve the desired rigidity, the bolts, space blocks, the wires and clamps as approved by the Engineer‑in‑charge shall be used but they must in no way impair the strength of concrete or leave stains or marks on the finished surface. Where there are chances of these fixtures being embedded, only mild steel or concrete of adequate strength shall be used. Bolts passing completely through liquid retaining walls/slabs or the purpose of securing and aligning the formwork should not be used.

11.1.6 For exposed interior and exterior concrete surfaces of beams, columns and walls, plywood or other approved forms, thoroughly cleaned and tied together with approved corrosion‑resistant devices shall be used. Rigid care shall be exercised in ensuring that all columns are plumb and true and thoroughly cross-braced to keep them so. All floor and beam centering shall be crowned not less than 8 mm in all directions for every 5 meters span. Unless described on the drawing or elsewhere to the contrary, beveled strips 25 mm shall be provided, without any extra charge, to form angles and in corners of columns and beam boxes for chamfering of corners. Temporary openings for cleaning, inspection and for pouring concrete shall be provided at the base of vertical forms and at other places, where they are necessary and as may be directed by the Engineer‑in‑charge. The temporary openings shall be so formed that they can be conveniently closed when required and must not leave any mark on the concrete.

11.1.7 All horizontal forms shall be constructed for pressures from the dead weight of concrete and embedment and a minimum live load of 200 kg/m².

11.1.8 All details of formwork, placing, tying etc. shall be subject to the approval of the Engineer and the contractor shall submit drawings, when requested, showing details of form construction. The contractor shall be responsible for the adequacy of the formwork to withstand the pressure of freshly placed concrete or other loads imposed without failure, movement or deflections of the component parts.

11.2.1. Cleaning & Treatment of Forms:

All parts of the forms shall be thoroughly cleaned of old concrete, wood shavings, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish, loose concrete, chippings, shavings, sawdust etc. shall be scrupulously removed from the interior of the forms before concrete is poured. Compressed air jet and/or water jet along with wire brushes, brooms etc. shall be used for cleaning.

The inside surface of the formwork shall be treated with approved nonstaining oil or other compound before it is placed in position. Care shall be taken that oil or other compound does not come in contact with reinforcing steel or construction joint surfaces and shall be non staining and non‑ injurious to concrete. They shall not be allowed to accumulate at the bottom of the formwork. The oiling of the formwork will be inspected just prior to placement of concrete and redone wherever necessary.

11.2.2. Design:

The formwork shall so designed and erected that the forms for slabs and the sides of beams, columns and walls are independent of the soffits of beams and can be removed without any strain to the concrete already placed or affecting the remaining formwork. Removing any props or re-propping shall not be done except with the specific approval of the Engineer and props can be reinstated in anticipation of abnormal conditions. If formwork for column is erected for the full height of the column, one side shall be left open and built up in sections, as placing of concrete progress. Wedges, spacer bolts, clamps or other suitable means shall be provided to allow accurate adjustment and alignment of the formwork and to allow it to be removed gradually without jarring the concrete.

11.2.3. Tie Rods:

Metal tie rods shall be used for supporting all forms. Provision shall be made for removal of a section of each rod at surface of the concrete to a depth of approximately 50 mm. All holes left by the removal of hital huts of other removal fixture embedded in the face of the concrete shall be filled and finished with cement in a manner specified in the section of "Finishing", threaded inserts embedded on the wall shall be used for attaching the forms to previously plated concrete.

11.2.4.Tie Wires:

Wire ties will be permitted only upon approval at the Engineer‑in‑charge and when permitted, shall be cut off flush with the face of the concrete, or countier sunk, filled and finished, as required by the Engineer‑in‑charge in the manner specified under the Sections of "Finishing".

11.2.5 Chamfers and fillets:

All corners and angles shall be formed with 45' mouldings to form chamfers or fillets on the finished concrete. The standard dimensions of chamfer and fillets, unless otherwise detailed or specified shall be 25 x 50 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the moulding shall be planned or surfaced to the same texture as the forms to which it is attached. Unit rates quoted shall include providing the chamfers as specified or as shown on the drawings.

11.2.6 Construction joint chamfers:

Vertical construction joints on faces that will be exposed at the completion of the project shall be chamfered as above except where not permitted by the Engineer‑in‑charge.

11.2.7 Joints:

Joints in forms shall be horizontal or vertical unless otherwise specified and shall be sufficiently tight to prevent any leakage. Suitable devices shall be used to hold adjacent edges together in accurate alignment. All forms shall be such that they can be removed without hammering or plying against the concrete.

Inspection of Forms:

Casting of concrete shall start only after the formwork has been inspected and approved by the Engineer. The concreting shall start as early as possible within 3 (three) days after the approval of the formwork and during this period the formwork shall be kept under constant vigilance against any interference. In case of delay beyond three days, a fresh approval from the Engineer shall be obtained.

11.3.1 Removal of Forms:

Before removing any formwork, the Contractor must notify the Engineer well in advance to enable him to inspect the concrete if he so desires. The Contractor shall begin the removal of formwork only after approval of Engineer‑in‑charge. He shall place on record the date on which the concrete is placed in different parts of the work and the date of theremoval of formwork there from. This record shall be checked and counter‑signed by theEngineer‑in‑ charge. The contractor shall be responsible for the safe removal of formwork but the Engineer‑in‑charge may delay the time of removal if he considers it necessary. Any workshowing signs of damage through premature removal of formwork or loading shall be entirely reconstructed without any extra cost to Owner. Forms for various types of structuralcomponents shall not be removed before the minimum periods specified, which shall also be subject to the approval of the Engineer‑in‑charge.However, in any case, formwork shall not be struck until the concrete has reached a strength at least twice the stress to which the concrete may be subjected to at the time of removal of forms.

11.3.2. The number of props left under their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab beam or arch as the case may be together with any live load likely to occur during curing or further construction.

11.3.3. Where the shape of the element is such that the formwork has reentrance angles, the form work shall be removed as soon as possible after the concrete has set, to avoid shrinkage cracking occurring due to the restraint imposed.

11.3.4. In case of cantilever slabs the removal of forms shall begin from outer edge towards support where as in case of slabs on four sides the removal of forms shall begin from center to supports.

11.4 Tolerance for the finished concrete:

11.4.1 The formwork shall be so made as to produce a finished concrete true to shapes, lines, plumb and dimensions .Tolerances limit specified under Clause 10 of IS: 456‑2000 shall be followed where so desired by the Engineer‑in‑charge. The Engineer‑in‑charge may call for finished work at any time to set standards of workmanship. Once approved these will become the acceptance sample.

The tolerance given above are specified for local aberrations in the finished concrete surface and should not be taken as tolerances for entire structure taken as a whole or for the setting and alignment of formwork, which should be as accurate as possible and true to shape required to the entire satisfaction of the Engineer‑in‑charge. Any error within the above tolerance limits or any other as may be specially set up by the Engineer‑in‑charge, if noticed in any lift of the structure after stripping of forms, shall be corrected in the subsequent work to bring back the surface of the structure to its true alignment.

11.5 Reuse of Forms:

11.5.1 Formwork may be reused, provided that it is true, un-warped, thoroughly clean and without broken or damaged edges and equal in use in every respect to a new lumber. All form lumber shall have the contact surfaces re-oiled or recoated with an approved composition prior to usage.

11.5.2 Before reuse all forms shall be thoroughly scrapped, cleaned, joints etc. examined, and when necessary repaired, and inside surface treated as specified herein before. Formwork shall not be used/reused, if de-cleared unfit or unserviceable by the Engineer‑in‑charge.

11.6 Classification:

Generally, the 'ordinary' class formwork shall be used unless otherwise directed by the Engineer.

a) Ordinary These shall be used in places where ordinary surface finish is required and shall be composed of steel and/or approved good quality partially seasoned timber.

b) Plywood These shall be used in exposed surfaces, where a specially good

finish is required and shall be made of approved brand of heavy quality plywoodto produce a perfectly uniform and smooth surface conforming to the shape described in the drawing with required grain texture on the concrete. Reuse may only be permitted after special inspection and approval by the Engineer. He may also permit utilization of used plywood for the 'ordinary' class, if it is still in good condition.

c) Ornamental These shall be used where ornamental and curved surface are required and shall be made of selected best quality well seasoned timbers or of plywood, which can be shaped correctly.

d) Shell roof For this item, the detailed design of formwork shall be submitted to the Engineer‑in‑charge, well in advance for his approval. Units of shell forms may be used repeatedly but prior approval shall be required for each repetition. Extra care shall be taken to keep correct levels and profiles.

Opening, chases, grooves, rebates, block outs etc. The Contractor shall leave all openings, grooves, chases, etc. in concrete work as shown on the drawings or as specified by the Engineer.

11.7 Acceptance:

11.7.1 Finished concrete shall be true to shape, lines, levels, plumb and dimensions as shown on drawings.

11.7.2 All embedded fixtures shall be of correct type and in correct position as shown in drawings.

11.7.3 Finished concrete surfaces shall be free from blemishes like honey‑combs air bubbles, fins etc.

11.7.4 Exposed decorative concrete surface shall be free from rust stains, grease and mould oil etc. and shall have uniform pleasing appearance to the satisfaction of the Engineer‑in‑charge.

11.7.5 The finished concrete shall be of a standard at least equal to that of the accepted sample.

12.0 AGGREGATES FOR P.C.C / R.C.C WORKS:

The aggregates required for Plain or reinforced cement concrete works should be obtained by machine crushing ,free from dust HBG of varying sizes with the composition given below for well graded metal.

13.0 HOLD FASTS & BED BLOCKS:

Hold fasts of doors and windows are to be provided in PCC(1:2:4) using 20 mm well graded HBG metal with the composition as given above . Bed blocks are to be provided in CC (1:2:4) using 20 mm well graded HBG metal.

The quoted rate shall include cost and conveyance of all materials, SEIGNORAGE labour charges, form work, curing with all leads and lifts etc., complete for finished item of work.

14.0 CEMENT:-

Cement shall be OPC/ PPC of 43 grade / 53 grade of make like RAASI, PRIYA, KCP, RAMCO, L&T, BIRLA or any other ISO company. Cement shall be procured by the contractor only.

i) All cement used for the work shall be ordinary Portland cement or such other cement as may be permitted by the Engineer-in-charge. Portland cement shall comply with the requirements of the latest issue of IS 269.

ii) Cement which has remained in bulk storage at the mill for more than 6 months, or which has remained in bags at the dealer's storage for over 3 months, or which has been stored at project site for more than 3 months shall be re-tested before use. Cement shall also be rejected if it fails to conform to any of the requirements of these specifications.

15.0 REINFORCED CEMENT CONCRETE :

15.1 Sun Shades: Sun shades of 62.5mm average thickness are to be constructed in RCC (1:2:4) using 20mm well graded machine crushed HBG metal with the composition as given above.

15.2 Lintels: Lintels are to be casted in RCC(1:2:4) nominal mix using 20mm well graded HBG metal with the composition as given above.

15.3 Under reamed Piles, Columns, Beams, Roof slab, Balcony/Portico, Projection Slab:

Under reemed Piles, Columns are to be laid with DESIGN MIX CONCRETE RCC M20 grade using 10 to 20mm well graded HBG metal.

Reinforced cement concrete 1:2:4  **for columns, Beams. Roof slab, Balcony/Portico, Projection Slab** using 10mm to 20mm size graded HBG machine crushed metal (50% each) from approved quarry giving cube crushing strength of 150 kg/m² and a minimum of 330 Kgs of cement for 1 m³ of concrete including cost and conveyance charges of cement and all other materials to site, scaffolding charges, seigniorage charges, centering, shuttering, machine mixing, laying concrete, curing for specified number of days by curing with wet gunny bags, vibrating etc compaction by pan vibrator or needle vibrator supplemented by hand spreading , rodding and tamping , all incidental and operational charges, all leads and lifts and for all floors leaving gaps and pockets wherever required etc complete., but excluding cost of steel and its fabrication ,all incidental charges etc. complete for finished item of work as directed by the Engineer in charge.

Reinforced cement concrete 1:2:4 columns, beams, roof slab using 10mm to 20mm size graded HBG machine crushed metal (50% each) from approved quarry giving cube crushing strength of 150 kg/m² and a minimum of 330 kg of cement for 1 m³ of concrete including cost and conveyance charges of cement and all other materials to site, scaffolding charges, seigniorage charges, centering, shuttering, machine mixing, laying concrete, curing for specified number of days by curing with wet gunny bags, vibrating etc compaction by pan vibrator or needle vibrator supplemented by hand spreading , rodding and tamping , all incidental and operational charges, all leads and lifts and for all floors leaving gaps and pockets wherever required etc complete., but excluding cost of steel and its fabrication ,all incidental charges etc. complete for finished item of work as directed by the Engineer in charge.

16.0 CONCRETING:-

**16.1 Composition**: Concrete shall be composed of cement, river sand also termed as/fine

aggregate broken rock or coarse aggregate and water, all machine mixed and brought to proper consistency whenever so ordered by the Executive Engineer/ Civil/ Gr.Hyderbad, Admixtures shall be added as stated in the special conditions. The exact proportion of each type of aggregate listed in these specifications will be determined from time to time on the mechanical analysis of the aggregate stock piles and tests of resulting concrete test cubes, or cylinders. In general, the design mix proportions are adjusted to produce a durable plastic and workable concrete suitable for the specific conditions of placement and design strength. The specifications for the cement, sand, coarse aggregate and water have been detailed in Technical specifications. (IN situ mix test for cement,aggregates shall conducted for cement concrete exceeding 100 m³ or 17 hours)

16.2 Concreting:- The contractor’s rate for various items of work shall include cost of materials, seigniorage, conveyance, labour, leads & lifts etc. complete. Concreting work, reinforcements, shuttering including curing etc. should generally conform to the relevant specifications as per ISI except for deviation if any hereunder. The strength requirements of concrete proposed to be used for various items of work mentioned in the bill of quantities shall be as follows.

**Table**

-------------------------------------------------------------------------------------------

Compressive Works test strength in N/sq.mm on 150 mm after testing conducted in

accordance with IS :517 Grade of

------------------------------------------------------------------------------------------------

Concrete Min. at 7 days Min. at 28 days

------------------------------------------------------------------------------------------------

M 10 7.0 10

M 15 10.0 15

M 20 13.5 20

M 25 17.0 25

M 30 20.0 30

M 35 23.5 35

M 40 27.0 40

M 45 30.0 45

M 50 33.5 50

------------------------------------------------------------------------------------------------

Note: Cylinder strength.

Where compressive strength tests of cylinders are adopted the compressive strength given above for cubes shall be modified according to the formulae.

Maximum cylinder compressive strength }0.8 x compressive strength specified

required } for 15cm cubes.

The approximate quantities of materials in dry conditions required for obtaining M20 grade concrete for 1 cum are as follows:

---------------------------------------------------------------------------------------------------------

Sl.No. Grade of concrete Sand in Cum Coarse aggregate Min cement

in m³. per 1m³

of concrete.

---------------------------------------------------------------------------------------------------------

1. M20 0.46 0.92 330 Kgs.

2 M25 0.46 0.92 360 Kgs.

---------------------------------------------------------------------------------------------------------

Any deviation in cement content (increase) from those specified in the above table over that required as per design mix shall be to the account of Board. No extra payment or deduction shall be made for variation in several ingredients except the cement content.

16.3 Sampling: -Sampling of fine and coarse aggregate and cement will be done periodically in accordance with standard practice/ cement concrete exceeding 100 cum or 17 hours, and tests made under the supervision of the quality control Engineer. Also the routine tests shall be made in various stages of batching Operation section for which the contractor shall provide all facilities necessary for procurement of representative samples for which no payment shall be made.

16.4 Slump tests: - All slump tests be made in accordance with recommended procedure given IS code 1199-1959 for reinforced concrete (setout Granville and Thomas or in designation C.148,52 of the American society of testing materials. The slump preferred to, shall be determined when the concrete is about to be deposited as such less slumps within the limits will be required as may, in the opinion of the Executive Engineer/ Civil/ Gr.Hyderbad , be practicable to produce concrete of better quality and of greater economy. Greater slump (but in all cases limited to 6” (15cm) maximum than those specified in the table) will be permitted in exceptional cases, wherein the opinion of the Executive Engineer/ Civil/ Gr.Hyderbad , internal vibration of the concrete is not practicable and where especially authorize by the Executive Engineer/ Civil/ Gr.Hyderbad for concrete in position, especially difficult for placement as in thin or heavily reinforced section.

16.5 Strength:-The required strength mentioned in the table are minimum crushing strength of ‘work test’ cylinders that must be obtained on cylinders made from concrete, either at the batching plant or at the placing point, and standard cured. The 28 days strength is the average strength of 3 test specimen taken from a single batch provided that not more than 10% of specimens tested shall have strength less than 80% of the required strength. The average strength of all tests for a given period shall equal or exceed the required strength. If the average crushing strength is higher, the contractor shall not be entitled to any increase in payment of work on account of the actual strength being above the minimum specified. In addition to the 28 days strength tests, the Executive Engineer/ Civil/ Gr.Hyderbad may at his discretion make 7 days strength tests. The minimum 7 days strength realized will not normally be less than 2/GROUND of the minimum 28days strength specified. The exact relation will be fixed on the site after studying the actual values realized. If at any time, the 7 days strength indicate that the strength of 28 days may not be achieved, as specified the Executive Engineer/ Civil/ Gr.Hyderbad shall have the authority to suspend concreting operations, until the reasons have been investigates and corrected and/or the mix has been redesigned etc and the contractor shall comply herewith without such suspension being made a reason for any claim.

The concrete for testing shall be collected as it comes out of the mixer once or more often as the Executive Engineer/ Civil/ Gr.Hyderbad may direct, and in quantity sufficient to prepare at least 3 test pieces from each sample. The compressive strength of concrete shall be determined through the medium of tests of (15x30cm) cylinders. If cylinders are made they shall be made and cured in accordance with American society of testing materials, designation C.31-40 and tested in accordance with designation c.31-49. Cylinders 6” by 12” will be used for concrete made from aggregate and smaller.

In addition to the strength tests carried above it is contemplated that the tests on actual cores from the concrete laid in position shall be made, and results thereof shall not be in any case lower than those of the test pieces. If the cores taken out show unreasonably low results the work is liable to be rejected and may be required to be dismantled and redone with all consequences to the contractor. The tests shall be carried out by the TGSPDCL at its own cost and as directed by the Executive Engineer/ Civil/ Gr.Hyderbad and the contractor shall afford all reasonable facilities for taking the test cores.

The contractor shall also arrange to fill the test holes left by the removal of the cores with concrete of the required strength without any extra payment and to the satisfaction of the Executive Engineer/ Civil/ Gr.Hyderbad .

The contractor shall at all times have access to and associate with sampling, design and tests of trial mixes, tests of strengths and similar other Operations. It shall then be the contractor’s responsibility to rebooting on the works, concrete of quality, density and strength corresponding to the laboratory and test designs.

The laboratory mix will be so designed that the minimum strength achieved on the laboratory test cylinder is about 25% higher than that specified above that concrete has a density of (155lbs) per cubic ft or more (2486 kg/m3) and as impermeable as can be made. The same mix shall be used in the field to assure the achievement of quality specified.

Failure on the part of the contractor to associate with the Operations aforesaid shall not absolve him of the responsibility of producing on the works concrete of specified quality, density and strength with design mixes determined from laboratory tests and results.

16.6 Water cement Ratio: -The water cement ration will be regulated by the requirements of workability and design, but in general will not exceed 0.60 by weight, exclusive of water absorbed by the aggregates. The amount of water shall be adjusted for any variation in the moisture content or the grading of the aggregate as they enter the mixer in any batch and shall not be more than the minimum necessary to produce concrete of the required consistency after making period specified in general or from time to time. Uniformity shall be maintained in the consistency of concrete from batch to batch.

16.7 Proportioning of concrete: - The exact proportions in which the different gradients are to be used from the different parts, of the work shall be determined by the contractor in any one of the recognized laboratories under the supervision of the departmental staff after trial mixes, the structural concrete is to be commenced only after establishing the cement in each grade of mix as per IS 456. The cost on account of laboratory test shall be to the account of the contractor.

16.8 Cement content: - The cement content is specified as the specific weight of cement used in the manufacture on 1 cum of concrete as measured in the finished work after vibration, consolidation, setting and curing. The actual volume of different gradients that would go in. in a batch of concrete to produce the specified volumetric unit shall be determined by tests and the cement content specified shall be put in for each batch supposed to produce the same unit of concrete in place is determined by the tests.

Any variation in the cement content shall also be similarly treated. No extra payment or deductions shall be made for variations in the several in-gradients except in cement content, which shall be adjusted as described. Variations in proportions of crushed metal and natural sand will not be considered for purposes of price variation.

If for any reasons it is found necessary to resort to volumetric batching instead of weigh batching which shall be subject to the specific approval of the Executive Engineer/ Civil/ Gr.Hyderbad . The proportion of cement (by volume) to that of the various aggregates also by volume shall be so adjusted that the cement content in the specific volumetric unit of finished concrete, shall not be less than that specified for the relevant class of concrete. For this purpose one bag of cement as supplied by cement manufactures shall be taken as 1.225 cft or 50 kgs.

16.9 Variation in Cement content: - The unit rate accepted for concrete shall be adjusted to account for the increase in the quantity of cement actually designed and specified (if different from that specified in the specifications) at the same issue rate per tonne of cement i.e 2400/- per MT. The variation in the quantities of other aggregates shall not be considered as justification for price adjustment. The proportions of cement as that in the mix shall be related to the volume of the finished concrete.

16.10 Admixtures: - The Executive Engineer/ Civil/ Gr.Hyderbad shall have the authority at any time, and from time to time to order the addition of any air entraining agent or other admixtures, to any mix of concrete in such proportion or quantity or mode, as he may specify and the contractor shall comply with the same. The admixtures shall be supplied by department free of cost for the purpose of the concrete or the motor as the case may be. The resulting modifications, if any to the content or proportion of cement as a consequence thereof, shall be accounted for in the rates for payment according to para 13.9 herein above.

The Executive Engineer/ Civil/ Gr.Hyderbad shall have the authority to arrange for the supply of the admixtures or admixtures aforesaid, through the contractor (by mutual agreement) or by other agency, as the Executive Engineer/ Civil/ Gr.Hyderbad may deem fit. Should the mixing entail any additional expenditure to the contractor by way of additional plant, equipment, or operation, the same shall be paid for at actual cost, as may be determined by the Executive Engineer/ Civil/ Gr.Hyderbad whose decision shall be final and binding upon the contractor.

The contractor shall not, without the written consent of the Executive Engineer/ Civil/ Gr.Hyderbad , add any admixtures, to any mix of concrete and whenever such an admixtures is permitted, the Executive Engineer/ Civil/ Gr.Hyderbad shall determine the adjustment in price if any, that should be made in consequence. The decision of the Executive Engineer/ Civil/ Gr.Hyderbad shall be final an binding on the contractor.

16.11 Handling of aggregate: - The contractor shall at all times, maintain a live storage of all grades of aggregates of at least one week’s requirement of work.

16.12 Batching equipment: -The batching plant shall be of the requisite capacity to maintain the specified progress on different items of work.

16.13 Check tests for equipment’s:- The tests shall be made in the presence of TGSPDCL representatives and shall be adequate to prove the accuracy of the measuring devices. Unless otherwise directed, tests shall be made once in two weeks in the case of all other scales. The contractor shall make such adjustments, repairs or replacements s may be necessary to meet the specified requirements for accuracy of measurements.

Detailed drawings showing reinforcement details will be supplied by the department during the course of execution. The top of roof slab of last floor is Provided with Impervious coat over exposed RCC Roof slab surfaces to required slopes with Polymer Acrylic Water Proofing layer of approved make as per manufacturer's specifications and over the layer 25 mm average thickness of screed cement concrete in CC 1:2:4 using 6 mm coarse aggregate with mixing of integral water proofing chemical at 150 ml per 50 kg of cement and over the screed concrete 4mm thick neat coat of cement plaster in CM 1:4 with mixing of integral water proofing chemical of approved make at 150 ml per 50 kg of cement and thread lining of regular intervals of 45 x 45 cms including and cost and conveyance of all materials, water, all labour charges, chemicals, curing for specified number of days, rounding off junctions of wall and slab, all leads, lifts, heights, levels and floors etc. complete as directed by the engineer-in-charge for finished item of work.

All materials shall conform to standard specification, IS and are to be approved by the Engineer-in-charge prior to their usage in the work. For this purpose, the contractor shall whenever called up to do so, furnish samples of materials in adequate quantities and carryout all tests on materials and concrete specimens. Testing shall be done in close liaison with Engineer-in-charge or his representative and methods of test shall conform to the relevant IS Specification. Test results also shall conform to the IS Specification. The cost of samples and testing shall be borne by the contractor.

No concrete work shall be done in the absence of the Engineer-in-charge. Before placing the concrete, the Engineer-in-charge shall have inspected and approved all reinforcement in place, form work, centering and scaffolding for concrete. At least 24 hours notice shall be given for this purpose.

All concrete works shall be machine mixed, vibrated for proper compacting unless otherwise specified by Engineer-in-charge.

Transportation and placing methods and adequacy of equipment and procedure shall be studied in advance. All form work, reinforcement steel and location and details of embedded parts etc. shall be checked and approved by the Engineer-in-charge. Construction joints shall be made at only those positions shown on the drawing or at locations approved by the Engineer-in-charge.

All sleeves, inserts, anchors and embedded items required for adjacent work or for its supports shall be placed prior to concreting. Care shall be taken not to displace reinforcement and embedded parts during the placing and compaction of concrete.

Curing of concrete shall start after 8 hours of placement, and in hot weather with in 4 hours of placement in exposed faces, and kept continuously wet preferably by continuous spraying of water after the final set for a period of at least 10 days from the date of casting.

If the temperature of atmosphere during the period has been continuously above 100 C, When the temperatures are higher, the Engineer may extend the curing period for a suitably longer period.

The quoted rate for concrete shall include the supply of materials, labour, tools and tackle, plant and equipment, scaffolding, staging, form work, centering and shuttering, curing, leads and lifts, other incidental charges etc. complete for finished item of work. The quoted rate shall also include, wherever applicable, the cost of placing, keeping in position any embedment or inserts, openings, joints etc., as shown in the drawings and as directed by the Engineer-in-charge. Reinforcement steel and its fabrication shall be paid separately. The quoted rate shall be excluding basic cost of cement, required cement will be issued at department stores at free of cost.

**16.14 Transport, Placing and Compaction of Concrete**

The method of transporting and placing concrete shall be approved by the Engineer-in-Charge. Concrete shall be transported and placed such that no contamination, segregation or loss of its constituent materials takes place.

No concrete shall be placed in any part of the structure until the approval of the Engineer-in-Charge has been obtained in writing.

If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-Charge. Concreting shall then proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete, which has been in position for more than 30 minutes unless a proper construction joint is formed.

Concrete when deposited shall have a temperature of not less than 4.5 dig C and not more than 38 dig. C unless otherwise specified. It shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried on properly designed agitators, operating continuously, in which case this time shall be within 2 hours of the addition of cement to the mix and within 30. Except where otherwise agreed to by the Engineer-in-charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 m when internal vibrators are used and not exceeding 0.30 m in all other cases.

Unless otherwise agreed to by the Engineer-in-charge, concrete shall not be dropped into place from a height exceeding 2 meters. When trucking or chutes are used, they shall be kept clean and used in such a way as to avoid segregation.

When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept clean, thoroughly wetted and covered with a 15mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 15 mm layer of mortar bed shall freshly mixed and placed immediately before placing of new concrete.

Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgment of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed, and then coated with neat cement Ground. The first layer of concrete to be placed on this surface shall not exceed 150mm in thickness, and shall be well rammed against old work, particular attention being given to corners and close spots.

All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators. Where vibrators cannot be used, an alternate scheme of compaction shall be approved by the Engineer-in-charge. Sufficient vibrators, in serviceable condition, shall be kept at site so that spare equipment is always available in the event of breakdowns.

The performance requirements of vibrators shall conform to relevant IS Codes. Vibration shall not be applied through reinforcement, and where vibrators of the immersion type are used contact with reinforcement and all inserts shall be avoided as far as practicable.

**16.15 Finishing**

**General**

Immediately after the removal of forms, all exposed bars or bolts passing through the reinforced cement concrete member and used for shuttering or any other purpose shall be cut inside the reinforced cement concrete member to a depth of at least 25mm below the surface of the concrete and the resulting holes be closed by cement mortar. All fins caused by form joints shall be broken. All cavities produced by the removal of the firm ties, all holes and depressions, honey-comb spots, broken edges or corners and all other defects shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces, which have been filled/pointed, shall be kept moist for a period of twenty-four hours. Any repair and rectification of defective work is to be undertaken and carried out as directed by the Engineer-in-Charged and the cost is to be borne by the CONTRACTOR.

If rock pockets/honey-combs, in the opinion of the Engineer-in-charge, are of such an extent or character as to effect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the affected portions of the structure.

All construction and expansion joints in the completed work shall be left carefully tooled and free from any mortar and concrete. Expansion joint filler shall be left exposed for its full length with clean and true edges.

Curing of the surface shall be continued for a period as approved by the consultants.

**16.16 Classes of Finishing**

The surface finishes for formed and unformed surfaces are classified and defined as below. Surface irregularities permitted for the various classes of finishes are termed either abrupt-or-gradual-. Fins or offsets caused by displaced or misplaced form sheeting, lining or form sections by loose knots in form timber or by otherwise defective from timber are considered abrupt irregularities. All other cases are described as gradual irregularities. Gradual irregularities will be measured with a template for equivalent for curved surfaces. The length of template for testing gradual irregularities on formed surfaces shall be 1.5 m in length, the permissible gradual irregularities being measured over this length of the template.

**16.17 Finish for foundations and plinth**

Class F2 Finish shall be obtained by the use of properly designed forms, either close jointed wrought timber forms or with forms having plywood or steel sheet lining. The abrupt irregularities shall not exceed 5mm and gradual irregularities shall be less than 8mm. Small blemishes caused by entrapped air or water may be permitted but the surface shall be generally free from honeycombing, voids and large blemishes. Surface irregularities in excess of those stipulated shall be removed by clipping or rubbing abrasive stone.

**16.18 Class F3 Finish**

Class F3 finish shall be formed by specially designed clothes jointed rigid forms having lining of high quality form plywood. The surface irregularities shall be limited to nil for abrupt irregularities and 3mm for gradual irregularities. Class F3 finish may be obtained form class F2 finish by carefully removing all abrupt irregularities including fins and projections by rubbing/grinding.

**16.19 Finish for floor slabs**

This is the screeded finish used on surfaces over which other finishes such as wearing coats etc. are to be placed. It is also the first step in the formation of U2 and U3 finishes. The finishing operation consists of leveling and screeding the concrete to produce an even and uniform surface so that the gradual irregularities are not greater than 6mm.

Surplus concrete should be removed immediately after consolidation by striking it of with a sawing motion of a straight edge or template across a wooden or metal strip that has been set as a guide. Unless the drawings specify a horizontal surface or show the slope required, the tops of narrow surfaces, such as stair treads, walls, curbs and parapets shall be sloped approximately 10mm per 300 mm width. Surfaces to be covered with concrete topping, terrazzo, and similar surfaces shall be smooth screeded and leveled to produce even surfaces, irregularities not exceeding 6mm.

**16.20 Construction Joints:**

Concreting shall be carried out continuously up to the construction joints, the position and details of which shall be as shown on approved drawings or as directed by the Engineer-in-charge. Such joints shall, however, be kept to the minimum. For vertical construction joint, a stopping board shall be fixed previously at the pre-determined position and shall be properly stayed for sufficient lateral rigidity to pack against it. Concreting shall be continued right upto the board. The board shall not be removed before the expiry of the specified period for removal of vertical forms. Before resuming work at the construction joint where the concrete has not yet fully hardened, all laitance shall be removed thoroughly. Care being taken to avoid dislodgement of coarse aggregates. When work has to be resumed on a surface, which has hardened, the surface shall be thoroughly hacked, swept clean, wetted and covered with a layer of neat cement grout.

The neat cement grout shall be followed by a 15mm thick layer of mortar mixed in the same proportion as in the concrete and concreting resumed immediately thereafter. The first batch of concrete shall be rammed against the old work to avoid formation of any stone pockets, particular attention being paid to corners and close spots.

In all cases, the position and detailed arrangement of all construction joints shall be predetermined and got approved by the Engineer-in-charge

**16.21 Tests and Standards of Acceptance**

**16.22 Preliminary Tests for Designing Concrete**

For designing concrete preliminary tests referred to in paras 2.0 and 3.0 shall consist of three sets of separate tests, and in each set, tests shall be conducted on six specimens. Not more than one set of six specimens shall be made on any particular day. Of the six specimens in each set, three shall be tested at seven days and the remaining three at 28 days. The preliminary tests of 7 days are intended only to indicate the strength likely to be attained at 28 days.

**16.23 Work strength Tests for design concrete mix**

Works strength tests shall be made in accordance with IS 517. Each test shall be conducted on ten specimens, five of which shall be tested at seven days and the remaining five at 28 days. The cubes shall be made at the rate of one set for every 50 cum., the number of cubes can be reduced to six with the specific permission of the Engineer-in-charge.

Similar works tests shall be carried out whenever the quality and grading of materials is changed irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by Engineer-in-charge, when procedure of test given above reveals a poor quality of concrete and in other special cases.

All work shall be carried out under the supervision of a qualified and a competent Engineer who will supervise proportioning, placing and compacting of concrete at all stages.

All necessary labour, materials, equipment, etc., for sampling, preparing test cubes, curing etc., shall be provided by the CONTRACTOR. Testing of the materials and concrete may be arranged by the Engineer-in-charge in an approved laboratory at the cost of the CONTRACTOR.

**16.24 Standard of Acceptance**

The average strength of the group of cubes cast for each day shall not be less than the specified works cube strength. 20 percent of the cubes cast for each day may have values less than the specified strength, provided the lowest value is not less than 85 per cent of specified strength.

**16.25 Manufacturer’s Certification: Testing Results etc.**

For all materials required for concrete construction including cement, aggregate, water, reinforcement the original copies of test certificates, test results etc., either carried out by the manufacturers or any other agency, the mix design recommendations etc. shall be submitted to Engineer-in-charge for his approval and record which shall remain the property of the owners.

**16.26 Chloride contents**

Since the chloride contents of the constituent materials of the concrete would be additive, it is desirable to keep a check on the overall chloride content of the concrete to keep it minimal. The cost of the testing for chloride content of the ingredients of concrete and of undertaking remedial measures if the chloride content is more than the permissible limit shall be borne by the CONTRACTOR.

Surface of prepared voids shall be wetted for 24 hours immediately before the patching material is placed. Repair of concrete shall be made by skilled workmen. Repairs shall be made as soon as practicable after removal of forms and in a manner to meet the requirements for the finish specified for particular location.

For repair of the concrete works, the CONTRACTOR may use epoxy of approved agency as a bonding agent prior to placing fresh concrete. The use or otherwise of epoxy for the repair work will be at discretion of the Engineer-in-charge. Epoxies shall be applied in strict accordance with the instructions of the manufacturer.

Epoxy is a two packed or three packed system containing base and hardener/s. The shelf life of the unmixed cans is about one year or more when stored in a place where ambient temperature does not increase beyond 24 degrees centigrade. The base and hardener/s shall be mixed in correct proportions recommended by the manufacturer. The blend after mixing intimately shall have a pot life of one hour and the material shall be applied over the old concrete to form a thin film. Fresh concrete shall be deposited immediately prior to the film drying up so as to ensure proper bonding between both concretes.

Where the dry pack method is used, holes shall be sharp and square at surface edges, but corners within holes shall be rounded. The perimeter of the hole shall be under-cut in several places. Holes for dry pack shall have a minimum depth of 25 mm. The holes to be repaired shall be scrupulously clean and slightly wet with no free water on the surface. The surface shall be then dusted slightly with cement by means of dry brush. Under no conditions shall the holes be painted with neat cement grout.

The dry pack mix shall be proportioned by weight: 1 part cement to 2.5 parts of sand that will pass a No.17 screen. Only enough water shall be used to produce a mortar which will stick together when moulded into a ball by a slight will stick together when moulded into a ball by a slight pressure of hands and will not extrude water but will leave the hands just damp. Dry pack material shall be placed and packed in layers having a compacted thickness of about 10mm. Each layer shall be solidly compacted over its entire surface by use of hardwood stick and hammer. The stick is normally about 300mm to 460mm long and not over 30mm in diameter. Most of the tamping should be directed at a slight angle and towards the side of the hole to assure maximum compaction and bond. Water shall not be used to facilitate finishing.

Filling materials used in repair of surfaces which will be exposed after completion of the project shall be made with cement from the same source as that used in concrete and blended with sufficient amount of white portland cement to produce the same colour as in adjoining concrete. Patched surface shall be given a final treatment of the patch to match that of the surrounding material.

Immediately after patching is completed, the patched area shall be covered with approved nonstaining, water-Saturated material and shall be kept wet and protected against sun and wind for a period of 12 hours. Thereafter, the patched area shall be kept continuously wet by a fine spray or sprinkling of water for not less than 10 days as required under section 9.1 and 11.1 of this specification. The layers of unite may be reinforced with steel mesh if directed by the Engineer-in-charge.

The extent of repair shall be decided upon by the Engineer-in-charge. The cost of repairs of defective areas shall be borne by the CONTRACTOR. The Engineer-in-charge may adopt at his discretion any other method of repairing like grouting with cement grout, epoxy grout or guniting etc., which will be carried out by the CONTRACTOR at his cost as per the specifications supplied by the Engineer-in-charge.

**16.27 sampling &testing :**

16.27.1 General

The contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and as supplemented herein for the following items at his own cost unless otherwise specified in this specification. The Contractor shall get the specimens tested in a laboratory approved by the Engineer and submit to the Engineer the test results in triplicate within 3 (three) days after completion of the test.

16.27.2 Aggregate

The Contractor shall carry out any or all the tests aggregates as may be required by the Engineer in accordance with IS:2386 PartI to VIII. The acceptance criteria of the samples tested shall be in accordance with the requirements of the relevant Indian Standards.

16.27.3 Water

Sampling and Testing of water being used for concrete works as per IS:3550 will be carried out by the Contractor at regular intervals and whenever directed by the Engineer. The final acceptance criteria in case of doubt will be as per IS:3025 & IS:456.

16.27.4 Admixture

16.27.5 a) Air Entraining Agents

Initially, before starting to use A.E.A., relationship between the percentage of air entrained and the cylinder cube crushing strength vis-à-vis quantity of A.E.A. used for all types of concrete will be established by the Contractor free of charge by carrying out sufficiently large number of tests. After that, at regular intervals and whenever directed by the Engineer, the Contractor will check up free of charge, the actual percentages of air entrained and corresponding crushing strengths to correlate with the earlier test results.

b) Other Admixtures

Tests for establishing the various properties of any other admixtures which may be required to be added shall be carried out by the Contractor free of charge to the Purchaser.

16.27.6 Concrete

The sampling of concrete, making the test specimens, curing and testing procedure etc. shall be in accordance with IS:517 and IS:1199 the size of specimen being 15 cm cubes. Normally, only compression tests shall be performed but under special circumstances the Engineer may require other tests to be performed in accordance with IS:517. Sampling procedure, frequency of sampling and test specimen shall conform to Clause 14 of IS:456. To control the consistency of concrete from every mixing plant, slump tests and/or compacting factor tests in accordance with IS:1199 and as mentioned in of this specification shall be carried out by the Contractor every two hours or as directed by the Engineer. Slumps corresponding to the test specimens shall be recorded for reference.

The acceptance criteria of concrete shall be in accordance with Clause 15 of IS:456. However, in exceptional circumstances, the Engineer may, at his discretion, accept a concrete of lower strength than specified and which is otherwise acceptable according to IS:456. Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specification by the Contractor. No payment for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures, etc. wasted in the dismantled portion shall be made. In the course of dismantling, if any damage is done to the embedded items or adjacent structures, the same shall be made good, free of charge by the Contractor, to the satisfaction of the Engineer.

* 1. The Bar Bending Schedule with the necessary hooks, laps, spacers and chairs shall be 100% checked for all foundation concreting before start of work:
  2. Cutting tolerances for bars shall be as follows:

a) When the specified length is not = 25 mm

stated to be either maximum or +75 mm

minimum.

b) When the minimum length is specified + 75 mm

c) When the maximum length is specified = 50 mm

* 1. All the bent bars shall be checked as per approved Bar Bending Schedules, unless otherwise specified by the Engineer‑in‑charge, reinforcement shall be placed within the following tolerances:

Tolerance

a) For member with effective + 10 mm

depth 200 mm or less

b) For member with effective + 15 mm

depth more than 200 mm

The cover shall in no case be reduced by more than one third of specified cover or 5 mm whichever is less. Also, in no case shall the cover be increased by more than 10 mm.

All the joints and crossing of bars shall be checked to see that they are

tied properly with annealed wire as per specification.

Any of the bars selected for use shall be free from cracks, surface flows, laminations and rough, jagged and imperfect edges.

After the reinforcement cage has been put in proper position and tied

with the main bars.

Tolerance in the foundation Blocks/Bolts for steel structures:

i) Along the depth + 5 mm

ii) Along the slope 1/1000

iii) Permissible deviation of anchor bolts (Plan view):

a) Located within the 5 mm

contour of column base

b) Located outside the 10 mm

contour of column base

iv) Permissible deviation in + 20 to 0 mm

level of anchor bolts

v) Deviation of anchor bolt + 30 to 0 mm

thread length.

16.27.7 Acceptance Criteria**:**

16.27.7.1 General:

The contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards at his own cost, in a laboratory approved by the Engineer‑in‑charge, and submitting of the test.

16.27.7.2 Testing of concrete:

1. Normally, only compression tests shall be performed but the Engineer‑in‑charge may require other test to be performed in accordance with IS:517 (latest edition).
2. For each grade of concrete as follows:

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑------------------------------------------------

Quantity of concrete Number of samples

in the work, cu.m.

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑----------------------------------------------

* 1. 1
  2. 2
  3. 3
  4. 4

51 & above 4 plus one additional for each additional 50 m³ part thereof.

‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑‑-----------------------------------------------

However at least one sample shall be taken from each shift. At least 6 (six) specimens per sample shall be taken and 3 (three) of these shall be tested at 7 (seven) days and remaining at 28 days. Minimum compressive strength of 15 cm cubes of different grades of concrete at 7 days shall be as per table 5 of IS: 456‑2000

.

1. To control the consistency of the concrete from every mixing plant, slump tests and/compaction factor tests in accordance with IS:1199 shall be carried out by the contractor every two hours or as directed by the Engineer‑in‑charge. Slumps corresponding to the test specimens shall be recorded for reference. The Engineer‑in‑charge, at his discretion, may waive the above tests for small and unimportant concreting.

16.27.7.3 ACCEPTANCE CRITERIA FOR CONCRETE

1. The acceptance criteria of concrete shall be in accordance with IS: 456 (latest edition).
2. Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specification by the contractor. No payment shall be done for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures, etc. wasted in the dismantle. If any damage is done to the embedded items or adjacent structures, the same shall be made good, free of charge by contractor, to the satisfaction of Engineer‑in charge.
3. The dimensions of concrete as cast when compared with those on the drawing shall be within the tolerances given below; steps in surface alignment shall not exceed 2 mm.

No reduction will be permitted in the cover to reinforcement because of a specified negative tolerance in a concrete section.

STRUCTURAL ELEMENT PERMISSIBLE

DETAIL DEVIATION IN MM

Faces of concrete in foundations and +25 ‑5

structural members against which

backfill is placed

Exposed concrete in foundations +10 ‑5

Top surfaces of slabs and of concrete +10 ‑5

to received grouted plant or structural

steel work

Alignment of beams, columns, walls, + 5 ‑5

slabs & similar items.

Cross sectional dimensions of beams, + 5 ‑5

columns, walls, slabs and similar items.

Level and alignment of holding down + 5 ‑5

Bolts.

Level of holding‑down bolt assemblies +10 ‑5

Alignment of holding‑down bolt + 5 ‑5

Assemblies.

Centers of pockets or holes with greatest + 5 ‑5

lateral dimension not exceeding 150 mm.

Centers of pockets or holes with greatest +10 –5

lateral dimension exceeding 150 mm

Departure from alignment in roads and +15 ‑5

paved areas

Top surface of roads and paved areas + 5 ‑5

Plumb 1 in 1000 of height.

16.27.7.4 STANDARD DEVIATION

Standard deviation shall be based on test results and determination of Standard deviation shall conform to Clause 14.5 of IS:456.

16.27.7.5 INSPECTION AND CORE TESTS

Inspection of concrete work immediately after stripping the formwork and core test of structures shall conform to Clause 17 of IS:456.

16.27.7.6 LOAD TEST

Load Tests of structural members may be required by the Engineer, when the strength of test specimen results fall below the required strength, as per 'Load Test on Parts of Structures'. Clause 17.5 of IS:456. If load testing is decided by the Engineer, the member under consideration shall be subjected to a test load equal to 1.25 (one and a quarter) times the specified live load used for design and this load shall be maintained for a period of 24 (twenty four) hours before removal. The detailed procedure of the test is to be decided by the Engineer. Load tests shall not be made until the structure is at least 56 days old.

If the member shows evident failure, such changes as are necessary to make the structure adequately strong shall be made by the Contractor free of cost to the Owner. Alternatively, if permitted under Statutory Regulations and at the discretion of the Engineer, the structure under test or a portion thereof may be retained as such without any modification by de-rating its load bearing capacity, provided the design criteria allows such de-rating. A reinforced concrete beam, floor or roof shall be deemed to have passed the test if the maximum deflection at the end of 24 hours does not exceed the deflection given in Clause 17.5 of IS:456. The entire cost of load testing shall be borne by the Contractor. If a portion of the structure is found to be unacceptable, it shall be dismantled and replaced by a new structure as per specification. The entire cost of dismantling and replacement and restoration of the site being borne by the Contractor. If, in the course of dismantling, any damage is done to the embedded items and or other adjacent structures, the same will be made good, free of charge by the Contractor to the satisfaction of the Engineer.

16.27.7.7 LIST OF IS CODES AND STANDARDS FOR REFERENCE:

All work under this specification shall, unless specified otherwise, conform to the latest revisions and/or replacements of the following or any other Indian Standard Specifications and Codes of Practice. In case any particular aspect of work is not specifically covered by Indian Standard Specifications, any other standard practice, as may be specified by the Engineer, shall be followed:‑

IS:73 Indian Standard Specification for Paving Bitumen

IS:217 Indian Standard Specification for Coal Tar Pitch

IS:226 Indian Standard Specification for Structural Steel (Standard quality)

IS:269 Indian Standard Specification for Ordinary and Low Heat Portland Cement

IS:383 Indian Standard Specification for Coarse and Pine Aggregates from

Natural Sources for concrete

IS:432 Indian Standard Specification for Mild Steel and Medium Tensile

Steel Bars and Hard Drawn Steel Wire for concrete reinforcement

IS:455 Indian Standard Specification for Slab Cement

IS:456 Indian Standard Code of Practice for Plain and reinforced concrete

IS:457 Indian Standard Code of Practice for general construction of plain

and reinforced concrete for Dams and other Massive Structures

IS:517 Indian Standard Specification for methods of test for strength of Concrete

IS:1139 Indian Standard Specification for hot rolled mild steel and medium

tensile steel and high yield strength steel deformed bars for concrete reinforcement

IS:1199 Indian Standard Specification for methods of sampling and analysis of Concrete

IS:1200 Indian Standard Specification for method of Part II measurement

cement concrete works

IS:1200 Indian Standard Specification for method of PartV measurement of Formwork

IS:1322 Indian Standard Specification for Bitumen Felts for waterproofing and

damp proofing

IS:1489 Indian Standard Specification for portland ‑ pozzolona cement

IS:1566 Indian Standard Specification for Methods of Sampling and analysis of Concrete

IS:1709 Code of practice for laying dampproof treatment using bitumen felts

IS:1786 Indian Standard Specification for cold twisted steel bars for concrete

reinforcement

IS:1791 Indian Standard Specification for batch type concrete mixers

IS:2185 Indian Standard Specification for hollow cement concrete blocks

IS:2210 Indian Standard Specification for design of reinforced concrete shell

structures and folded plates

IS:2386 Indian Standard Specification for methods of test for aggregates for

concrete PartI to VIII

IS:2502 Indian Standard code of practice for bending and fixing of bars for

concrete reinforcement

IS:2505 Indian Standard Specification for concrete vibrators, immersion type

IS:2506 Indian Standard Specification for screed board concrete vibrators

IS:2514 Indian Standard Specification for concrete vibrating tables

IS:2722 Indian Standard Specification for portable swing weigh batchers for

concrete (Single and Double Bucket Type)

IS:2751 Code of Practice for welding of mild steel bars used for reinforced

concrete construction

IS:2770 Indian Standard Specification for method of testing bond on reinforced Concrete

IS:3025 Indian Standard Specification for methods of sampling and test

(physical and chemical) for water used in industry

IS:3201 Indian Standard Specification for design and construction of precast

Concrete trusses

IS:3370 Indian Standard Specification for code of practice for concrete

structures for storage of liquids

IS:3550 Indian Standard Specification for method of test for routine control for

water used in industry

IS:3558 Code of Practice for use of immersion vibrators for consolidating concrete

IS:3590 Indian Standard Specification for load bearing light weight concrete blocks

IS:3696 Safety code for scaffolding and ladders

IS:3812 Indian Standard Specification for fly ash for use as admixture for concrete

IS:4031 Indian Standard Specification for method of tests for hydraulic cement

IS:4082 Indian Standard Specification for recommendation on stacking and

storage of construction materials at site

IS:4090 Indian Standard Specification for design of reinforced concrete archs

IS:4634 Indian Standard Specification for method of testing performance of

batch type concrete mixes

IS:4656 Indian Standard Specification for form vibrators for concrete

IS:4925 Indian Standard Specification for concrete batching and mixing plant

IS:4926 Indian Standard Specification for ready mixed concrete

IS:4990 Indian Standard Specification for plywood for concrete shuttering work

IS:4991 Indian Standard Specification for blast resistant design of structure for

explosion above Ground

IS:4995 Indian Standard Specification for design of Part I&II concrete bins for

the storage of granular and powdery materials

IS:4998 Indian Standard Specification for design of reinforced concrete chimneys

IS:5512 Indian Standard Specification for flow table for use in tests of hydraulic cement and pozzolanic materials

IS:5513 Indian Standard Specification for vicat apparatus

IS:5515 Indian Standard Specification for compaction factor apparatus

IS:5551 Indian Standard Specification for precast concrete coping blocks

IS:5817 Indian Standard Specification for method of test for splitting tensile strength of concrete cylinders

IS:5891 Indian Standard Specification for hand operated concrete mixers

IS:6452 Indian Standard Specification for high alumina cement for structural use

IS:6909 Indian Standard Specification for supersulphated cement

IS:6923 Indian Standard Specification for method of test for performance of

screed board concrete vibrators

IS:6925 Indian Standard Specification for method of test for determination of

water soluble chloride in concrete admixtures

IS:7242 Indian Standard Specification for concrete spreaders

IS:7246 Indian Standard Specification for table vibrators for consolidating concrete

IS:7251 Indian Standard Specification for concrete finishers

IS:7320 Indian Standard Specification for concrete slump test apparatus

IS:7861 Indian Standard Specification for recommended Part I&II practice for

extreme weather concreting

IS:7969 Safety code for storage and handling of building materials

IS:8041E Indian Standard Specification for rapid hardening portland cement

IS:8112 Indian Standard Specification for high strength ordinary portland cement

IS:8142 Indian Standard Specification for determining setting time of concrete

by penetration resistance

IS:8989 Safety code for erection of concrete framed structures

IS:9013 Indian Standard Specification for method of making, curing and determining compressive strength of accelerated cured concrete test specimens

IS:9077 Code of practice for corrosion protection of steel rails in RB and RCC

construction

IS:9103 Indian Standard Specification for admixtures for concrete

IS:9417 Indian Standard Specification for welding cold worked steel bars for

reinforced concrete construction.

17.0 REINFORCEMENT STEEL:- Reinforcement Steel shall be procured by the contractor only. Reinforcing steel shall be clean and free from loose mill scales, dust, loose rust and coats of paints, oil, grease or other coatings which may impair or reduce bond.

**17.1** Mild steel reinforcement shall cover all hot rolled mild steel bars conforming to IS 432 (part-I) Grade-I.

**17.2** High yield strength deformed bars reinforcement either hot rolled deformed steel bars conforming to IS-1139 or cold twisted deformed steel bars conforming to IS 1786 shall be used unless otherwise specified. Grade of Reinforcement Steel shall be Fy 500 / Fy 550 grade

**17.3 Structural steel sections and plates shall conform IS: 226 and IS :** 2062 The quoted rate shall include the cost and conveyance of all materials, labour, tools, tackle, plant and equipment, cutting, bending, placing in position, binding wires etc. complete for finished item of work.

**18. Plastering**

A. Sand for plaster shall have the characteristics specified in IS:1542.

The sand shall not contain any harmful impurities, as specified in Clause 3.3 of IS:2117. The maximum quantities of clay, fine silt, fine dust and organic impurities in sand shall not exceed the following limits.

a . Clay, fine silt and fine dust : Not more than three (3) percent

(determined in accordance with by weight.

IS:383, Appendix C and also

IS:2386 Part II)

b. Organic impurities : Below that indicated by comparison

(determined in accordance with with standard solution specified in

IS:2386 Part II) Clause 6.2.2 of IS:2386 Part II.

B. Plaster shall be applied only when walls are perfectly dry. Jutting or recessed edges shall have sharp or suitably round corners, as specified by the engineer. Plaster of all kinds, either smooth or round finished, shall never show cracks, faulty alignment, either in horizontal or vertical planes, detachment from walls , blisters or other faults and shall have a uniform and perfectly smooth appearance. However, the new plaster shall not be trowelled to a glazed surface since white wash would not adhere to it.

C. Any faulty plastering shall in any event be removed and replaced at the contractor's expense at the sole discretion of the engineer.

D. The joints of brick work and masonry shall be raked out to 10 mm deep with mortar still green to form key for the cement plaster and surfaces to be plastered, if not sufficiently rough, shall be thoroughly picked and roughened to provide a good bond for the plaster. The rates for plastering shall be inclusive of preparing the surface as above.

E. Cement and sand shall be mixed dry and then just enough water added to form an easily workable paste. In no case shall mortar which has been allowed to stand more than twenty (20) minutes after mixing, be used.

F. The surface of brick work, stone, concrete and other structures to be plastered shall be thoroughly cleaned from dust. dirt, oil, salt and bituminous spots, wetted, as directed before the application of the rendering coat.

G. All scaffolding log holes shall be properly filled in advance of plastering as scaffolding is being taken down.

H. Patches of plaster nearly 150 mm x 150 mm should be put three (3) meters apart horizontally and vertically to correct plane and to the specified thickness. In case of floors and ceilings, the mortar slab shall be truly horizontal or to specified slope and shall be provided 3 meters apart in both directions.

I. The plaster shall then be laid in single coat correct to the line connecting the 150 mm x 150 mm patches laid beforehand. This shall be beaten with thin strips of bamboo about one meter long to ensure thorough filling of the joints and then brought to a true surface by working a wooden straight edge reaching across the patch as with small upward and sideways movement at a time. The surface shall be finished smooth with wooden floats and shall be of first class workmanship of required texture to the satisfaction of the engineer. Excessive trowelling or overworking the float shall be avoided. During this process a solution of live putty shall be applied on the surface to make it workable. In case of internal walls, the plaster shall be left off in a straight line 225 mm above the floor level. This together with portion of the floor near the wall shall be plastered together, the junction being curved to a radius of 35 mm or larger if so specified on the drawings.

J. For any increase in plaster thickness due to irregularities in brick work face,the contractor will not be entitled for any extra payment.

K. Proper precautions shall be taken to see that each coat of plaster is cured for a maximum period of fourteen (14) days by an approved method. Curing shall be done as soon as the applied plaster has hardened enough so as not to be damaged. The dates on which plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period can therefore be watched.

L. The contractor shall take every precaution, right from the commencement of plaster work to prevent any defects that may appear on the surface of the plasters, and shall be responsible to make good any portion of the work which in the opinion of the engineer required removal and/ or redoing.

M. The uneven face plastering 20 mm thick shall be applied in two layers. The first coat 17 mm thick with the second coat 4 mm thick applied after the under coat has sufficiently set but not dried and in any case within 48 hours. The plaster of under coat when brought to a true surface with a wooden straight edge, the surface shall be left rough and furrowed 2 mm deep with a scratching tool diagonally both ways to form key for the finishing coat.

N. Plastering of the ceiling shall be done before wall plastering. Wall plastering shall be done from the ceiling downwards.

O. In suspending work at the end of the day the plaster shall be left, cut clean to line both horizontally and vertically, when recommencing the plastering the edge of the old work shall be scrapped, cleaned and wetted before plaster is applied to adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of wall and not near than 15cm to any corners or recesses. Horizontal joints in plaster work shall not occur on parapet tops and coping, as these invariably lead to leakage. No portion of the surface shall be left-out initially to be patched up later on.

P. If directed by the engineer, the contractor shall use approved water proofing admixtures made by reputed manufacturer in the mortar for plastering work. The quantity to be used etc., shall be in accordance with the manufacturer's instructions subject however to the approval of the engineer. These admixtures shall not contain calcium chloride unless specially allowed by the engineer and shall conform to IS:2645. payment shall be made for actual quantity of such admixtures used unless it is already covered in the rates for the work concerned.

**Measurement:**

Plastering on walls and ceilings shall be measured by their actual finished surface, without taking into account jutting parts, etc., no special allowance or extra price shall be computed for these parts, nor for corners and angles. Prices are intended either for plane or curved surfaces. Provisions of transition grooved mouldings between walls and ceiling or between walls, with radius not larger than 150 mm is also included in the price, keeping in mind that plaster work shall be measured also in this case as having sharp corners.

All area openings, doors, windows, fan openings etc., shall be deducted while paying for plastering work. The plaster prices are intended to include also finishing at bottom after completion of floors.

Plastering shall be measured by their actual finished surface in square meters.

**18.1 For Walls (Uneven faces)**: The walls of uneven faces of superstructure are to be Smooth/ sponge plastered in one coat in 20mm thick in CM (1:5). The dubara Smooth/ sponge finish plastering is to be done on uneven faces of wall as per the schedule-A and APSS.

**18.2 For Walls (Even faces)** : The walls of even faces of superstructure are to be dubara smooth/ sponge plastered in one coat in 12mm thick in CM (1:5). Smooth finish plastering is to be done on even faces of wall as per the schedule-A and APSS.

**18.3 Under side roof slab/Ceiling**:- The underside roof slab (i.e. ceiling) is to be finish plastered 12mm thick in one coat in CM(1:3) at all heights. The sponge finish plastering is to be done as per schedule-A and APSS.

**18.4 Over RCC Roof Slab**:- Provided **Impervious coat over exposed RCC Roof slab surfaces** to required slopes with Polymer Acrylic Water Proofing layer of approved make as per manufacturer's specifications and over the layer 25 mm average thickness of screed cement concrete in CC 1:2:4 using 6 mm coarse aggregate with mixing of integral water proofing chemical at 150 ml per 50 kg of cement and over the screed concrete 4mm thick neat coat of cement plaster in CM 1:4 with mixing of integral water proofing chemical of approved make at 150 ml per 50 kg of cement and thread lining of regular intervals of 45 x 45 cm including and cost and conveyance of all materials, water, all labour charges, chemicals, curing for specified number of days, rounding off junctions of wall and slab, all leads, lifts, heights, levels and floors etc. complete as directed by the engineer-in- charge for finished item of work.

**18.5 For Drains:-** The walls of drains, UG sump, O.H. tank, columns in cellar floor, parapet walls are to be plastered with CM(1:5) 12mm thick for drains at all heights. The plastering is to be done as per schedule-A and APSS**.**

**18.6 For Compound wall:-** The retaining wall are to be plastered with CM(1:5) 20mm thick for all heights. The plastering is to be done as per schedule-A and APSS**.**

**18.7 For Sunken Portions:-** Providing and laying of **Impervious coat in Sunken portion of slabs** to required slopes with CM 1:3 of 20 mm thick per-mixed with water proofing chemical compound of approved quality & make and ISI Mark at 1 kg per one bag of cement (or as per the recommendations of the manufacturers) laid over sunken / roof slab when it is green, rendered smooth with a floating coat of neat cement including and cost and conveyance of all materials, water, all labour charges, chemicals, curing for specified number of days, rounding off junctions of wall and slab, all leads, lifts, heights, levels and floors etc. complete for finished item of work and as directed by the engineer-in-charge.

**18.8 The quoted rate for plastering works shall include**

* 1. Erecting, dismantling and removing of the scaffolding.
  2. Preparing the surface to receive the plaster.
  3. Providing cement plaster with specified finish and specified thickness.
  4. All labour, cost and conveyance of all materials, use of tools and equipment to complete the plastering as per specification.
  5. Curing for 14 days.
  6. Any grooves, bands etc, if shown on the drawings or as directed by the Engineer-in-charge.
  7. All lifts and leads.
  8. All wooden frames, steel frames or other fixtures which are required to be painted or polished subsequently shall be cleaned after the plastering work is complete for finished item of work.

19.0 FLOORING:-

1. Flooring with a bed of 100 mm thick in CC (1:4:8) using 40 mm and 20mm size HBG metal 50% each.
2. Flooring with Vitrified Tiles of 1st Class Quality 8mm thick of 600x600x8mm size for floorings of Rooms, passages set over CM 1:3 of 12 mm thick and neat joining with white cement including cutting , laying, over CC bed already laid including neat cement slurry of honey like consistency, spread at the rate of 3.3 kg of cement per m², jointed to full depth, (Joints must be flushed ) with white cement paste mixed with pigment when required including cost and conveyance of cement and all materials, labour charges, at all levels, heights and floors, curing all incidental charges etc. complete as directed by the engineer-in-charge and for finished item of work .
3. Flooring with Ceramic Tiles of 1st Class Quality 7.3mm thick of 300x300x7.3mm size of approved brand , shade and design of different sizes laid over a floor bed of CM 1:3 of 12 mm thick base coat and neat grey cement slurry of honey like consistency spread at the rate of 3.3 kg of cement per m² and pointed to full depth, (Joints must be flushed ) with white cement paste mixed with pigment when required including cost and conveyance of cement and all materials, labour charges, at all levels, heights and floors, curing etc
4. Flooring with Adanga green Marble Stone of good quality 20 mm thick of size for steps in single piece of 1.5 m for staircase raise and tread and max available length and width piece for staircase lobby laid over CM 1:3 of 12 mm thick and neat joining with white cement including cutting , laying, minimum of five coats of tinoxide polishing over CC bed already laid including neat cement slurry of honey like consistency, spread at the rate of 1.5 kg of cement per m², jointed to full depth, (Joints must be flushed ) including cost and conveyance of all materials, labour charges, at all levels, heights and floors, curing etc. complete a for finished item of work and as directed by the engineer-in-charge.
5. Providing Flooring in Stilt floor with Parking Tiles ( Pavement Tiles) Tiles of 1st Class Quality of approved colour and pattern 10 mm thick of 300 x 300 mm size set over CM 1:3 of 12 mm thick and neat joining with white cement including cutting , laying, over CC bed already laid including neat cement slurry of honey like consistency, spread at the rate of 1.5 kg of cement per m², jointed to full depth, (Joints must be flushed ) with white cement paste mixed with pigment when required including cost and conveyance of cement and all materials, labour charges, at all levels, heights and floors, curing etc. complete as directed by the engineer-in-charge and for finished item of work .
6. Skirting/ Dadoing to Walls Bath Rooms and stair case walls with Decorated back ground glazed Tiles of 1st Class Quality 7.3 mm thick of 200 x 300 mm size set over CM 1:2 of 12 mm thick and neat joining with white cement including,cutting, laying cement slurry of honey like consistency spread at the rate of 3.3 kg/m² and filling the joints with white cement paste mixed with pigment of matching shade is to be done including cost and conveyance charges of cement and all other materials to site, seigniorage charges, incidental and operational charges, all labour charges for mixing mortar, finishing, all leads and lifts, including cost and conveyance of all materials, labour charges, at all levels, heights and floors, curing all incidental charges etc. complete for finished item of work and as directed by the engineer-in-charge.
7. Providing Dadoing to Walls faces of Lifts, with Chilly Red or any other approved colour of Polished Granite Stone of thickness 15 mm laid over base coat of CM (1:2) of 12 mm thick applying araldite to the stone and pointing with 6 mm bewel edged grooves matching colour cement set over with neat cement slurry of honey like consistency spread at the rate of 3.3 kg/m² and filling the joints with white cement paste mixed with pigment of matching shade including cost and conveyance of all materials, labour charges at all leads, lifts, floors, levels and heights,all incidental charges etc. complete for finished item of work andas per the approved drawings and directions of the engineer-in-charge.

20. DOORS, WINDOWS & WOODEN PARTITIONS :

20.1 Supply and fixing doors with the frame of the door shall be made of well seasoned MT wood of cross section 125x75mm. The shutter shall be made of ISI marks flushed door with decolam sheets pasted on both sides with Teak beading 40mm width all-round. Frame shall be painted with two coats of synthetic enamel paint of approved colour over one coat of primer over luppum with spray with 3 no 150 mm Aluminum hinges , 1 no Aluminum door stopper 150mm, 2 no 300 mm Aluminum aldrops, 2 no 300 mm Aluminum tower bolts, 2 no 150 mm Aluminum fancy door handles. The quoted rate shall include cost and conveyance of the materials, fixing, labour charges, tools, handles, locking arrangements, and other fixtures & fittings for finished item of work as directed by the Engineer-in-charge.

20.2 Supply and fixing of aluminum anodized sliding windows & ventilators as per drawings with all required accessories such as stoppers, bolts, weather stripping etc., for all sizes and sections in accordance with approved drawings & as per IS 1948-1961 with top & side frames of size 62.63X36X1.5 mm thick and bottom frame of size 62.6X31.6X1.5mm thick sloping outwards for drainage & fixed, sliding shutter with 40X27.5X18 X1.5mm interlocking section 40X18X1.5mm size for top side &bottom sections interlocked for weather scaling & mounted on Nylon rollers of lift type with 5mm thick plain glass glazing, fitted with Aluminum glazing clips & suitable rubber beeding for all sizes of windows( Aluminum sections shall be of standard make as approved by Engineer in Charge.

20.3 Supply and fixing of Structural glazing made of pre painted steel (base ;steel as per IS 513 of 0.6 mm thick D quality, galvanized as per IS 277 with Zinc of 120 GSM ) Primer coated with epoxy primer of 5-7 microns thick, finish painted with a polyester paint of 12-16 microns thick and back coated with 5-7 microns thick alkyad backer. section for outer frame should be 46x52mm, beading should be 18X25mm . the glazing should be paneled with 5mm thick plain float glass with ethylene propylene diene monomer (EPDM) gaskets. the sections are tobe cut to length, mitre joined with corner bracket. Center mullions are to be fixed suing mullion cap. Handle made of high grade Aluminum powder coated and nylon receiver. Gaskets made of ethylene propylene diene monomer (EPDM) corner brackets made of CRCA with zinc phosphate. Mullion caps made of glass filled nylon. The above frames should be fixed to the concrete- masonry walls be means of self expanding screws. Including all taxes and complete for finished item of work. (Fixed glazing2'-0"X3'-0" (609.6 X914.4mm) grid outer frame section size of 46x52mm) S.No.694 in SSR and as directed by Eng-in -charge.

20.4 Wooden Partition:

20.4.1 Supply & Fixing of wooden partitions with double skin 8mm thick plywood on both sides with supporting frame of 3"X1.5" section of 1'6"X1'6" grid, 1.5mm thick decolam pasted on both sides, 6mm thick glass for openings with necessary beeding including labour charges fixtures with necessary labour & hardware etc., for complete item of work

20.4.2 Supply & Fixing of flush door of 30mm thick with laminate finish on both sides, 6mm thick glass for glazed portion including labour charges fixtures such as hinges, cylindrical lock & hardware etc., for complete item of work

21. PAINTING IRON WORK :

Paint to be used for various items of work shall be of best quality and shall be obtained ready mixed in sealed containers from approved manufacturer. The Contractor shall obtain the Engineer's approval for the make and colour of the paint he proposes to use. If required, polish for woodwork shall be tested as per IS:5807 (Parts I & III).

All surfaces shall be thoroughly cleaned of all dirt, loose particles and rust and approved prior to application of paint. For Steel gates & Rolling shutter surfaces, a priming coat without colouring matter shall be first applied after which all holes, cracks, etc., shall be stopped with putty and all knots properly killed with quick lime. Workmanship shall conform to IS:1477 (Parts I &II and 2338 (Part I).

Specified number of coats shall be applied and at least 24 house shall elapse between the application of successive coats. No painting shall be carried out on exterior work in wet weather or on surfaces which are not entirely dry.

Painting rate shall include all necessary scaffolding, cradles and plant. Measurements will be on the basis of Sq.m. for doors and windows, only the projected area will be measured, if such painting is not already a part of the item, without deducting for the glazed portions though not painted. The Contractor's rate should take this into account.

22 GATES and ROLLING SHUTTERS:-

22.1 Supply and fixing of Iron gates as per approved drawing with approved thick two coat of enamel over coat of anti rust paint including cost and conveyance of all materials and labour charges for fabrication and fixing, painting, hold fasts, hinges, locking arrangements etc. complete as directed by Engineer-in-charge SNO:144 IN SSR as directed by Eng-in- charge.Mode of Payment : The payment for the windows and ventilators shall be made on the basis of area in m² specified.

* 1. Supply and fixing of Collapsible steel shutters with verticle, double channel of 20x10x2mm of 100mm center Bracers with flat iron 40x40x6mm with 38mm dia steel pully with all fixtures and furniture as per spl.spn.1105 including cost and conveyace of all materials and labour charges etc. complete and as directed by Engineer-in-charge S.NO.116 IN SSR as per directions of Eng-in-charge.

23 RCC DROP WALLS :

Sun breakers and drop walls at all elevations are to be provided in CM (1:2) 50mm thick over rabbit wire mesh & 6mm dia. Reinforcement steel. The rate shall be inclusive of reinforcement steel (6mm @ 150mm C/C both ways), cement, all labour ,leads, lifts chicken wire mesh, shuttering, scaffolding cost of cement mortar and finishing with ordinary plastering for finished item of work as directed by Engineer-in-charge.

24 PAINTING :

24.1 OUTSIDE WALLS :

Painting to External Faces of walls(outside) in all floors as specified with two coats of ACE or equivalent quality paint of approved colour make and shade over one coat of white cement primer including cost and conveyance of all materials, labour charges at all leads, lifts, heights, levels and floors,all incidental charges etc. complete for finished item of work.

24.2 INSIDE WALLS:

Painting in all floors as specified with two coats of oil bond distemper of approved colour make and shade over one coat of white primer including cost and conveyance of all materials, labour charges at all leads, lifts, heights, levels and floors,all incidental charges etc. complete for finished item of work .

The rate quoted includes cost of all materials, conveyance, taxes, scaffolding, all leads, lifts, all heights, levels, floors, curing ,all incidental charges etc. complete and as directed by Eng-in-charge.

1. No painting work shall be started unless specimen colours and shade are submitted in advance to the Executive Engineer/ Civil/ Gr.Hyderbad for approval, such approval of paint specimen by the Engineer does not relieve the contractor of his full and entire liability as to the life and quality of paint.

2. The Engineer-in-charge while work is in progress, may take samples of the products employed in the different Operations in order to have them analyzed and tested as deem fit at the contractor’s expense.

3. Any deviations and defects shall have to be rectified by the contractor at his own expense. Contractor shall protect the work and materials by suitable covering or other method acceptable to Engineer-in-charge.

4. The contractor shall remove all the paint and varnish spots from floors, walls, glass panels and other surfaces and restore them to original condition. No impression of brushes should be visible on the wall surface.

5. Painting of second coat over the first coat should be right angle to the first coat application direction

Supply & Application of One Coat of Altek Water Based Cement Primer & Two Coats of Altek Alltimate (100% Pure Acrylic Emulsion Paint) after making surface even and free from all dents including cost and conveyance of all materials, labour charges at all leads, lifts, heights, levels and floors,all incidental charges etc. complete for finished item of work .

24.3 Providing Two coats of Painting to New Wood Works ie. doors in wooden frames and flush shutters, in synthetic enamel paint of approved make, colour and shade over single coat primer coat of wood primer, including cost and conveyance of all materials, labour charges, cost of brushes, emery papers, applying putty wherever necessary to get new finish etc complete, for finished item of work and to the satisfaction of engineer-in-charge.

24.4 PREPARATION OF SURFACE :The surface is to be prepared as per the relevant clauses of APSS/ISS and as directed by Engineer-in-charge. Application of primer and number of coats to be applied shall be as specified and as directed by Engineer-in-charge and as per manufacturer’s specification. The surface on finishing shall be absolutely uniform and smooth.

24.5 The Quoted rate shall include the following.

* 1. Supplying the paints of approved shade and make.
  2. Preparing different surfaces to be painted as per standard specification.
  3. Providing and erecting scaffolding and removing the same wherever necessary. Safety measures are to be followed to avoid mishaps. at the work site
  4. Lifting the materials to all heights.
  5. Application of Paint as per standard specification.
  6. Curing and protecting the painted surface.
  7. Labour Charges, slandered tools and tackles should be used on the work like brushes etc.
  8. Any other incidental charges etc complete for finished item of work.

25 PAINTING NEW STEEL WORK :

* 1. New Steel work is to be painted with approved synthetic enamel paint (Asian/ Berger or equivalent) in two coats over one coat of wood primer.
  2. The Steel surfaces to be painted must be thoroughly dry, clean and smooth and must be approved by the Engineer-in-charge before any paint is applied.
  3. Primary Coat: It shall be of approved brand and shall be brushed uniformly free from brush marks etc.
  4. Stopping: After priming all small holes, cracks, open joints and similar minor defects of every kind shall be stopped with approved brand readymade putty.

**e) Synthetic enamel paint:**

* + 1. PAINT: Synthetic enamel paint and primer of approved brand, manufacturer and shade shall be used.
    2. PREPARATION OF SURFACE: Preparation of Surface shall be as per standard specification of APSS. The primary and number of coats to be applied shall be as specified and shall be applied as per manufacturer’s specification.
    3. Ready mix paint only preferred. No admixtures are allowed to add to the paint.

**26 C.I. COVERS**

**Providing and Fixing of Heavy duty C.I. Covers confirming to IS:12592(Part1&2) of double seal type including Frames and locking arrangement over the Under Ground Sump and Over Head Tank of size 600 x 600 mm and suitable thick and weight not less than 38 kg inclusive of cover and frame in the RCC Slab of tanks, including cost and conveyance of all materials, labour charges etc complete for finished item of work**

**27 RCC HUME PIPES**

**Supplying, laying and Jointing RCC Hume Pipes of S & S ends of 250 mm dia. of NP2 Class including cost and conveyance of all materials, labour charges, leads and lifts and finishing with ordinary plastering for finished item of work.**

**28. PLUMBING & SANITARY ITEMS:**

* 1. **SALT GLAZED STONE WARE PIPES:**

**Stone ware pipes shall be salt glazed and free from cracks, deformities and imperfections. They shall be cylindrical straight and to standard dimensions. They shall be made of hard burnt stoneware of dark grey colour and thoroughly glazed and shall give sharp clear sound when struck with a light hammer. The pipes shall conform to the requirements of IS:651 and shall be of perfect potteries of approved equivalent make.**

* 1. **CAST IRON PIPES:**

**Cast iron pipes, where called for on the drawings shall be good tough quality dark grey on fracture and capable of being worked with a driller file. Cost iron pipes and fittings shall be sound with smooth inner and outer surface, free from laps, pin holes and other imperfections and shall ring clearly when struck all over with a light hard hammer. Cast iron pipes supplied by the manufacturer shall bear coating of bitumen by hot dipping, which should neither flow at 77 °C temperature nor brittle at 0 °C temperature or chip off when lightly scribed with a pen knife. The coating shall be smooth and tenacious. Pipes and fittings for drainage (Soil, Waste, and vents) shall conform to IS:3989 and/ or IS: 1729 and as specified.**

**All cast iron pipes and fittings shall be of Indian Iron & Steel Company, manufacture or other approved equivalent.**

* 1. **GALVANISED IRON PIPES:**

**Galvanized Iron pipes and fittings where called for on the drawings shall be of galvanized mild steel or galvanized wrought iron. The pipes shall be ‘B’ class manufactured by Indian Tube Company or Bharat Steel Tubes or TATA or other approved as called for. The fittings shall be “R” brand fittings of Mehta Corporation (Ahmedabad) or approved equivalent as called for. All pipes and fittings conform to IS:1239 – Part-I, Part-II and the galvanizing shall conform to IS:4736. On delivery to site, the pipes and fittings shall be inspected for the galvanized coating. Pipes with damaged coatings shall be immediately segregated.**

* 1. **PVC PIPES:**

**PVC pipes where called for shall be either un-plasticized PVC pipes or High density polyethylene pipes supplied with appropriate fittings. The pipes and fittings shall be 6.0 kg/m² pressure class for sewer pipes ie 110mm and 90 mm pipes (PVC/SWR) an 4.0 kg/cm² pressure class for waste water pipes. Plastic Pipes shall be handled with care and stacked in a place protected from the sun. All plastic pipes and fittings shall be manufactured by SUDAKAR or NOCIL or WAVIN or NANDI or approved plastic pipes and fittings shall conform to Indian Standard IS:4984 or IS:4985.**

* 1. **WATER SUPPLY FITTINGS:**

**All water supply fittings (including supplying, fitting and accessories) shall be of brass/copper, heavy chromium of approved make and design specified. The fittings shall be cast fittings of screw type, machined and threaded properly for fixing to the supply pipes. The plating shall conform to IS:4827. The fittings shall be supplied complete with chromium plated matching flanges nuts and extension pieces if required lengths. Metallic washers where required shall also be of chromium plated brass. All bib cocks and stop cocks shall conform to IS:781, Pillar cocks shall conform to IS: 1795. Bath fittings to IS:1701, Bath filler, shower arm, rose, sockets and other fittings shall match the supply fittings in construction and appearance. All fixing accessories and screws shall be similar fittings. All fixing, all washers shall conform to IS:4326.**

* 1. **SANITARY FIXTURES:**

**All glazed vitreous shine sanitary ware fixtures shall be of best Indian made of approved manufacture conforming to IS:2556. These shall be non-porous and fully vitreous, with all the visible portions perfectly glazed should be absolutely free from hair line cracks, pin holes and local depressions. These shall have perfectly symmetrical uniform and smooth curves.**

* 1. **WASTE FITTINGS:**

**All waste fittings (waste, chain, pop up, overflow, spreaders caps etc.) shall be of brass/copper heavy chromium plated of approved make and designs specified and match the supply fittings. They shall conform to IS: 2963.**

* 1. **VALVES:**

**All valves (gates, globe, check, safety etc.) shall be either all brass or gun metal valves suitable for the particular service. All valves shall be for the particular duty and designs called for similar to ‘leader’ or G. G. Bombay make or approved equivalent, valves shall be tested to 21 kg/cm² pressure at manufacturer’s works.**

**Valves shall either be of the screw type or flange type, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valve gate, globe and gate, globe and check valves shall conform to IS:778 and non-return valves to swing check type reflux (non return valves IS:5312 part-1).**

BALL VALVES WITH FLOATS: Ball valves with floats to be fixed in storage tanks shall consists of cast brass lever arms having copper balls (28 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing /opening mechanism incorporating the piston and cylinder shall be of a non-corrosive metal and include washers. The size and construction of ball valve and float shall be suitable for desired working pressure operating the supply system. Ball valve shall be supplied with brass hexagonal back nuts to secure then to the tanks and socket to connect to supply pipe. All brass valves with floats shall conform to IS:1703.

* 1. **FLOOR TRAPS and NAHANI TRAPS:**

Floor traps, Nahani traps and urinal traps shall be provided wherever necessary and shall be of cast iron of size required, of approved design incorporating a deep seal size required (6cm. minimum) and venting device unless otherwise indicated. The traps shall be supplied with a specially cast iron extension piece with required number of sockets in appropriate directions to receive the waste/soil pipes from wash basin/bath tub/urinals.

**28.10 PIPE HANGERS, BRACKETS ETC:**

Sturdy hangers, brackets and saddles of approved design shall be installed to support all pipe lengths which are not embedded over their entire run. The hangers and brackets shall be fabricated from suitable M.S Rolled sections. The hangers and brackets shall be adjustable heights and painted with red oxide primer, clamps, collars and saddles to hold pipes shall be provided with suitable gaskets. The Brackets and hangers shall be designed to carry the weight of pipes safely.

All pipes and shall be secured near every joint and halfway through every pipe length unless otherwise specified.

**28.11GRATING FOR FLOOR TRAPS:**

Gratings made of 3 mm thick brass heavily chromium plated shall be installed to cover all floor traps and floor drains. The gratings shall be of size required and be square or circular in shape as called for. The gratings shall be supplied complete with matching chromium plated Brass screws, and brass rings to fasten the gratings to the floor on traps.

**28.12 COWLS:**

Cowls of cast iron of proper size shall be supplied to cover all open terminals of soil, waste, vent. The cowls shall be of the indicated design vent away type, bituministic coated and provided with a tail piece to fit snugly in the receiving pipe.

**28.13 ALIGNMENT AND EXCAVATION OF TRENCHES:**

28.13.1 ALIGNMENT AND GRADE: - All pipes shall be laid true to alignment and gradients as shown on the drawings. No deviations from the lines, depths of cuttings or gradients called for on the drawings shall be permitted without the approval in writing by the Engineer-in -charge.

* + 1. SETTING OUT TRENCHES:- The contractor shall set out all trenches, man holes and such other works to true and alignment as called for. He shall provide the necessary instruments for setting out and verification of the same. All trenches shall be laid to true grade and in straight lines and as shown on the drawings. The trenches shall be laid to proper levels by the assistance of rods and sight rails which shall be fixed at intervals not exceeding 10 meters or as directed.
    2. EXCAVATION OF TRENCHES FOR PIPES:- The trenches for pipes shall be excavated with bottom formed to levels and gradients as shown on the drawings or as directed. In soft and filled in Ground the contractor may require the trenches to be excavated to a greater depth than that shown on the drawings and to fill up such excavation with concrete consolidates to bring the excavation to the required levels as shown on the drawings. All excavation shall be properly protected where necessary by suitable trimmings approved.

Excavation below water table shall be done after dewatering of the trenches. No blasting shall be allowed without prior approval in writing from the Engineer in-charge. It shall be carried out under thorough and competent supervision, with written permission of the Engineer in-charge taking full precautions connected with blasting operations. All excavated earth shall be kept sufficiently clear of the trenches.

All pipes, water mains, cables etc., met in the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the cables, the removal of which shall be arranged by the owner.

* + 1. BACK FILLING:-Refilling of the trenches shall not be commenced until the length of the pipe there in has been tested and approved. Where the pipes are unprotected by concrete hunching selected fine material shall be carefully hand packed around the lower half of the pipes so as to buttress them to the sides of the trench. The refilling shall then be continued in 150mm thick layers over the top of the pipes using selected fine hand packed material, watered and rammed on both sides of the pipes with a wooden rammer. The process of filling and tamping shall proceed evenly in layers not exceeding 150mm in thickness. Each layer being watered and consolidated so as to maintain an equal pressure on both sides of the pipe line. In gardens and fields, the top soil and turf if any shall be carefully replaced.
  1. **RILLING & CUTTING:-**

Drilling and cutting of installed pipe work and masonry shall be restricted to absolute minimum. Where such cutting and drilling is unavoidable it shall be executed only with prior permission. All cutting and drilling shall be pre-determined and suitable sockets and specials shall be employed to effect necessary connections. All cutting and drilling shall be executed by skilled workmen with proper tools. The disturbed surfaces shall be restored to the satisfaction of the Engineer at site.

* 1. **LAYING OF PIPES AND JOINTING OF PIPES:** 
     1. General: The pipes shall generally be laid with sockets leading uphill and shall rest on solid and even foundations for the full length of the barrel. To accommodate sockets depressions shall be formal in the foundations sufficiently deep to allow ample space of the pipe jointer to work right round the pipes. Each separate pipe shall be individually set for line and levels. Pipes shall always be installed in accessible positions. Except where absolutely necessary and indicated the pipes shall be installed in wall chase/floor.
     2. Salt Glazed Stoneware Pipes: The laying and jointing of stoneware pipes shall be executed in accordance with Code of Practice for laying of glazed stoneware pipes as per IS:4127. Salt glazed stoneware pipes shall be jointed as follows:

Hemp shall first be wrapped round the spigot of each pipe and spigot shall then be placed into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the hemp caulked tightly home as not to fill more than quarter of the total depth of the socket. The remainder of the socket shall then be filled with a stiff mixture of cement mortar (1:1) one part of cement to one part of washed coarsed sand. When the socket is filled shall be formed found the joint with a trowel making an angle of 45 deg. with the barrel of the pipe. After the joint is made, any extraneous material shall be removed from the inside of the joint with suitable scraper. The newly made joint shall be protected until set, from sun, drying winds, rain or dust. The joint shall be cured by keeping it continuously damp for four days.

The inside of the pipes shall be left absolutely clear in bore and free from cement mortar or any other obstruction. These joints shall be tested to ahead of 100 cm for two hours without developing leaks or fall in pressure. In case of leaks, the piping shall be redone in such position and the test repeated till satisfactory result.

* + 1. CAST IRON PIPES:-Cast iron pipes shall be laid and jointed in confirmation with the code of practice for laying of cast iron pipes IS:3114. Cast iron shall be joined by best quality caulking lead free from all impurities. In wet trenches, joints shall be made with lead wood. The spigot shall be centered in the adjoining socket by tightly caulking in sufficient turns for tarred gasket to leave the unfilled required depth of socket for load. Where the gasket has been caulked tightly home a jointing ring shall be placed round the barrel and against the face of the socket. Molten lead shall then be poured into fill the remainder of the socket in one operation. The lead shall then be poured into fill the remainder of the socket in one METRO ZONE.

The lead shall then be solidly caulked with suitable tools by hammering right round the joint to make up for the shrinkage of the molten metal on cooling and shall preferably finish 3mm behind the socket face. caulk

The joints and pipes laid for water supply system shall be tested to pressure of 12 kg/cm² for two hours without developing leaks/fall in pressures. The drainage pipe lines and joints shall be tested to a head of 150 cm for two hours without developing leaks/fall in pressures. In case of leaks, the piping shall be redone in such portions and the test repeated till achieving satisfactory results.

* + 1. GALVANISED STEEL PIPES:-Galvanized steel pipes shall be jointed with screwed and socket joints using screwed fittings. Care shall be taken to remove any burr from the ends of the pipes after threads cutting. White lead or an equivalent jointing compound of proprietary make shall be used, according to the strands of red lead shall not be used fine yarn while tightening. Compounds containing of water, read lead shall not be used because of the danger of contamination of water. Any threads exposed after jointing shall be painted with bituminous paint to prevent corrosion.

Pipes and joints laid for water supply system shall be tested to a pressure of 7 kg/cm² for two hours without developing leaks/fall in pressure. In case of leaks, the piping shall be redone in such portions and the test repeated till achieving satisfactory result.

* + 1. VALVES:-Valves shall be provided at accessible locations on every branch from main lines. In case of valves with screwed female inlet/outlet, each valve shall be provided with a union, on either side and installed in piping system. On external lines, valves shall be installed in brick masonry chambers with a frame and cover as directed by the Engineer-in-charge.
    2. **PIPING SYSTEMS INSTALLATION, INSPECTION & TESTING:**

The soil pipes shall be of minimum diameter of 100 mm and waste pipes of 80mm. Pipes shall be fixed by means of clamps in two sections, bolted together, built in to the walls, wedged and neatly painted as directed and approved by the Engineer keeping 50mm distance from the walls. Where indicated, the soil and waste pipes shall be continued upwards without any change/distinction in its diameter, without any bend or angle to the height shown in the drawings.

Unless specified otherwise soil and waste pipes from urinal/wash basin/sinks upto the floor trap shall be of GI medium class pipes (Class B) . All the traps of water closets and urinal traps shall be provided with anti-siphon /relief vent pipes as directed by the Engineer. All terminal manholes shall be provided with vent pipes. This may be dispensed if the upper floor soil stacks connecting to such manholes are vented. All soil, waste and vent pipes shall be given two coats of approved paint.

All connections, between soil, waste and ventilating pipes, and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. The doors shall be provided with 3 mm thick rubber insertion packing and when closed and bolted shall be air and water tight.

Where soil, waste and ventilating pipes are accommodated in shafts, ducts adequate

access to cleaning shall be provided

1. **SANITORY FIXTURES & FITTINGS**:-
   1. **INSTALLATION OF FIXTURES & FITTINGS:-**

The sanitary fittings shall be installed at the correct assigned positions as shown on the drawings and as directed by the Engineer/architect, and shall fully meet with the aesthetic and symmetrical requirements. Fixtures shall be installed by skilled workmen with appropriate tools according to the best practice in the trade. Manufacturers’ instructions shall be followed for the installation of the fixtures. Fixtures in all toilets shall be standard height mounted rigid plumb and true to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are abutting properly on the receiving pipes before making the joints.

It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. A check shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, lavatory basins, sinks, flushing cisterns and other appliances. Where the built-in type of brackets are used, they shall be securely fixed to the slabs and walls by approved means. It shall be ensured that while fixing the fixtures and fittings no tool marks or scratches are developed.

* 1. **PROTECTION OF FIXTURES:-**Care shall be taken at all times, particularly after fixing, to protect fixtures from damage. All orifices shall be temporarily plugged during progress of work to prevent obstruction. Fixtures shall be finally cleaned to the satisfaction of the Engineer-in-charge.
  2. **MISCELLANEOUS WORKS**:-
  3. **CONNECTION TO WATER TANKS AT TERRACE: -** The contractor shall provide all inlets, outlets, washouts, vents, ball cocks, overflow, control valves and all such other piping connections including level indicator to water storage tanks as called for. The pipe shall be embedded with puddle flanges as necessary at no extra cost. Suitable float controls of an approved make, securely fixed to the tank and set in a position that water inlet in-to the tank is cut off when filled up to the full water line. The water level in the tank shall be adjusted to 25mm. below the line of the overflow pipe.

Full way gate valves of approved make shall be provided as near the tank except the overflow pipe. The overflow pipe shall be so placed as to allow the discharge of water being readily seen. The overflow pipe shall be as indicated. A stop valve shall also be provided on the inlet water connection to the tank. The outlet pipes shall be fixed above the bottom of the tank as indicated. A wash out pipe shall be provided at the bottom of the tank towards which the flux of the tank is slopping to enable the tank to be emptied for cleaning.

* 1. **DISINFECTION OF PIPES SYSTEM AND STORAGE TANK:** Before commissioning the water supply system, the Contractor shall arrange to disinfect the entire system. The filtered water storage tanks and pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again the disinfecting chemical containing chlorine added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give the water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is used, the proportions will be 150 g of powder to 1000 litres of water. The powder shall be mixed with water to creamy consistency before being added the water in storage tank. If a proprietary brand of chemical is used the proportion shall be as specified by the makers. When the storage tank is full, the supply shall be stopped and all the taps on the distribution pipes opened successively working progressively away from storage tank. Each tap shall be closed when the water discharge begins to smell of chlorine. The storage shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally, the tank and pipes shall be thoroughly flushed out before any water is used for domestic purposes.
  2. **SANITARY APPLIANCES**:

The contractor shall furnish all labour, materials and equipment required for supply and installation of various sanitary appliances required for the civil works mentioned in sub-section and as per drawing and specifications.

1. **WASH BASINS:** Wash basins shall be of colour vitreous china of standard size (23” X 20”) 585 x 500 mm. with flat back. Wash basin shall be one piece construction including a combined overflow and soap holder. Wash basins with approved quality chromium plated pillar taps(15mm.) dia. along with stop cocks, brackets, waste coupling etc., shall be provided. The wash basins shall in all respects conform to IS:2556(part IV).

Wash basins shall be provided with waste couplings, 75mm. CP Nahani floor trap and connecting pipes.

**Mode of Payment:-** Rate per 1 No

1. **INDIAN TYPE OF WATER CLOSET : -** The installation shall consist of squatting pan of a specified size 23”(581mm size ) and make with an integral flushing rim coupled to a ‘P’ or ‘S’ trap with or without an inspection vent as specified by the Executive Engineer/ Civil/ Gr.Hyderbad . The installation shall be securely fixed level in brick jelly concrete with cement mortar , so that the floor of the privy gently slopes towards the rim of the squatting pan. The outlet of the trap shall unless otherwise specified be connected to the PVC/SWR soil pipe throughout a short length of lead pipe of the same bore by means of a brass socket and a ferrule. The joint between the trap outlet and the brass socket shall be made by cement mortar(1:1) with a packing of yarn. The joint between the PVC/SWR. soil pipe and the brass socket shall be made by caulked pig lead with a packing of yarn.

**30 MAN HOLE AND GULLEY TRAPES**:-

**Man Holes / Inspection chambers with brick masonry** 1.5 m outer dia at bottom and 1 m outer dia at top varying from 1.5 m to 1.0 m including laying of 150mm CC bed in CM(1:4:8) using 40mm HBG metal and 0.23 m thick brick masonry walls in CM(1:6) tapering; forming necessary channels and bedding upto the bottom of channels and plastering with CM(1:3) 12mm thick both inside and outside, supply and fixing of heavy duty (20 kg) man hole cover of 508 mm dia with frame and CI rungs including painting to cover, frame and rungs, cost and conveyance of all materials labour charges, leads and lifts, curing, etc., complete for finished item of work

**Gully Trap**(150X100 mm) of 1st class, with CI grating and constructing single brick masonry wall chamber of 20"x14"x12" in CM 1:6 over a CC bed 1:5:10 of 100 mm thick and plastering in CM 1:3 for 12 mm thick with 12"x9" CI frame and hinged cover of approved quality including cost an conveyance of all materials to site, labour charges, etc. all complete.

**GENERAL TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS**

**1.0 BUSDUCT AT TRANSFORMER SECONDARY:**

Bus duct shall be fabricated out of 14 SWG powder coated sheet steel. The bus duct intended for connection between the secondary of 1000 kVA transformer and the incoming feeder of the 415 volts Main Distribution Board shall be dimensioned perfectly to match the transformer / switch board end flanges.

The bus duct shall have ventilation louvers at every 1000 mm intervals on both sides of the duct.Necessary interchange in connections shall be done to maintain the phase sequence. Bus bar supports shall be of SMC.

A copper earth bus of size 30 x 6 mm shall be run throughout the length of the busduct.

Flexibles of adequate sizes shall be provided at' both transformer and distribution board ends.

**2.0415 volts MAIN / SUB DISTRIBUTION BOARDS**

2.1 CONSTRUCTION

i) Sheet steel - 2 mm thick for frames and equipment mounting plates 1.6 mm thick for partitions.

ii) Welded construction - with transport sections bolted together. All such joints are to be           gasketed.

iii) The cubicles shall be totally dust and vermin proof conforming to IP-54.

iv) All doors should be of hinged type except bus bar chamber covers which shall be of bolted type. The panels shall he of flush front design, suitable for access from front and rear, except where the boards are mounted against the wall in which case the boards shall be designed for maintenance with front access only. All switch boards enclosures shall be powder coated *of* approved shade.

v) The construction shall be such as to facilitate easy extension at both ends. SMC supports and heat shrinkable PVC sleeves shall be provided for bus bars.

vi) The design shall have individual feeders in separate segregated compartments, with proper barriers between adjacent feeders, bus bar chamber and cable termination chambers.

vii) All feeders in compartmentalized design for housing ACB's or MCCB's shall have door interlocking such that the door cannot be opened with the switch in closed position.

viii) All feeder terminations shall be properly terminated to receive Aluminum heavy duty power cables or 1.1 kV grade stranded copper cables as the case may be. Adequate space shall be provided to facilitate proper and easy terminations. Details *of* the same shall clearly be brought out in the layout and sectional views which the contractor is required to furnish.

(xix) The feeder terminations shall be either from the top or bottom as necessary at site.

ix) Wherever necessary, if the switch boards are to be mounted against a wall, the lay-out *of* the components and interconnections shall be designed to facilitate maintenance from the front.

x) The design *of* the switch board shall be such that clear segregation shall be provided for the various components, feeders and interconnections - such as bus bars, incoming / outgoing feeders, cable chambers, etc. The height of the panel shall not exceed 2200 mm. The maximum operating height *of* any components shall not exceed 1700 mm.

xi) A minimum clearance of 25 mm between phases and between phases and neutral shall be maintained.

xii) An Aluminum earth strip / bus *of* adequate section shall be run throughout the length of the switch board to which all earth terminals of the various components shall be connected.

(xiii) **Bus bars shall be of Aluminum**.

The bus bars shall have uniform cross section throughout and shall be capable of carrying. The rated current under the increased ambient temperature conditions within the enclosure.Unless otherwise specified, the neutral shall have a rating of 50 % of the phase bus bars. The bus bar sizes shall be specified in the drawings to be submitted by the contractor.

(xiv) The Air circuit breakers, MCCB's, etc., shall have the features as specified in the bill of quantities.

1. All MCCB's at SDB's and MCC's shall be of current limiting type with breaking capacity of min. 70 kA and with Ics = 100% leu

(xvi) All control wiring shall be carried out with 1.1 kV grade single core PVC cables with stranded copper conductors of minimum 1.5 mm² for potential circuits, and 2.5 mm² for current transformer circuits. The wiring shall be neatly bunched, adequately supported and properly routed. The wires shall be identified by ferrules at both ends.

(xvii) Terminal blocks shall be of 500 volts grade and with minimum current rating of 10 amps.

(xviii) All routine tests as specified in the Indian Standards shall be carried out in the presence of TGSPDCL / Consultants and test certificates submitted for approval.

Test certificates shall also be submitted for all major components of the switch boards like ACB's, CT's, Relays, etc.,

(xix) Prior to fabrication of the panels, the contractor has to submit the following drawings for approval:

(a) Single line diagram

(b) Power circuit Control circuit diagrams

(c) Front view showing layout of components

(d) Sectional view

(e) Foundation drawings

(xx) The outgoing cable feeders in distribution boards shall be either from top or bottom as necessitated at site conditions and this shall be properly examined prior to fabrication of boards.

2.2 The detailed specifications of the individual components have been furnished in the Bill of Quantities and only components of makes as recommended in the tender shall be provided.

2.3 All routine tests as per IS shall be conducted on the main distribution boards and sub distribution boards prior to dispatch / supply. The tests shall include all operational tests and shall also cover sequencing and interlocking functions wherever provided.

2.4 The following documents in 5 sets shall be furnished prior to dispatch / supply: ­

(i) Routine test certificates of complete panels

(ii) Routine test certificates for major components breakers, etc.,

(iii)All final drawings as listed in item 2.1(xviii)

(iv)Operation and maintenance manual for the panels

2.5 On completion of installation, necessary tests shall be performed at site prior to commissioning.

2.6 The scope of supply shall cover all installation materials such as base channels on which the switch board shall rest, foundation bolts, nuts, etc., & any other installation materials as necessary.

2.7 All meters shall be of digital type and CT secondary shall be rated for 1 A.

**3.0 MCB Distribution Boards**.

3.1 Distribution boards shall be made of 1.6 mm thick sheet steel for body and 2 mm thick for doors powder coated with approved shade. The bus bar system shall be of integral single piece which is separated by SMC insulating material. The bus bars shall be of Copper electrolytic ally plated and rated for 200 A capacity. Separate neutral links and earth bus bar should be provided.

The boards shall conform to IS: 8623 standards & shall be factory built.

The bus bars shall be properly shrouded with 3 mm thick hylam sheets.

* 1. Body shall be connected to earth bus by green 4 sq mm copper flexible wires.

3.3 The MCB DB's shall be of industrial type with double door and intended for wall mounting. The DB's shall be of concealed type with its outer door flush with the wall. Both the inner and outer doors shall be of hinged type. The depth of DB's shall not exceed 125 mm.

The neutral bus and earth bus shall not foul with the leading in and out of the Aluminum /Copper cables and hence shall be separately located.

The neutral and earth bus shall preferably be at the top so that the neutral and earth core of outgoing feeders can be terminated very near the cable gland itself.

3.4 The DB's shall be dust and vermin proof and with degree of protection IP 54.

3.5 The DB's shall be complete--with internal wiring from the bus bars to the MCB terminals by means of 1.1 kV grade flexible copper cables of the following sizes.

for current upto 10 A 2.5 mm²

above l0A upto & including 20 A 4 mm²

above 20 A upto & including 30 A 6 mm²

3.6 Terminations shall be with insulated lugs crimped to the bus bars / MCB's.

3.7 Wherever Incoming feeders exceed 32 A, epoxy moulded bolted type ACDC make terminals shall be provided to which the Incoming cables can be terminated. Wiring from these terminals to Incoming MCB / MCCB termination shall be with flexible copper.

3.8 Cable gland plate detachable type shall be provided as required to suit site conditions.

3.9 The maker ofDB's shall be as per the recommended list.

**4.0 CONCEALED CONDUIT WIRING SYSTEM**

4.1 CONDUIT LAYING

Conduits shall be laid on the finished centering with at least 3mm cover and this may be achieved by supporting the conduits on spacers kept at regular at regular intervals. Conduits shall be laid as far as possible straight runs.

Open ends of the conduits / junction boxes shall be well sealed with PVC caps to prevent entry of concrete slurry. The conduits and the junction boxes shall be tied to the reinforcement with binding wires at regular intervals to prevent them from getting dislodged while the concrete vibrator is applied for consolidating the concrete. PVC solution shall be applied for all conduit joints / connections.

4.2 DRAWING OF WIRES

­Guidelines as stipulated in IS shall be followed and the contractor shall also obtain approval from the architects/ consultant prior to commencement of work.

4.3 BUNCHING OF CABLES

­Cables carrying alternating current shall be so bunched that the outgoing & return cables are always drawn into the same conduit.

4.4 BENDS IN CONDUITS

All necessary bends in the system including diversion shall be done by bending pipes as far as possible or by inserting suitable inspection facilities. Radius of bends in conduit pipes shall not be less than 7.5 cm. No dent/crack shall be made on the pipes while bending.

4.5 FIXING OF CONDUIT IN CHASE

The conduit pipes shall be fixed by means of hooks or by means of saddles not more than 60 cm apart or by any other approved means of fixing. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors.

4.6 FISH WIRE

To facilitate easy drawing of wires in the conduit suitable size steel wire shall be provided along with laying of conduit.

4.7 ERECTION AND EARTHING OF CONDUITS AND BOXES

The conduit of each circuit or section shall be laid and inspected before conductors are drawn in. If conduit pipes are liable to mechanical damage, they shall be adequately protected. In conduit wiring system the pipe must be continuous when passing through walls of floors. All metal boxes shall be effectively earthed.

4.8 TERMINATION OF CONDUITS

Wherever conduits are terminated in an outlet box or a distribution board, flexible pipes with check nuts shall be fixed on either side of the box. After the conduits, junction boxes, outlets boxes, etc., are fixed in position and wires are drawn, their outlets shall be properly plugged using PVC stopper or rubber bushing to prevent entry of mortar, vermin's or any other foreign material into the conduit system.

4.9 **Separate conduit wiring for 100W 4 No’s shall be provided for separate DC wiring in the control room.**

1. **SUBSTATION AND LINE SPECIFICATION**

**I. SPECIFICATION OF RS JOISTS, MS CHANNEL, FLAT AND STEEL STRUCTURES (Made out of sponge only)**

The scope includes

* Supply of RS Joist with 9m length150 x 150 mm as per specification for substation structures.
* Supply and welding to the RS joists including 6mm base plate
* Supply of RS Joist with 6m length150 x75 mm including 6mm base plate as per specification for power transformer DP’s
* Aligning straightening the RS joists to zero level confirming with spirit level leveling in prefabricated MS frames before erecting.
* Fabrication of RS joists poles duly fabricating 6mm base plate including cutting, drilling the required holes, with Power drills
* Excavation of
  + pit of size 4',x4,'x5.5', (1.3x1.3x1.7m =2.9 m³
  + concrete mix of PCC 1:4:8: using 40 mm HBG metal size 4'x4'1/2'(1.3x1.3x0.2=0.4m³
  + Mass concreting with 2.6'x2.6'x6'(0.8x0.8x2m=1.3 m³
  + back filling 1.4'x1.4
  + Painting of all supports to a height of 0.3 m coping with bituminous paint (black colour) and painting of coping with two coats of white cement (including cost of paint
  + Erection of auxiliary structures i.e., prefabricated MS channels etc using bolts and nuts on already erected poles.
  + Hot dip galvanized bolts/Zinc coated nut and bolts including spring/flat washers

**(Gas cutting/Welding not allowed)**

**RS Joists**

|  |  |  |
| --- | --- | --- |
| **Sl.No.** | **Description of Material** | **Quality** |
| 1 | RS Joists 175x85 mm (12 m) |  |
| 2 | RS Joist 150x150 mm (9.0 m) |

The equipment / materials offered will be entirely satisfactory for operation under the climatic conditions indicated below:

(a) Maximum ambient air temperature (in shade) 450 C

(b) Maximum ambient air temperature (under sun) 500 C

(c) Maximum daily average ambient air temperature 350 C

(d) Maximum yearly average ambient air temperature 300 C

(e) Maximum humidity 100%

(f) Altitude above M.S.L. Up to 1000 m

(g) Average No. of thunder storm days per annum 50

(h) Average No. of dust storm days per annum Occasional

(i) Average No. of rainy days / annum 90

(j) Average Annual Rain fall 925mm

(k) Normal tropical monsoon period 4 months

(l) Maximum wind pressure 150 kg/m².

**MS channel**

|  |  |  |
| --- | --- | --- |
| Sl.  No | Material | Quality |
| 1. | 1. MS Channel 100x50 mm 2. MS Channel 75x40 mm 3. MS Angle 65x65x6 mm   4) MS Angle 50x50x6 mm | **IS-2062 Grade-A** |

The equipment / materials offered will be entirely satisfactory for operation under the climatic conditions indicated below:

(a) Maximum ambient air temperature (in shade) 450 C

(b) Maximum ambient air temperature (under sun) 500 C

(c) Maximum daily average ambient air temperature 350 C

(d) Maximum yearly average ambient air temperature 300 C

(e) Maximum humidity 100%

(f) Altitude above M.S.L. Up to 1000 m

(g) Average No. of thunder storm days per annum 50

(h) Average No. of dust storm days per annum Occasional

(i) Average No. of rainy days / annum 90

(j) Average Annual Rain fall 925mm

(k) Normal tropical monsoon period 4 months

(l) Maximum wind pressure 150 kg/m²

**MS – Flat (All sizes)**

|  |  |  |
| --- | --- | --- |
| Sl.  No | Material | Quality |
| 1. | 1. MS Flat 75x8 mm 2. MS Flat 50x6 mm | **IS-2062 Grade-A** |

The equipment / materials offered will be entirely satisfactory for operation under the climatic conditions indicated below:

(a) Maximum ambient air temperature (in shade) 450 C

(b) Maximum ambient air temperature (under sun) 500 C

(c) Maximum daily average ambient air temperature 350 C

(d) Maximum yearly average ambient air temperature 300 C

(e) Maximum humidity 100%

(f) Altitude above M.S.L. Up to 1000M

(g) Average No. of thunder storm days per annum 50

(h) Average No. of dust storm days per annum Occasional

(i) Average No. of rainy days / annum 90

(j) Average Annual Rain fall 925mm

(k) Normal tropical monsoon period 4 months

(l) Maximum wind pressure 150 kg/m²

1. **ERECTION OF BAYS:**
   1. Foundations:
      1. The Cement Concrete used for the foundations shall be M-150. The sand used shall be composed of hard silicon material and well sieved. It shall be clear of a sharp angular grill type and free of earthly organic matter and salts. The aggregate shall be clean broken hard granite. It shall be as far as possible cube like, preferably angular, but not flank, preferably clean and free from earth organics. 38mm aggregate shall be of size.
      2. Water used for mixing concrete shall be fresh, clean and free from oils, acid, alkali water shall not be used.
      3. Proper moulds adequately braced to retain proper shape while concreting shall be used. The mould shall be made water tight so that cement cream will not come out leaving only sand and jelly, consequently forming honey-combing in the concrete.
      4. After concreting, top surface shall be finished smooth. Plastering of outer surfaces shall be done with 12mm thick with 1:3 cement mortar. White washing with white cement shall be done neatly.
   2. Fabrication
      1. All pieces shall be straight; straightening shall not damage the material. Hammering shall not be permitted for straightening and/or flattening of members. Sharp bends are not permitted. Cutting may be affected by shearing, cropping, flame cutting or sawing. The surfaces so cut shall be clean, smooth reasonably square and free from distortion.

**Holes in the members shall either be drilled or punched and shall not be formed by flame cutting process. All blurs left by punching or drilling shall be completely removed.**

It shall be ensured that fasteners provide positive attachment at all times and under conditions when the structure is subject to vibrating loads. Bolts used for erection shall preferably be of 12, 16,20mm diameter and in no case bolt diameter shall be less than 12mm. The length of the bolt shall be such that the threaded portion does not lie in the plane of contact of members.

It shall be ensured that the threaded portion of the bolt protrudes not less than 3mm and not more than 8mm over the nut after it is fully tightened. Holes shall be cylindrical and perpendicular to the structural members. Oval or lobed forms of holes shall not be permitted. The diameter of holes shall be equal to the diameter of the bolt plus 1.5mm. The accuracy of the location of the holes should be such that for any group of members where assembled, the holes shall admit the bolt at right.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Spacing of Bolts and Edge distances:** | | | | |
| Bolt dia (mm) | Hole dia (mm) | Bolt spacing (mm) | Edge hole center to rolled (mm) | Distance min. hole centre to sheared or flame cut edge (mm) |
| 12 | 13.5 | 32 | 16 | 20 |
| 16 | 17.5 | 40 | 20 | 23 |
| 18 | 21.5 | 48 | 25 | 28 |

|  |  |
| --- | --- |
| **Spring washers of positive lock type of the following thickness shall be provided for insertion under all nuts.** | |
| Bolt dia (mm) | Thickness of spring washer (mm) |
| 12 | 2.5 |
| 16 | 3.5 |
| 18 | 4 |

1.2.2 Bolts and nuts: Nominal nut size Proof stress

(N/mm²)

M16 490

M20 500

1.2.3 The bolts and nuts shall be hot dip galvanized as per IS-1367

* + 1. Spring washers shall be of type B and shall confirm IS-3063. The spring washers shall be made from high quality spring steel conforming to IS-4072. The spring washers shall be electro galvanized with a coating thickness of 25 microns.
    2. The structures shall be erected piece-meal method on foundations after allowing the required curing time for the foundations. After erection of structures, the bolts shall be checked to ascertain that all nuts are fully tight shall ensure that none of the bolts are left out. The structure shall be truly vertical after erection and no stringing is permitted to bring them to vertical position. The tolerance allowed for verticality is one in 360 structure heights.

1.3 Stringing of Bus bar: 33kV and 11kV bus in 33/11kV Sub-Station shall be formed with panther conductor (200 mm² AAAC) to a tension of 250 kg comprising of three phases. The bimetallic clamps and other connectors required for connections between bus and equipment and between equipments are to be procured by contractor. The stringing of bus conductors covers hosting of tension insulator strings, suspension insulator strings, post type insulator stacks and other accessions along with tensioning of conductor and clamping. The jumpering to the equipment shall be arranged properly.

The insulator strings shall be assembled on the ground. These shall be cleaned and examined before hosting. All the parts including current carrying parts shall be clean and smooth without grease, paint, and dirt. Insulators with cracks or chips or those having glazing defects exceeding 0.5 mm² shall not be used.

The sag of bus conductor shall not be more than 1%. Damaged conductor shall not be used. No joints are to be made. The conductor surface shall be clean and smooth without projections, sharp points, cuts, or abrasions etc. and the conductor shall be continuous in line span.

**1.4 FINAL CHECKING, TESTING AND COMMISSIONING**

**1.4.1 FINAL CHECKING:** After completing the works, the contractor shall ensure that following points are not missed:

1. Backfilling is completely done and compacted along with leveling.
2. Coping / Muffing / Plinth surfaces are done to proper shape.
3. Bolts of the structures are properly tightened.
4. Cables are properly dressed.
5. Equipments such as breakers, isolators are properly operated.

**1.4.2 TESTING:** The contractor shall give necessary assistance to the TGSPDCL Engineers at the time of testing the equipment by providing required labour and testing equipment at the test location. Any defects found during testing shall be rectified by the contractor forthwith without any charges to the Board.

**1.4.3 COMMISSIONING:** All the tests shall be completed by the contractor successfully before commissioning of Sub-Station.

**1.5 RECTIFICATION OF DEFECTS DURING THE DEFECTS LIABILITY PERIOD:**

The defects liability period of the Sub-Station is 12 months from the day of commissioning and acceptance by the TGSPDCL. Defects if any, noticed during the above period shall be rectified by the contractor free of cost of the Board on hearing from the TGSPDCL.

Note: The Contractor has to follow REC standard for the work where ever it is not specifically mentioned above.

III. Specification of erection of distribution transformer

* Running of 11kV jumpering to 11kV AB switch, HG fuse set and distribution transformers terminal etc.
* Providing of earthing with GI pipe 40mm dia, 2 m,3mm thickness with bolts and nuts.
* Supply and earthing of GI flat 25x3mm including material for station transformer
* Providing of RCC collar to existing earth pits.
* Fabrication of 100/50 channel for fixing the LT cable including fixing of LT cable with nuts and bolts complete.
* Supply and erection of HG fuse set.
* Supply and erection of LT distribution box with MCCB’s and fuses.

V. SPECIFICATION OF AC DISTRIBUTION PANEL

**AC Distribution Panel**

Scope of supply: The scope of supply includes supply erection and testing, commissioning of 2000mm X1750 mm X 300 mm AC distribution panel with 16 gauge CRC steel sheet, Powder coated Siemens grey with the following accessories including the internal earth with 25 X 3 mm plated copper and external earth with 25 X 6 mm GI Earth flat complete as detailed below.

* 0-500 V Digital AC voltmeter,0-100 A, Make: AE/Enercon/Rishab
* Digital AC Ammeter, Make:AE/Enercon/Rishab
* Frequency Meter Make:AE/Enercon/Rishab
* Voltmeter selector Switch Make: L&T, Kaycee/Switron.
* Ammeter selector Switch Make: L&T, Kaycee/Switron
* LED RYB Indication lamp, Make : Technique/ Vaishno
* 200 A Switch fuse unit(HRC), L & T/Siemens
* 200 A, 4 pole Change over Switch with neutral isolation for both the supplies, L&T/Siemens
* 8 No's 32 A 3 phase 4 pole, Hager,ABB,Legrand,Siemens Make
* 30 No's 1 phase 2 pole MCB's Hager,ABB,Legrand,Siemens Make
* Connectors of stud type of M4 Connectwell make,
* Metering unit of 200/5 A LT CT's of 0.5 Class, Make AE/Kappa
* Supply fixing of Digital LT CT meter make: Secure/L& T, Siemens for station transformer consumption.

The A.C. Panel with all accessories detailed above shall be mounted in a metal sheet steel, abide for OUTDOOR, floor mounting free standing type with following features: -

1. Made of cold rolled sheet steel of thickness not less than 16 SWG.
2. It shall be completely dust and vermin proof and all the doors shall be hinged type with suitable gaskets for the mating surfaces, in-corner, and all the feeders shall be provided with hinged doors individually.
3. Provision of glands for incoming and outgoing cables, suitable lugs for the terminators.
4. Shall be painted with 2 coats of the Siemens grey powder coated.

Bus bar (200 A) shall be made of high conductivity Aluminum alloy of electrical grade conforming to IS 5802.

The Bus bar shall be insulated throughout their lengths by heat shrunk PVC sleeves. The PVC Sleeves used shall be able to withstand the temperature attained by the Bus bars during normal/short circuit conditions. The bus bar shall be identified with coloured bonds to identify buses.

**Out Going Feeders**

**NOTE:** (1) All switch fuse units shall conform to IS4064 Part – 1 1978.

(2) All the connections inside the panel shall be with PVC insulated copper wire of adequate size.

VI. SPECIFICATION OF COPPER CONTROL CABLES

**Control cables**

The scope includes supply laying and connecting to various equipment like un-armoured PVC insulated and PVC sheathed 1100 V grade cables with stranded conductors of annealed high conductivity copper conforming to IS:1554 and IEC 228 of size:

10 C x 2.5 mm²

4 C x 2.5 mm²

**1. General**

1. The contractor shall provide cable lugs, and other terminating accessories like jointing ferrules, cable clamps, cable grips, cable compound flux, tapes etc., as necessary and shall include supply of accessories in the quoted rates for cable laying.
2. Wherever lugs are compressed, the bear ends of the connections shall be covered with insulating sleeves so as to prevent accidental contact with ground or with the adjacent terminals. The insulating sleeves shall be fire resistant and long enough to over pass the conductor insulation and shall be of correct size of the conductor used.
3. The Contractor shall provide Identification ferules at both ends of the control cable.

Cables are to be laid in cable ducts, trenches, cable trays; ladders and all necessary accessories and fittings are to be provided to complete the installation as per specifications and to the approval of the Engineer.

4. The Contractor shall prepare a detailed layout drawing for cable trenches, cable tray layouts, showing the color codes to be adopted, detailing the method of cable laying and end termination for approval by the Engineer before commencement of the work.

**2.0 STANDARDS:**

The control cable shall conform to the latest revisions with amendments with available of relevant standards, rules and codes some of which are listed hereunder for ready reference, unless otherwise specified elsewhere in this specification.

IS:1554 (Part-1) : Specification for PVC insulated (heavy duty) electric cables for working voltages upto and including 1100 volts.

IS:5831 : Specification for PVC insulation and sheath of electric cables.

IS:8130 : Specification for conductors for insulated electric cables and flexible cords.

IS:10810 : Specification for methods of test for Cables.

Cables meeting with any other authoritative standards which ensure equal or better quality than the standards mentioned above will also be accepted.

**3.0 CLIMATIC CONDITIONS:**

**3.1** The Control Cables called in this Specification are required to operate satisfactorily under the following climatic conditions.

1) Location Hyderabad and Rangareddy District in the State of Telangana

2) Maximum ambient Air Temperature (°C) 50

3) Minimum Ambient Air Temperature (°C) 7.5

4) Average daily ambient air Temperature (°C) 35

5) Maximum relative humidity (%) 74

6) Maximum altitude above mean sea level (m) 1000

7) Average annual rainfall (mm) 925

8) Maximum wind pressure (kg/m²) 200

9) Iso ceraunic level (Days/Year) 50

10) Seismic Level (Horizontal Acceleration) 0.1g

**4.0 MAIN FEATURES:**

**4.1** These general purpose insulation cables shall be suitable for use where the combination of ambient temperature and temperature rise due to load results in conductor temperature not exceeding

-- 70°C for normal continuous operation

-- 160°C for short circuit condition

**4.2** The cables shall be suitable for laying in covered/open trenches, ducts, trays or buried directly underground under dry or wet conditions. Suitable additives to prevent attack by rodents, termites shall be added to the outer sheath PVC compound. Also, the outer sheathing shall be so designed as to afford high degree of mechanical protection besides making it resistant to heat, oils, chemicals, abrasion, weather conditions etc. Common acids, alkalis, contaminants saline solutions etc., shall not have adverse effects on the PVC sheathing material used.

**4.3** The cables shall be capable of operating continuously under the system frequency variation of + or - 5% voltage variation of + or - 10% and a combined frequency - voltage variation of + or - 10%.

**5.0 TECHNICAL REQUIREMENTS**

**5.1 CONDUCTOR**

**5.1.1 MATERIAL:**

The conductor shall be composed of plain annealed copper wires (complying with IS:8130) made of high conductivity copper rods (complying with the latest version of IS:613).

**5.1.2 FORM:**

The conductors shall be circular, stranded. They shall be clean, reasonably uniform in size and shape, smooth and free from all harmful defects.

**5.1.3 JOINTS:**

Joints shall be permitted in the individual wires of which the conductor is formed but no joint shall be within 300mm of any other joint within the same layer. The joints shall be made by resistance butt welding, fusion welding, cold pressure welding, electric welding, gas welding, brazing or silver soldering.

**5.1.4 CLASSIFICATION:**

Class-2 for stranded circular non-compacted cables used for fixed installation.

**5.1.5 SIZE, NUMBER, RESISTANCE:**

The wires in the conductor shall have the same nominal diameter before stranding. The number of wires in the conductor shall be not less than 3 and the maximum resistance of conductor at 20°C shall be 7.41 Ω/km as per Table 2 of IS:8130.

**5.2 INSULATION:**

**5.2.1 MATERIAL:**

The insulation shall be "General Purpose Insulation" of Type-A PVC Compound (conforming to the requirements of IS-5831) suitable for a maximum rated conductor temperature of 70 deg C intended for cables with rated voltages up to and including 3.3 kV. The conductor shall be provided with this Type-A PVC insulation applied by extrusion.

**5.2.2 COMPOSITION:**

The insulation shall consist of a compound based on one of the following materials, which have been SUITABLY COMPOUNDED AND PROCESSED to meet the requirement of the IS:5831

1. Polyvinyl chloride (PVC)

b) Suitable co-polymers of which the major constituent shall be vinyl chloride.

c) Mixture of (a) and (b)

**5.2.3 TEST REQUIREMENT:**

The insulation shall satisfy the test requirements stated in columns 2,3,4, & 7 of TABLE-1 of IS:5831.

**5.2.4 THICKNESS:**

The average thickness of insulation shall be not less than the nominal value (t1) of 0.9mm applicable for unarmoured multicore cables of size 2.5 mm² as per Column 3 of Table 2 of IS:1554.

**5.2.5 TOLERANCE ON THICKNESS:**

The smallest of the measured values of thickness of insulation shall not fall below the nominal value (t1 i.e. 0.9mm) by more than 0.1mm + 0.1 t1.

**5.2.6 APPLICATION:**

The insulation shall be so applied that it fits closely on the conductor and it shall be possible to remove it without damage to the conductor.

**5.3 CORE:**

**5.3.1 IDENTIFICATION:**

Cores shall be identified by different coloring of PVC insulation by adopting the following scheme:

a) 4 cores : Red, Yellow, Blue & Black

b) 10 cores :

**5.3.2 ARRANGEMENT OF MARKING:**

The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing "d" between consecutive numbers shall not exceed 50mm as shown in Fig.1 of IS:1554 (Part-1)-1988 Page-4 (CORE IDENTIFICATION BY NUMBERS).

**5.4. LAYING UP OF CORES:**

In the twin and multicore cables, the cores shall be laid up together with a suitable lay; the outermost layer shall have right hand lay and the successive layers shall be laid with opposite lay, where necessary. The interstices shall be filled with non-hygroscopic material (discussed in Cl.5.5.1).

The following lay-up of core shall be applicable as recommended in Table-3 of the IS: 1554 Part-1).

--------------------------------------------------

No. of cores Lay-up

---------------------------------------------------

4

10 10

------------------------------------------------

**5.5 INNER SHEATH:**

**5.5.1 MATERIAL:**

Inner sheath as well as filler material (discussed in Cl.3.5.4) shall be as follows:

a) Un-vulcanized rubber or

b) Thermoplastic materials, or

c) Proofed tape (for inner sheath only)

Un-vulcanized rubber or thermoplastic material used shall not be harder than the type-A PVC used for insulation and the Type Sl. 1 PVC used for outer sheath. The material shall be so chosen as to be compatible with temperature ratings of the cable and shall have no deleterious effect on any other component of the cable.

**5.5.2 CONSTRUCTION:**

The laid up cores shall be provided with inner sheath applied by extrusion only. It shall be ensured that the shape is as circular as possible. The inner sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to remove it without damage to the insulation. The thickness of the inner sheath shall be 0.3mm minimum as specified in Col.3 of Table-4 of IS:1554, applicable for the multi core cables whose calculated diameter over laid up cores is up to and including 25mm. If and when one or more layers of binder tapes are applied over the laid up cores, the thickness of such tapes shall not be construed as part of the inner sheath.

**5.6 OUTER SHEATH:**

**5.6.1 MATERIALS:**

For cables with general purpose insulation, the outer sheath shall be of Type ST-1 PVC compound conforming to the requirements of IS:5831 as recommended for general purpose sheath intended for use in cables operating at a maximum rated conductor temperature 70°C. Composition of the outer sheath shall be as specified in Cl.5.2.2 of this specification but the test requirements shall be as per Columns 2,3,4 & 6 of Table-2 of IS:5831.

**5.6.2 CONSTRUCTION:**

This outer sheath shall be applied by extrusion over the inner sheath as applicable for unarmored twin and multi core cables. It shall be so applied that it fits closely over inner sheath and it shall also be possible to remove it without damaging the inner sheath. The color of the outer sheath shall be black.

**5.6.3 THICKNESS:**

The average and minimum thickness of the PVC outer sheath shall be not less than the values specified hereunder as per Col.3 & 4 of Table 7 of IS:1554.

|  |  |  |  |
| --- | --- | --- | --- |
| Calculated diameter under the outer sheath | | Thickness of outer sheath for un-armored cables. | |
| Over (mm) | Up to and including | Nominal (mm) | Minimum (mm) |
| --- | 15 | 1.8 | 1.24 |
| 15 | 25 | 2.0 | 1.40 |

**NOTE:** In case of multi-core un-armored cables, it is permissible to supply the inner and outer sheaths in a single extrusion out of the material intended for outer sheath. The average/minimum thickness of such extruded sheath shall be not less than the sum of the inner sheath thickness specified (0.3mm) and the nominal/minimum outer sheath thickness specified above.

**5.6.4** The guaranteed technical particulars for the material being supplied shall be provided with the bid as specified in the Annexure-I enclosed. The bid received without these particulars shall be treated as non-responsive and rejected.

**6.0 TESTS:**

**6.1 TYPE TESTS:**

All the control cables offered should have been fully type tested as per the relevant standards. The date of type tests conducted shall be the latest and not earlier than 2002. The bidder shall furnish two sets of type test reports along with the offer. The bids received without type test reports will be considered **nonresponsive.**

**6.2 ACCEPTANCE TESTS:**

The following shall constitute acceptance tests

a) Annealing test

b) Conductor resistance

c) Thickness of insulation and sheath

d) Tensile strength and elongation at break of insulation and sheath

e) Insulation resistance test

f) High voltage test at room temperature

The sampling plan for acceptance tests shall be as per Appendix-A of the IS:1554 (Part-1)

**6.3 ROUTINE TESTS:**

The following shall constitute routine tests:

a) Conductor resistance test

b) High voltage test at room temperature

**6.4 OPTIONAL TESTS:**

a) Cold bend

b) Cold impact

NOTE: i) For test methods, relevant parts of IS - 10819 shall be referred.

ii) The test certificates as a result of the inspection of the cables (pursuant to Clause 7 below), shall be furnished to the purchaser for his approval prior to dispatch.

**6.5 LAYING OF CONTROL CABLES:**

This section covers laying of cables in cable ducts, cable joining & termination at both ends and testing of the complete cable installation. The rate of cable installation and the rate of cable laying shall be including cost of cables.

The L.T. Control cable shall be copper cables and the LT Power cable shall be Aluminum cables.

**6.5(a)** Copper cables shall comprise of copper wire of 2.5 mm² cross sectional area and number of wire being 4, 10 as the case may be. The rate for cable termination shall include cost of ferrules, lugs and labour charges of the same.

Copper control cables shall be used from DCDB to various breaker control panels,LT AC panel to yard lighting junction Box and battery charges, and from yard lighting to 150W Metal halide lamps respectively.

**6.5 (b)** The Aluminum LT Power cables shall be of the size 3 ½ core 185/95/25 mm², 3-1/2 core cables shall be used for station transformer to LT AC panel.

The cable schedules will be furnished to the contractor. The cable laying shall be done strictly in accordance with these schedules. There shall be no joints in between point to point termination of the above cable.

All the electric equipment is to be set in place and aligned. The contractor shall provide power and auxiliary connection to the equipment and shall work in cooperation with Contractors representatives in obtaining correct direction of rotation and commissioning of the equipment, cable laying shall also include termination of cables i.e. both ends of cable of equipment switch-gear, control and protection panels etc. as well as equipment to marshalling boxes and marshalling boxes to switch-gear panels.

Cables lugs shall be provided by the contractor and the costs of lugs shall be included in the quoted rates for cable laying. Contractor shall supply all other cable terminating accessories, like jointing ferrules, cable clamps, cable grips, cable compound flux, tapes, etc., as necessary and shall include supply of accessories in the quoted rates for cable laying. Dressing / bunching of all individual cores of the cable shall be done in a neat fashion. The contractor shall drill holes suitable for the cables in cable gland plate whenever necessary

Cable lugs be compressed on the conductor ends by means of suitable insulating sleeves shall be furnished and covered over the bare ends of the connections so as to prevent accidental contact with the grounds of with the adjacent terminals.

The insulating sleeves shall be fire resistant and long enough to over pass the conductor installation and shall be of correct size of the conductor used.

Cables: entering the control room from outdoor areas shall be sealed.

Standard cable grips and seals shall be utilized for cable pulling. After pulling a cable, the contractor shall attach Aluminum cable markers at both ends of the cables and at the control room entry. The cable number and other data shall be punched and the cable markers are securely attached to the cables. Cable shall not be jointed. When absolutely necessary, the approval of the TGSPDCL Engineer at site should be taken before resorting to jointing. Sharp bending and kinking of cables shall be avoided. Cables shall cross control room basement wall in 100 mm dia AC pipe embedded in cement concrete basement wall. These pipes shall be supplied and installed by contractor.

In each cable run some extra length as per the direction of the Engineer shall be kept at a suitable point adequate for two straight through joints at the cable terminal pits where the conductor and cable insulation will be terminated.

Before any cable terminal connections are made, conductor’s insulation shall be pulled out at the end and identifying ferrules shall be fixed according to the wiring diagrams. Connections shall be made according to the wiring diagrams to be supplied by the TGSPDCL.

Polarity or phasing shall be checked before connections are made and corrections of polarity, phasing or rotation shall be made by the contractor without additional cost.

Control cable terminations shall be made in accordance with wiring diagram using colour codes established by the TGSPDCL for the various control circuits, by code marked wiring diagrams furnished to the contractor for this purpose or any other approved means of identification. It is the intent that the contractor shall terminate the cable, which he installs.

Additional work of testing and reconnecting where leads have been brought by the contractor to the terminal Boards and connected, but where on further testing, reversed or other rearrangement of lead turns out to be necessary, shall be performed by the contractor without additional cost.

Jointing of cables shall be in accordance with Indian Standard codes. The manufacturer’s special instructions on materials and tools required for cable jointing work shall be arranged by the contractor.

Metal sheath and armour of the cable shall be connected to the earthing system of the station by a steel strip wire. Bending the metal sheaths of single core cables in close trefoil formation shall be as stipulated in the relevant codes of practices.

The contractor shall furnish two sets of cable layout drawings after installation, indicating altered cable routes and location of straight joints. Details of alternative sizes of cables used if any shall also be furnished in such drawings.

VII. SPECIFICATION OF EARTHING

**Earthing**

**1. Scope of supply** : The scope of supply includes providing the copper bonding steel earth electrodes and backfilling with zerolyte compound and excavation and running of Earth mats of size 75 X 8 mm MS flat in the excavated trench of 0.6 m depth with bentonite underneath the MS flat duly jointing the earth mat (T, straight, +) as per IS 3043 including the cost of bentonite powder, welding, Jointing, and painting the exposed earth flat with Black paint and joints with Bituminous paint, transformer neutral earthing with flexible copper jumper ( current Capacity of 25 kA for 1 sec bracing complete etc).

**2. Requirements of the finalized design:** The finalized design shall provide the following:

1. The Grid Resistance and Overall Earth Return Impedance values.
2. The earth potential rise (Equipment Potential Rise), for a maximum value of ground current.
3. Specify whether the substation is hot or "cold".
4. Show the limits of the hot zone - if applicable.
5. Confirm that at all points, the internal maximum touch and step potentials are below the safe acceptable value.
6. Confirm that at the fence, the maximum touch potentials are below the safe acceptable value.
7. Confirm that the maximum external step potentials are below the safe acceptable value.
8. Where the design makes significant use of vertical rods, the fault current distribution within the grid is required to ensure that the rods can carry their proportion of current without damage.

Ensure that there is earth electrode reasonably close to each item of plant which requires connection to it.

**3. Earth-grid Design:**

These guidance notes are intended to guide you through the process of designing an effective earth system for a 33/11kV substation installation in accordance with European industry standards. The process is set out below in the form of a flow chart. Accompanying notes in the sections that follow supports the steps of the flow chart.



1. In cases where it is clear that the substation will require an extended earthing system, the grid boundary conductor should be shown installed 1 meter deep using standard MS Flat electrode, and normally situated 1 meter outside any metallic fencing.
2. Convert the outer ring to a mesh by plotting standard tape across the site, in two directions at 90° to each other, each flat being parallel to the outer conductor where practicable. The cross-members should form squares or oblongs, should be spaced a nominal 10 meters apart and laid to a depth of 0.6 meters. They will be bonded to the outer ring and at each crossing point.
3. Some of the cross members should be laid in rows alongside plant to facilitate the connection of exposed metalwork to the grid. Great care must be taken when planning the grid layout to ensure that critical components such as transformer neutral connection points, switchgear earth bars etc., are provided with **direct and duplicated routes** to the electrode.
4. At or near to the connection point of each cross member to the perimeter ring electrode, install one 3m x 5/8’’ copper bonded steel rod and shall be backfilled with Zerolyte. Each pipe is to be backfilled with Zerolyte and loamy soil (black top soil) with added Gypsum, to a diameter of 300mm if necessary.
5. **COPPER BONDED EARTH RODS**

The Earth Rods shall have a nominal (actual) dia of 5/8" (14.2 mm) and length of 10' (3 m). The Rods shall have a steel core with molecular bonding of 250 micron of copper as per international standards.

The Core used shall be 1035 steel cold drawn to ASTM A 1080 and AISI C 1017 standards with tensile strength min. 90000 psi.

A nickel layer is applied to steel core (and subsequently copper) by an electrolytic process forming a metallurgical bond between the three. The copper used shall be type DHP alloy No. 122 CDA and rated at 99.95% copper. The thickness of copper layer shall be uniform 0.010" (250 micron).

The Earth Rod shall be UL (Under writers' Laboratory) listed and should have the UL mark.

The Rods should be manufactured by a company of high repute to ensure quality of Copper Bonding.

**Coke and salt are not to be used as backfill as they are corrosive.**

Metal fencing should be connected to the grid at each corner and at points along its length not exceeding 50 meters

|  |  |  |
| --- | --- | --- |
| S.No | Item | Material to be used |
| 1 | Grounding Electrodes | 5/8’’mm Copper Bonded steel rod backfilled with zerolyte or ground enhancement material with a resistivity of 0.12 ohm-m |
| 2 | Earth Grid | 75 X 8 mm MS flat |
| 3 | Connection between Earth Electrodes and earth Grid | 75 X 8 mm MS flat |
| 4 | Connection between Earth Grid and Equipment including the cable terminations | 50 X 6 mm MS flat |
| 5 | Backfilling material | a) Zerolyte ground enhancement material with a resistivity of 0.12 Ω-m  b) Backfill with soft loamy or black cotton soil if necessary. |
| 6 | Connections | Welded Joints for the earth mat and earth electrodes and with hot dip galvanized bolts |
| 7 | Power Transformer | Double earthing for Neutral with flexible copper capable of carrying 20 kA for 1second. |

The size of trench for burying earth grid shall be 300 mm x 600 mm. The earth mat shall be buried in the ground at a depth of 600mm. The earth grid shall extend over the entire switchyard.

All junctions and risers in the earth flat shall be properly welded by providing suitable angle pieces for contact between two flats.

Provision shall be made for thermal expansion of steel flats by giving smooth circular bends. Bending shall not cause any fatigue in the material.

After welding, the joints and tap off shall be given a coat of Bitumen paint and then covered with Hessian tape to avoid rusting.

MS flats shall be touched up with zinc-rich paint where holes are drilled at site for bolting to equipment or structures.

**The combined earth grid resistance shall be less than 0.5 Ω.**

**The contractor shall give warranty for 5 years for the material supplied for the earthing system.**

Back filling of earth grid trench shall be done with a layer of bentonite powder before laying of earth grid and then back fill with good earth, free of stones and other harmful mixtures. Back fill shall be placed in layers of 150mm, uniformly spread along the ditch, and tampered by approved means.

The earth mat should be laid in the presence of the Engineer only.

1. Transformer Neutral connection earth electrode shall never be used for the equipment earthing.
2. A separate earth electrode shall be provided adjacent to the structures supporting lightning arrestors. Earth connection shall be as short and as straight as practicable. For arrestors protecting transformers the earth conductors shall be connected directly to the transformer tank.
3. An earthing pad shall be provided under each operating handle of the isolator and operating mechanism of the circuit breakers. Operating handle of the isolator and supporting structures shall be bonded together by a flexible connection with No.8 SWG and connected to the earthing grid.

All equipment and switchgear etc., erected shall be earthed as per I.E Rules 1956,IEEE 80, IEEE100, IEEE148, IS 3043.

**4. CONNECTION OF ABOVE GROUND PLANT AND USE OF METALLIC STRUCTURES.**

* Items of plant shall be connected to the earth grid with MS flat to the existing copper earth flat of OUTDOOR and outdoor switchgear.
* Facility to provide the hollow duct with concrete or channel with suitable clamps shall be provided wherever possible for support of cables and earth flat.
* Care shall be taken for perfect joints between the earth grid and equipment and within the earth grid and bituminous paint shall be done for all joints and care shall be taken that there shall be no high resistances at steel jointing surfaces.

A calculation is required to ensure that the steel has sufficient cross-section area and that the final temperature will not exceed 250°C for a bolted/welded joint.

**4.1. Low Voltage Cables:**

1. Cables used exclusively for "in house" supplies.The sheaths of these cables must be bonded to the substation grid.
2. Cables used for supplying external loads. LV cables for which the neutral/earth connection is within the substation, are not suitable for supplying customers outside if there is any possibility of the Equipment Potential Rise exceeding 430V/650V (as appropriate).

For similar reasons, house supplies to a substation should not be provided direct from an adjacent LV network.

**5.COMMUNICATION FACILITIES**

Because of the high frequencies involved, a different earthing grid design is required. This attempts to maximize the amount of conductor in the immediate vicinity of the structure. For example, at a microwave dish or large aerial, it is normal to have a number of parallel earth down leads near the base of the structure, each of which terminate in an earth rod. This reduces the overall impedance.

The mast itself will normally carry most of the fault/lightning current down to the base, even if down leads are fitted. Electrodes, which run out radially, are relatively close together and arranged symmetrically may be used in addition to rods. For further details, specialist advice should be sought.

Where (as is usually the case), the communication facility shares the same site as a substation, and then the two earthing systems would normally be well interconnected. Particular attention is required to the bonding/termination of pilot and communication cables and the earthing arrangement for the LV supply. The substation earthing system will be especially important in the event of a lightning strike to the communication tower, as it will help disperse the energy associated with this. The overall design should seek to minimize any potential difference across the earthing system during the strike.

**6. EARTH GRID RESISTANCE GRAPH**

The graph below shows the minimum theoretical resistance of a mesh grid for different soil resistivity’s and grid area. This can be used as a quick guide as to determine the value of Equipment Potential Rise of the grid. Having established an equivalent soil resistivity from the site measurements the grid resistance can be read off the y-axis for the grid area under consideration along the x-axis. The resistance can then be multiplied by the fault current to give the Equipment Potential rise

VIII.SPECIFICATION OF ILLUMINATION

Illumination

1. Scope of supply

* Supply and fixing of 10/9 m long tubular poles, with necessary Cantilever arrangement utilizing 40 mm dia GI Pipe as per  IS: specification 2713-1980

|  |  |  |
| --- | --- | --- |
| Overall Length(meters) | 9.00 | 10.00 |
| Planting Depth(meters) | 1.5 | 1.8 |
| Load applied from the Top at a Distance (meters) | 0.3 | 0.6 |
| Height above the ground. (meters) | 7.5 | 8.20 |
| Length of the section (Bottom) (meters) | 5.00 | 5.20 |
| Length of the section (Middle) (meters) | 2.00 | 2.40 |
| Length of the section (Top) (meters) | 2.00 | 2.40 |
| Outside Diameter and thickness of the section.(Bottom) | 114.3 x 4.50 | 139.7 x 4.50 |
| Outside Diameter and thickness of the section(Middle) | 88.9 x 4.05 | 114.3 x 4.50 |
| Outside Diameter and thickness of the section(Top) | 76.1 x 3.25 | 88.9 x 3.25 |
| Approximate weight (kg) | 92 | 128 |

* Pit excavation of size 0.75x0.75x1.5 m with concreting mix ( 1:4:8 CC) and coping
* Fixing of metal Hallide fixtures (150 W)/LED (100) Philips or equivalent quality with completed fixture shall be provided for yard lighting at locations indicated by the Engineer.
* Junction Box with MCB with suitable capacity,
* GI pipe from ground level to Junction Box.etc,
* LT UG copper Cable from control room ACDB to street light poles,
* Earthing with GI Wire painting with one coat of red oxide two coats of Aluminum painting, inclusive of all materials’ and labour.

**The following are the recommended values of intensity of illumination**

|  |  |  |  |
| --- | --- | --- | --- |
| S.No | Item |  |  |
| 1 | Vertical control panels , | 300 | 19 |
| 2 | Rear of control panels , | 150 | 19 |
| 3 | Control desks | 300 | 19 |
| 4 | Outdoor switchyard | 20 | - |
| 5 | Corridors | 70 | 16 |
| 6 | Approach roads | 20 | - |
| 7 | Pathways | 20 | - |
| 8 | Other Rooms | 150 | - |

The lighting system of a particular area, whether outdoor or OUTDOOR should be designed in such a way that uniform illumination is achieved. Dark spots should be avoided.

The rate is inclusive of all accessories such as GI Pipe, clamps, MCCB, Cable etc required for the lights.

**2. Spreading of H.B.G Metal:**

The work involves spreading of quarry dust to a thickness of 25mm after consolidation of the earth work with roller and also supply and spreading of 40mm size machine crushed blue granite metal to a thickness of 40mm over the above quarry dust in the switchyard. Kerb stones of size 200x200 mm shall be provided in the switchyard to retain the metal all along the periphery of the metal spreading wherever it is required. The kerb stones shall be buried in the ground up to 100 mm deep. The joints between the kerb stones shall be done in CM 1:6 and plastering the kerb stones shall be done in CM 1:2.

Before spreading the HBG metal care shall be taken to remove all the vegetation and roots of the plant. The trimming of the earth surface for perfect level ground should be carried out and the surface should be watered and rammed for consolidation with suitable means and the earth surface should be given chemical treatment for anti vegetation growth.

Required metal quantity may be stacked at suitable area for easy handling for pre measurement. Higher size metal may be separated and removed from the stacks. The crushed metal dust or quarry dust should not be allowed to be used. The HBG metal shall be brought from the approved quarry as directed by the Engineer in charge and samples of the 'HBG metal to be used may be shown to the Engineer in charge and prior approval of the Engineer shall be taken before use. Spreading of the metal carried out by dumping at lower heights.

IX.SPECIFICATION OF MISCELLANEOUS ITEMS

**1. SCOPE OF SUPPLY AND ERECTION OF MISCELLANEOUS ITEMS AS PER SPECIFICATION**

**The Scope of supply includes supply and erection of following items**

|  |  |
| --- | --- |
| i) | Supply of Aluminum Ladders,for OUTDOOR works |
| ii) | Fabrication of ladder of suitable length to be provided in cable trench in convenient place. |
| iii) | Trolley Mounted Co.2 Cylinders ( IS - 2878 ) 15 LB. |
| iv) | Fire Buckets Stand with 4 Buckets ( 8-10 L Capacity) |
| v) | Room Fire Extinguisher for Control Room ( 2 L Capacity)- 4 No’s |
| vi) | Helmet 4 No's,Earth rod ( 1 set Big, 1set small)& Hand Gloves 33 kV 2 sets, 11 kV 2 sets |
| vii) | Supply of Nokia Cell Phone (Black and white) with charger |
|  | **SUPPLY OF GODREJ/ OR EQUIVELENT** |
| viii) | Executive table of size 4'x3'.30'' with three racks on one side and one cupboard on left side with laminated decolam Top |
| ix) | S' type Chairs with continuous arms and back in quality wood and quality cane (14 gauge pipe) 5 No’s |
| x) | S type Plastic chairs -4 No’s |
| xii) | Angle rack size 18''x36''x60'' |
| xiii) | Steel Almariah size 61/2'x3'x18'' with three shelves making for compartments and one shelf with safe deposit locker |
| xiv) | Danger Boards with clamps ( 33 kV & 11 kV),Boards as men on line, line clear etc(5 No’s each) |
| xv) | SS Name Board in GLOW SIGN BOARDS**/**Radium sticker with TGSPDCL logo on Aluminum/Acrylic sheet of size (2.0 m Length X 0.75 m breadth ) |
| xvi) | Digital wall clock of standard quality with dial tone and long melody ( Make Ajanta) |
| xvii) | **T&P(Taparia/Everest)** |
|  | Tool box of size 20''x10''x15'' with 3-tier arrangements,'D' Spanners (No.6 to 54),Ring Spanners (No 6 to 42),Screw Driver 9'' long ,Insulated Screw Driver 6'',Rechargable LED Torch Light,Hack-SAW 12'' long,Adjustable Screw spanner, Box spanners 8to38, Pipe wrench,cutting pliers, Nose pliers, Tong tester,Multimeter,Megger (5 kV),Earth Tester(3-30 ohms) |

All the fire extinguishers shall be provided with first filling conforming to IS: 2878.

Statutory test certificate issued by the Chief Controller of Explosives Department and Cylinder manufacturing test certificate shall be furnished.

## X. PRESTRESSED CEMENT CONCRETE POLES

## (11.0 m 9.1 m & 8.0 m)

**(PRETENSIONED TYPE)**

1. **Scope**

1.1 This specification covers the manufacture and supply, delivery at site of pretensioned prestressed cement concrete poles as per specifications No. IS: 1343 and 1678 and as amended up to date and including all other relevant standards.

1. **Design**
   1. The poles shall be manufactured in accordance with the TGSPDCL design & drawing, enclosed. The poles are designed to withstand the working loads of **(a) 280 kg for 9.1 m length (b) 140 kg for 8.0 m** length respectively, acting at 0.6 m from top of the poles and the planting depth of the poles being 1.5 m below ground level. Where the Bidder wants to submit his own design which is economical, the load indicated by the TGSPDCL shall be adopted and detailed calculations shall be submitted to the TGSPDCL for approval along with his tender. Otherwise, it shall be construed that the bidder’s prices are for the TGSPDCL design only and any subsequent change in design shall be subjected to the approval of TGSPDCL, as laid down in this specification and the price shall be reduced by the difference in cost of various ingredients as per the estimated cost of the same at SSR rates in case of reductions and no extra rates are payable in case of any increase whatsoever.
   2. The manufacturing process to be adopted for mass production shall be with the specific prior approval of the TGSPDCL.
   3. The contactor should supply 6 Nos. of poles in each category of length for testing against design load adopted. On being found satisfactory, design will be accepted for further production. In case of failure in tests the firm will have to supply additional 6 Nos. Poles in each category for further tests.
2. **Materials**
   * 1. The properties of the high tensile steel as 6003/1970 along with test certificates shall be verified by the Engineer and approved before commencing manufacture. In the absence of test reports three samples shall be selected in the presence of the Engineer and tests conducted in stock tested periodically at the cost of the tenderer.
     2. The cement used shall conform to IS 269-1976 (Specification for ordinary and low heat Portland cement for the following minimum requirements.
3. Initial setting time not less than 30 minutes.
4. Final setting time not less than 600 minutes.
5. The minimum compressive strength of standard mortar cube with graded sand as per IS : 650-1966 (1st revision ) at 7 days shall be 220 kg/cm²)
6. 53 Grade cement manufactured by the standard company shall be used in the work.

3.2.2 As far as possible, the cement shall be obtained from one source to minimize variations in the quality. A test certificate shall cover each consignment. Each consignment of cement shall be stocked separately and shall be clearly identified.

3.2.3 Before using a particular batch of cement, a minimum of 3 trial cubes shall be made with aggregate grading as followed for the approved design mix and the average compressive strength results at 7 days shall be determined to assess the suitability of the cement. Any other suitable quick testing method may be adopted with the approval of the Engineer.

* 1. **Aggregate :**
     1. For adequate control of concrete, the coarse aggregates shall be classified into two sizes, and the requisite proportions of each size shall be used in making the concrete. Each size of graded aggregates shall be stocked in different storage bins or stock piles and shall be mixed only after the quantity required for each size has been separately weighed. The storage bins or stock piles shall be under cover protected from weather.
     2. The quality of the aggregate shall conform to IS 383 – 1970
  2. **Concrete :**
     1. The concrete shall be of ‘Controlled’ quality with the nominal maximum size of aggregates limited to 20mm.
     2. Two granulometric curves for aggregates shall be plotted by the manufacturer showing the limits of grading according to the types and sizes of the aggregates proposed to be used to achieve the requisite strength of concrete. The curves and the proposed water cement ratio shall be got approved by the Engineer before commencing manufacture. The actual granulometric curves for aggregates used in manufacture shall lie within these limits. To ensure, a compliance with this requirement, the granulometric curves shall be plotted and checked every day before commencement of concreting. Whenever there is change in source or quality of aggregate and cement, fresh granulometric curves shall be plotted and got approved by the Engineer. The water cement ratio should preferably be as low as possible aiming at zero/no slump and should be preferably between 0.33 &0.37. The moisture content in fine aggregates shall be determined daily and the required quantities of water to be added in the concrete mix shall be determined.
     3. The mix design shall be in accordance with the provisions of Clauses 208 to 210 of British Standard code of practice (CP110/1972 and the standard deviation shall be taken as 66N/mm².)

1. **Design**
   1. The strength of the concrete shall be as below :
      1. Compressive strength at 28 days: The work test cube crushing strength of the concrete shall not be less than 400 kg/cm². The specified strength of the mix to be used in the works is 400 kg/cm². The designed target strength of the mix is 466 kg/cm².
      2. Compressive strength at transfer: The works cube compressive strength at transfer of prestress shall not be less than 200 kg/cm² under conventional water curing process.
   2. A minimum of 6 test specimens of 15 m³ cubes shall determine the compressive strength of concrete at each stage. The compressive strength stipulated above shall be based on the lowest cube test result of the 6 test specimens. This shall, however, be relaxed to the second lowest cube test result in case the number of test specimens is increased to a minimum of 12 at each stage.
   3. The final working stress in concrete shall be limited as follows
2. Maximum permissible compressive stress shall be limited to 0.4 of the minimum works test cube crushing strength specified.
3. Tensile stress shall be limited upto 5.3 N/mm² due to working load moment/first crack moment and 3.0N/mm² due to average permanent load moments respectively.
4. **Manufacture** 
   1. Moulds
      1. Moulds shall be of steel and shall be of rigid construction to prevent distortion. The moulds shall not allow any leakage of cement grout in casting. The holes in the end plates, for the H.T. wires shall be accurately drilled by jig to ensure interchangeability.
      2. In the case of the long line method of manufacture the casting bed shall have provision to ensure correct alignment of the moulds. The moulds shall be free to move/slide along the line to permit transfer of pre-stressing force along the line without restraint.
   2. **Stretching of wires**
      1. The pre-stressing wires shall be stretched by an approved method. In the stretching of the H.T.S. wires, the tensile stress in the wires shall not exceed 80% of the specified minimum ultimate tensile strength. The anchoring of the stretched wires shall be such that during manufacture and until the wires are released, no slipping occurs.
      2. The tensioning of pre-stressing steel shall be carried out in a manner that will induce a smooth and even rate of increase of stress in the wires.
      3. The force induced in the pre-stressing wires shall be determined by means of calibrated gauges only attached to the tensioning apparatus and cross-checked by extension of the wires observed. The extension to be achieved shall be determined in advance based on trials conducted on representative samples of the wires used in the poles the force to be adopted for stretching each wire shall allow for the frictional resistance encountered in stretching.
   3. **Mixing and consolidation of concrete**
      1. Provision shall be made to measure the quantities of cement and of fine and coarse aggregates by weight only. The accuracy of the measuring equipment shall be 3%. All the measuring equipment shall be maintained in a clean, serviceable condition and its accuracy checked regularly. Volume batching shall not be permissible. Modern high speed mixer preferably pans or Turbine type, approved by the Engineer shall be used for mixing the concrete.
      2. Mixing and placing of concrete shall as far as possible be avoided during the extreme temperature in summer and winter. The concreting shall commence within one hour of stressing of the wires, failing which the High Tensile Steel wires shall be checked and re-tensioned if necessary.
      3. The manufacture of poles shall be done under suitable cover and the poles shall not be cast in the open.
      4. The concrete shall be thoroughly mixed and consolidated by means of high frequency vibrators. The extent of vibration required for obtaining full consolidation should be determined on actual field trials.
      5. The freshly cast poles shall be protected during the first stage of hardening from the harmful effects of sunshine, dry winds, cold and rains.
   4. **De-tensioning of Wires :**
      1. The anchoring system shall provide a device for gradual de-tensioning of the wires. No back pulling of the wires shall be permitted in the gradual de-tensioning device for the purpose of release of any wedge or other parts of the de-tensioning device. Flame cuttings of the wires before release of the full tension shall be strictly prohibited.
      2. The transfer of pre-stress shall not be affected until the concrete in the pole has attained the strength specified in Clause 4.1 (ii) above as established by control tests on cubes specified in Clause 6.3.1.
   5. **Curing**
      1. The curing of the concrete shall be by water curing till the strength for transfer pre-stress is attained. The curing of poles shall be carried out by covering the poles with empty gunny bags and constantly wetted prior to de-tensioning and after de-tensioning the poles are cured in the ponds for balance specified period. The poles during this period of curing shall not be allowed to dry out at any cost. In case the bidder resorts to steam curing, the curing cycle may be got approved by the Engineer.
   6. **Earthing** 
      1. Earthing shall be provided by having a length of 8.00 SWG G1 wire embedded in concrete during manufacture and the ends of wire left projecting from the pole to a length of 100 mm at 250 mm from top and 150 mm below ground level.
      2. The earth wire shall not be allowed coming into contact with pre-stressing wires.

**5.7. Supervision:**

* + 1. A competent and qualified person shall be employed by the manufacturer whose duty will be to supervise at all stages of the placement of the concrete. All tests on materials the making and testing of cubes, the maintenance and calibration of all mixing and measuring plants and gauges shall be carried out under his direct supervision. He shall also maintain a direct record of the quantities, proportions and source of supply of aggregates used, nature and duration of curing actually done, the results of internal as well as external tests etc. these records shall be kept available for scrutiny by the Engineer at all times. The name of the competent person shall be intimated to the Engineer before commencing manufacture.
  1. **Tolerances :**
     1. The tolerance on overall length of the poles shall be + 15 mm. The tolerance on cross-sectional dimensions shall be +3mm. The tolerance on uprightness of the pole shall be 0.5 per cent.

**Finish**

* + 1. All poles shall be free from surface defects including hair cracks. The surface of the poles in contact with the steel moulds shall be smooth and regular in shape, and as far as possible, be free from pores. Water retaining pockets or honey combing formations shall not be admissible.
    2. The ends of the pre-stressing wires shall be cut as close to the surface of the poles as possible and in any case, shall not project more than 3 mm.
    3. The ends of high tensile steel wires shall be given two coats of suitable epoxy or anticorrosive paints approved by the Engineer.
  1. **Stacking in Lots :**
     1. After the poles have been checked both dimensionally and from the point of view of finish they shall be stored at a convenient place in lots, each lot comprising of all pole cast together and de-tensioned simultaneously in one long line (of single or multiple moulds).
     2. The poles shall be stacked on leveled and consolidated grounds, on one another upto a height corresponding to not more than 15 poles. Each pole shall be separated from the other vertically by wooden battens of size 50X50mm to ensure that the poles are stacked evenly without damages.

1. **Inspection and Testing**
   1. **Inspection :** 
      1. The Contractor shall supply at his expense all the poles required for tests and for retest, samples of materials and all labour, machines, tools, gauges, apparatus, forms of tests reports etc., and all things which may be necessary or required by the Engineer for carrying out any or all of the checks and tests mentioned in the specifications and shall tender all reasonable assistance in making such checks and tests.

One pole for every 200 poles shall invariably be tested to destruction.

* + 1. All pressure gauges and measuring dials on the compression test machines, pre-tensioning equipment, static bending Test Machine, Weight Batching Machine shall be got checked and calibrated regularly as directed by the Engineer by an independent agency and the adjustment certificates shall be furnished to the Engineer. The frequency of calibration of different gauges is given below.

Frequency for calibration of different gauges and testing equipment

|  |  |  |
| --- | --- | --- |
| 1 | Cube testing machine | Once in six months |
| 2 | Weight | Every week or after casting 500 poles whichever is earlier |
| 3 | Pole testing machine | After testing 250 poles on machine jack or three months whichever is earlier. |
| 4 | Tensioning jack | Every three months or after tensioning 5000 poles whichever is earlier. |
| 5 | Dimensional gauges | Three months or after checking 5000 poles whichever is earlier |

* + 1. The Engineer shall have free access at all times to the works in which the poles are manufactured. They shall be at liberty to inspect the manufacture at any stage and to reject any material or work, not conforming to the terms of this specification.
  1. **Check and Tests :**
     1. In addition to the control checks exercised on the materials and manufacturing process specified in Clause 3 & 4 above, the concrete and finished pole shall be subject to the following periodical checks and tests.

1. Compressive strength test of concrete at 20 days.

2. Compressive strength test of concrete of de-tensioning.

3. Modulus of Rupture test of concrete

4. Check for dimensional tolerances and surface finish of poles

5. Statistic bearing strength test of poles.

* + 1. For the purpose of testing and acceptance of poles each lot shall be as defined in Clause 5.9.1 above.
    2. Pole to be tested shall be selected at random by the Engineer. One hour before the tests, the poles shall be given a coat of lime wash in order to make the cracks easily visible. The poles shall be tested as per the proforma vide Annexure II, III and IV.
  1. **Compressive Strength tests of concrete**
     1. Test cubes of size 15 X 15 X 15 cm shall be made and consolidated from the same concrete simultaneously with the poles. The cubes shall be cured along with the poles in the same manner and tested prior to transfer of pre-stress, to check that the concrete has developed the requisite minimum compressive strength specified at transfer. The remainder of cubes shall be cured as specified in IS-456-1964 and tested at the end of 28 days to determine the concrete strength at that age. The pre-stress will be released only if the concrete for as attained the minimum strength at transfer.
  2. **Modulus of rupture test of concrete**
     1. The modulus of rupture test of concrete shall be carried out on concrete poles as specified in IS-516. The results obtained shall be supplied to the Engineer for information.
  3. **Check for Dimensional Tolerance and finish**
     1. The poles shall be examined visually for finish and free from surface defects. The dimensional tolerances specified, directed by the Engineer.
  4. **Static Bending Strength test of poles**
     1. The following cracking failure moments of the poles shall be ascertained by recording the corresponding loads.

1. First crack moment

2. Failure moment

* + 1. The cracking moment shall be that moment at which when a load is applied on the pole for testing as in Clause 6.6.4 below, the pole just begins to develop hair line crack (s) barely perceptible to the naked eye of a length of 15 mm and above. The failure moment shall be the moment corresponding to that load beyond which a further load increment shall be no longer possible due to the progressive deflection of pole.
    2. The loading arrangements for conducting the static bending strength tests shall be with the load applied at 0.6 m from top of the pole. Bottom supports shall be carefully fixed to avoid un-even leveling and the bearing surfaces shall be proper to ensure uniform line contact with concrete surface. Any roughness and unevenness of concrete in the tearing area shall be made up with plaster of Paris gypsum or suitable rubber packing. The testing shall be done at point of application of load, fixing the pole from the bottom at 1.5m height.
    3. When testing the concrete poles the formation of the hair cracks shall be carefully observed and the load shall be increased upto the point at which hair cracks just perceptible to the naked eye appear and load noted. The loads shall be increased at the rate of 50 kg the interval between two installments being 1 minute for observing cracking moment and failure moment.
  1. **Frequency of check and testing :**
     1. For each lot of poles, compressive strength tests on concrete both at 28 days and transfer of load shall be carried out on a minimum of 3 cubes each time.
     2. The modulus of rupture test of concrete shall be carried out at the rate of one pole per day for the first 1500 poles produced. Thereafter, it will be sufficient if a minimum of one pole is tested for week’s production.
     3. For the check and tests on the poles, the number of poles to be tested and the frequency of testing shall be as follows :
        1. (i) Dimensional checks and surface finish :

The frequency of dimensional check shall be at the rate of 10% from each lot of pole for dimensions like length, breadth, width where such dimensions depend up on the accuracy of the mould.

(ii) Static bending strength

In case of lots whose works concrete cube strength is equal to or more than 400 kg/cm², the Static Bending tests as per Clause 6.6.3, shall be carried out at 0.6m from top of pole at the rate of one pole for every 200 poles manufactured.

* + 1. Inspection

The TGSPDCL may carry out inspection at any stage of manufacture. The successful tenderer shall grant free access to the purchaser’s representative at a reasonable time when the work is in progress. Inspection and acceptance of any material under this specification by the purchaser shall not relieve the Contractor of his obligation of furnishing materials in accordance with the specification and shall not prevent subsequent rejection if the material is found to be defective.

The Contractor shall keep the purchaser informed in advance about the manufacturing programme so that arrangements can be made for inspection. The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The Contractor shall give 15 days (for local supply) 30 days (in case of foreign supply) advance intimation to enable the purchaser to depute his representative for witnessing the acceptance and routine tests.

1. **Acceptance of poles**
   1. The standard of acceptance for the cube test on concrete

The compressive strength shall be as specified in clause 4.1 and 4.2 where the compressive strength of concrete at 28 days as determined above, falls below 400 kg/cm², the corresponding lots of poles shall be rejected.

* 1. Dimensional tolerances and surface finish :

The checked poles shall comply with the dimensional tolerance and surface finish as specified in Clauses 5.8 and 5.9.

* 1. A lot of poles shall be considered acceptable, if compressive strength of the concrete is acceptable and the corresponding test pole from the lot passes all the tests mentioned in Clauses 6.2 to 6.6 above.

1. **Re-tests**
   1. If any of the poles tested for Static Bending Strength as per Clause 6.6.3 above fails to fulfill the values in Clauses 7.3, two additional poles from the same lot shall be selected for re-testing and if both those poles pass the test, the lot presented by these pole shall be accepted if the lot is otherwise acceptable except for the poles which originally failed in the test. If either of those two additional poles fails, the whole lot shall be rejected.
2. **Loading and dispatching**
   1. Only those poles which have been passed by the Engineer shall be loaded for dispatch.
3. **Guarantee**
   1. The Contractor shall guarantee the poles for a period of 18 months from the date of delivery or one year after they have been put in service in line, whichever is earlier. If during the guarantee period, any poles are found to develop defects attributable to bad materials and workmanship requiring withdrawal from service, the cost of replacement shall be borne by the Contractor. The defective poles withdrawn from service shall be handed over at site to the Contractor for his disposal. The Contractor shall make good the cost of replacement within 60 days of advice of defects, during which period, the Contractor or his representative shall be given permission to inspect the poles, make his observations and carry out check or examine jointly with the Engineer.

XI. FOR PANTHER ACSR CONDUCTOR

1.0 **SCOPE**

1.1 This specification covers manufacture, testing before dispatch, packing and supply of 37/3.0 mm PANTHER ACSR Conductor for use on 132kV Transmission Lines.

2.0 **STANDARDS**

2.1 The conductor shall comply in all respects with the latest edition of IS 398 Part-ii-1996 with latest amendments unless other-wise stipulated in this specification or any other standard which ensures equal or higher quality of material.

2.2 The materials used in the manufacture of the ACSR conductor shall conform to the following standards.

i) IEC-209 : Specification for Aluminum Conductor Steel

Reinforced for overhead power transmission.

ii) BS-215 : Aluminum conductor steel reinforced for overhead

power transmission.

iii) IS-209 : Specification for Zinc.

iv) IS-2633 : Galvanization

v) IS-1778 : Packing reels and drums for bare conductors.

vi) IS-4826 : Galvanized coating on round steel wires.

vii) IS-1521 : IS-2429, IS-4324, IS-6743, IS-18412, IS-5484

methods of testing & other processes.

**3.0 GENERAL TECHNICAL REQUIREMENTS**

3.1 The General Technical Requirements are given in Appendices-I & II. The conductor shall confirm to these technical requirements.

3.1.1 The bidder shall furnish guaranteed technical particulars in Appendix-III.

* 1. **MATERIALS**

Important technical particulars are given hereunder:

The material offered shall be of best quality and workmanship. The steel cored Aluminum conductor strands shall consist of hard drawn Aluminum wire manufactured form not less than 99.5% pure electrolytic Aluminum rods of E.C. grade. The steel wire shall be from material produced either by the acid or basic open-heart process or by electric process. No steel wire drawn from Bessemer process shall be used. The steel wire shall not contain sulpher exceeding 0.045% and phosphorous 0.035%. The chemical compositions of the steel wire should be as specified in Appendix-II.

The steel wires shall be evenly and uniformly coated with electrolytic high grade, 99.95% purity zinc complying with the latest issue of IS-209 for zinc. The uniformity of zinc coating and the weight of coating shall be in accordance with Appendix-II and shall be tested and determined according to the latest IS-2633 or any authoritative standard.

The steel strands shall be hot dip galvanized and shall have minimum zinc coating of 250gm/m² (before stranding) of the uncoated wire surface. The zinc coating shall be smooth, continuous, and of uniform thickness, free from imperfections and shall withstand minimum three dips after stranding in standard Preece test. The steel strands shall be performed and post formed in order to prevent spreading of strands in the event of cutting of composite core wire.

3.3 **SIZES**

3.3.1 The size of steel cored Aluminum conductor the resistance and weight shall be accordance with the values given in Appendix-I.

3.4 **TOLERANCES**

3.4.1 The following tolerances shall be permitted on standard diameter and on the resistance of Aluminum wires.

Tolerance on standard diameter of +1% Aluminum wires

Tolerance on the standard resistance +0.3% when corrected to standard weight and temperature

3.4.2 A tolerance of plus or minus 2 (Two) percent shall be permitted on the standard diameter of the galvanized steel wire. The variation from the weights shall not be more than plus or minus (Five) percent.

3.4.3 The cross-section of any wire shall not depart from circuitry by more than an amount corresponding to the tolerance the standard diameter.

3.5 **MODULUS OF ELASTICITY AND COEFFICIENT OF LINEAR EXPANSION**

3.5.1 The value of the final modulus of elasticity for steel cored Aluminum conductor is the average of values obtained for actual stress strain tests.

3.5.2 The coefficient of linear expansion for steel cored Aluminum conductor has been calculated on the basis of coefficient linear expansion of 23.0 X 10-6 per degree centigrade of drawn Aluminum and 11.3 X 10-6 per degree centigrade galvanized steel wires and represents only the even values. These values shall however be given by the bidder under the guaranteed technical particulars.

3.6 **SURFACE CONDITIONS**

* + 1. All Aluminum and steel strands shall be smooth and free from all imperfections, spills, and splits. The finished conductor shall be smooth, compact, uniform and free from any imperfections including spills and splits. Die mark scratches, abrasions, scuff marks, kinks (protrusion of wires) dents, pressmarks, cut marks, wire cross-over, overriding, looseness, pressure and/or unusual bangle noise on tapping material inclusions, white rust, powder formation on black spots (on account of reacting with trapped rain water etc. Dirt, grit, etc. The surface of the conductor shall be free from points, sharp edges, abrasions or other departure from smoothness or uniformity of surface contour that would increase radio interference and corona losses. When subject tension upto 50% of the ultimate strength of the conductor, the surface shall not depart from the cylindrical form of any part of the component parts on strands move relative each other in such a way as to get out of place and distance the longitudinal smoothness of the conductor.
  1. **JOINTS IN WIRES AND CONDUCTORS:**

3.7.1 Aluminum wires

No joint shall be permitted in the Aluminum wires in the outermost layer of the ACSR conductor. Joints in the individual Aluminum wires in the layers are permitted. In addition to those made in the base rod or wire before firm drawing, but no two such joints shall be less than 15 m apart in the complete stranded conductor. The cold pressure butt-welding shall make such joint.

3.7.2 Galvanized steel wires

There shall be no joints except those in the base rod on wires before final drawing, in steel wires forming the core of the steel reinforced Aluminum conductor.

* 1. **STRANDING**
     1. The wires used in Construction of the standard conductor shall, before stranding, satisfy all requirements of IS-398 and as per Appendices-I & II.
     2. In all Constructions the successive layers shall be stranded in opposite directions. The wires in each layer shall be evenly and closely stranded round the underlying wire or wires. The outermost layer of wires shall have a right hand lay. The lay ratio of the different layers shall be within the limits given under Appendix-I.

3.9 **PACKING AND MARKING**

* + 1. The conductor shall be wound in non-returnable reels or drums conforming to IS:1778-1980 “Specification for Reels and Drums for bare wire” or any other authoritative standard and marked with the following:

Trade name if any

Name of the manufacturer

Size of conductor

Length of conductor and

Net weight of conductor

The bidders should submit their proposed drum drawings along with the bid.

3.9.2 The reels shall be of such Constructions has to assure delivery of conductor in the field free form displacement and damage and should be able to withstand all stresses due to handling and the stringing operations so that conductor surface is not dented, scratched or damaged in any way during manufacture, transport and erection. The conductor shall be properly lagged on the drums and the method of lagging to be employed may be clearly stated in the tender. It should be notched to suit the reel and held in place by steel strapping. Lagging shall not be nailed or bolted in place.

* + 1. The conductor drum should be suitable for wheel mounting. All wooden components shall be manufactured out of seasoned soft wood free from defects that may materially weaken the component part of drums. Preservative treatment for anti-termite/ anti-fungus shall be applied to the entire drum conductor. The inner check of the flanges and drum barrel surface shall be painted with bitumen based paint. Before reeling cardboard or other suitable weather proof material shall be secured to the drum and inside flanges of the drum. Medium grade neft paper shall be used in between the layers of the conductor. After reeling the conductor the exposed surface should be wrapped with suitable soft material to prevent the conductor from getting contaminated with dirt and grit. Any space between the drum lagging and conductor should be suitably filled with soft filler material compactly packed.
  1. **LENGTHS**
     1. The conductor shall be supplied in standard lengths of 1300 meters. A tolerance of plus or minus 5% on the standard length shall be treated at lengths. Not less than 95% of total quantity of the conductor shall be supplied in standard lengths. Thus the quantity of conductor in lengths shorter than standard ones shall not exceed 5% of the total quantity to be supplied. Further no single conductor length in respect of such 5% (Max) supply in random lengths shall be shorter than 70% of the standard length. Only one standard length or random length of conductor shall be wound on each drum.

4.0 **TESTING**

4.1 **SELECTION OF TEST SAMPLES**

4.1.1 Before dispatch from the works individual wire and finished steel core Aluminum conductor shall be subjected to the tests as specified in the IS 398 or any other authoritative standard.

4.1.2 Sample for individual wires for test shall be taken before stranding from not less than 10% of the spools in the case of Aluminum wire and 10% of the wire coils in stranding, they shall be obtained by cutting 1.2 m from the outer end of the finished conductor from not more than 10% of the finished reels.

4.1.3 The mechanical test shall be carried out on single wire only.

4.2 **TESTS**

4.2.1 All the type routine and acceptance tests required shall be carried out on the conductors as per detailed procedures given in latest edition of IS-398 (Part-II) – 1996 and IS-398 (Part-V).

4.3 **CHECKING AND VERIFICATION OF LENGTH OF CONDUCTORS**

4.3.1 The contractor should arrange for inspection by the representative of the purchaser specially authorized for this purpose. At least 5% of the total No. of drums of conductor (with a minimum of one drum during testing) taken at random should be checked to ascertain the length of conductor so transferred by means of a meter.

Arrangements should be made available at the works of the manufacturer for transferring the conductor from one reel to another at the same time measuring the length of the conductor so transferred by means of a meter.

**APPENDIX-I**

**DETAILS FOR POWER CONDUCTOR OF ‘PANTHER’ ACSR**

|  |  |  |
| --- | --- | --- |
| S.No. | Particulars | Panther ACSR |
| 1 | Conductor | ‘Panther’ steel cored Aluminum stranded conductor. |
| a | Stranding and core diameter  Aluminum  Steel | 30/3.00mm  7/3.00mm |
| b | Calculated equivalent area of Aluminum | 207 mm² |
| c | Approximate total weight | 976 kg/ km |
| d | Calculated resistance of conductor at 200 C | 0.140 Ω/ km |
| e | Ultimate strength of conductor. | 9127 kg |
| 2. i) | Minimum breaking load of steel wire.  Before standing  After stranding | 947 kg  900 kg |
| ii) | Minimum breaking load of Aluminum wire  Before stranding  After stranding | 119 kg  113 kg |
| 3 | Lay ratios  Steel core Maximum  Minimum  Aluminum Layers  12 wire layer Maximum  Minimum  18 wire layer Maximum  Minimum | 28  13  16  10  14  10 |
| 4 | Final modulus of Elasticity | 0.787 X 10+4 kg/ mm² |
| 5 | Coefficient of linear Expansion | 17.73 X 10-6 per ° C. |

**APPENDIX – II**

Solid steel and Aluminum wires used in steel cored Aluminum conductors

|  |  |  |  |
| --- | --- | --- | --- |
| S.No. | Particulars | Steel | Aluminum |
| 1. | Diameter of strand  Maximum  Minimum | 3.00mm  3.06mm  2.94mm | 3.00mm  3.03mm  2.97mm |
| 2 | Cross sectional area | 7.069 mm² | 7.069 mm² |
| 3 | Weight | 55.13 kg/ km | 19.11 kg/ km |
| 4 | Minimum ultimate tensile strength | 134 kg/ mm² | 16.83 kg/mm² |
| 5 | Minimum breaking load  Before stranding  After stranding | 947 kg  900 kg | 119 kg  113 kg |
| 6 | Zinc coating No. and duration of dipping  Minimum weight of coating | 240 g/m² | |
| 7 | Resistance of Aluminum strand at 20°C.  Standard  Maximum | 4.025Ω/ km  4.065 Ω/ km | |

XII.SPECIFICATION OF AB SWITCHES

TECHNICAL SPECIFICATION

AB SWITCHES

(33 kV 800 A, 11 kV 400 A & 11 kV 200A)

**1. SCOPE:**

The specification provides for the manufacture, testing before dispatch, packing forwarding supply and delivery at destination stores (FADS) of **1) 33 kV 800 AAB Switch metallic 2) 11 kV 400A conventional AB Switches with insulators 3) 11 kV 200A conventional type AB switch metallics.**

**2. STANDARDS:**

**A) 33kV 800 A AB Switch metallics:** The 33kV, 800A double break AB Switches shall confirm in all respects to Tender Spn No. SPMPT – 22/02-03 IS:9920 part I to IV (latest version) and IS – 9921 part I – IV (latest version)

**B) 11kV, 400A conventional AB Switches with solid core insulators:** The 11kV 400A double break AB Switches shall confirm in all respects to tender Spn No. SPMPT – 22/02-03, IS 1818/1972, IS – 9920 part I to IV (latest version), IS: 9921 part I to IV (latest version).

**C) 11kV, 200A conventional AB Switch metallics:** The 11kV 200A conventional AB Switch metallics shall confirm in all respects to tender Spn No. SPMPT – 22/02-03, IS 1818/1972, IS – 9920 part I to IV (latest version).

**3) DIMENSIONS :** The dimensions of 1) 33 kV 800A AB Switch metallics 2) 11 kV, 400A conventional type AB Switch metallics 3) 11 kV, 200A conventional type AB switch metallics and 4) 11 kV, 400A solid core insulators shall confirm in all respects to IS as mentioned above.

**4) DRAWINGS:** The successful tendereres before proceeding for manufacture of the material, the detailed drawing shall be got approved by this office. The tenderers also required to produce three sets of drawings together with bill of materials along with the tender.

**5) TESTS AND TESTS CERTIFICATES:**

i) As soon as the material is ready for dispatch, the material is to be offered for inspection by Registered Post and the tests as per the standards are to be carried out in the presence of TGSPDCL representative without any cost and test certificates shall be got approved by this office.

ii) The TGSPDCL reserves the right to carry out the tests by any standard organization at contractor cost, in case of any discrepancy regarding the quality of materials.

**6) GUARANTEED TECHNICAL PARTICULARS:**  The Guaranteed Technical Particulars as per the IS shall be guaranteed and statement of Guaranteed Technical particulars shall be furnished along with the tender.

**7) NAME PLATE:**  Equipment should be provided with name plate giving full details of manufacture, capacities and other details as specified in the relevant ISS or other specification stipulated. The Purchase Order No. and date and year of supply and words TGSPDCL must be etched on the name plate.

**8) ASSEMBLY:** The Assembly of the AB Switches at the destination stores is the responsibility of the Contractors.

1. **For 33 kV 800A AB Switches:**

1. Operating down pipe : 6.1 m, 32 NB Class-B GI Pipe

2. Connectors (Jumper plate) : LM –6 Alloy terminal connectors (75X12mm) suitable for panther conductor.

3. Fixed Contact : 25X4 mm Copper Flat (HDE)

4. Moving Contact :38 OD and 30 ID Copper Pipe (HDE)

5. Base Channel : 100X50 mm MS Channel of length 1065 mm

6. Provision for pad lacking in ON-OFF position shall be provided.

7. Three numbers Guides of MS Angle 50X50X6 mm for supporting the down pipe, slotted holes are to be mate to the angles for fixing the same to the pole.

1. **For 11 kV 400A Conventional AB Switches (Double Break):**

1. Operating down pipe : 6.1 m, 32 NB Class-B GI Pipe

2. Terminal Connectors : LM –6 Alloy terminal connectors suitable for Dog ACSR conductor.

3. Fixed Contact : 25X4 mm Copper Flat (HDE)

4. Moving Contact : 32X6.5 mm HDEC Flat

5. Flexible Jumper : Two numbers flexible jumpers of size

25X4X360 mm

6. Base Channel : 75X40 mm MS Channel of length 609.6 mm

7. Provision for pad lacking in ON-OFF position shall be provided.

8. Three numbers Guides of MS Angle 40X40X5 mm for supporting the down pipe, slotted holes are to be mate to the angles for fixing the same to the pole.

1. **For 11 kV 200A Conventional AB Switches:**

1. Operating down pipe : 6.1 m, 32 NB Class-B GI Pipe

2. Terminal Connectors : LM –6 Alloy terminal connectors suitable for 20/30/50 ACSR conductor

3. Fixed Contact : 25X4 mm Copper Flat (HDE)

4. Moving Contact : 32X5 mm HDEC Flat

5. Flexible Jumper : Flexible jumpers of size

25X4X360 mm (Copper)

6. Base Channel : 75X40 mm MS Channel of length 609.6 mm

7. Provision for pad locking in ON-OFF position shall be provided.

8. Three numbers Guides of MS Angle 40X40X5 mm for supporting the down pipe, slotted holes are to be match to the angles for fixing the same to the pole.

**GUARANTEED TECHNICAL PARTICULARS FOR 33 kV 800A AB SWITCHES**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Details** | **33kV 800A** |
| 1. | Whether single break or double break | Double Block |
| 2 | No. of poles | 3 Poles |
| 3. | Frequency | 50 Hz |
| 4. | Voltage rating | 36 kV |
| 5. | Current rating in A |  |
|  | i) Normal | 800 A |
|  | ii) Maximum with duration | 800 A |
| 6. | Temperature rise of the following at full rated current in Degree over ambient temperature | Within limits as specified in IS. |
|  | i) Copper contract with coating | Within limits as specified in IS. |
|  | ii) Terminals of switches intended to be bolted to  the external conductor | Within limits as specified in IS. |
|  | iii) Metallic parts acting as springs | Within limits as specified in IS. |
| 7 | Whether contacts are silver coated or tin coated | Silver plated |
| 8. | Volt drop across terminals of poles | Note more than 20 mV at 100A DC. |
| 9. | Short time current and duration | 25 kA |
| 10. | Material of fixed contract & size | Copper flat |
| 12. | Material of moving blade & size | Electrolytic Copper tube |
| 13. | Material of terminal connector | LM-6 Alloy |
| 14. | Type diameter and length of operating pipe | 6.1 m, 40 mm N.B. class ‘B’ GI Pipe |
| 15. | Material of arcing horns | GI Rod 10mm dia |
| 16. | Size & Length of base mounting channel (Hot dip Galvanized) | 100X50mm channel 1065 mm long |
| 17. | Whether dimensional drawing is enclosed with the tender | Yes |
| 18. | Whether the air break switch is complete with all accessories | Yes |
| 19. | Minimum clearance between phases (The center distance between the insulators of adjacent phases in the assembled position of switch) | 1524 mm |
| 20. | Center to center distance between insulators of the consecutive poles of the same phase in the assembled position of switch (in mm) | 457.5mm |
| 21. | Whether mechanical interlock has been provided for arcing switches | Yes |
| 22. | Types of bearing used in |  |
|  | i) Rotating insulators stack | Ball bearing |
|  | ii) Operating shaft | N-m |
| 23. | Impulse withstand voltage (peak) with 1/50 MS wave positive and negative polarity |  |
|  | i) Across isolating distance | 195 kV Peak |
|  | ii) To earth between poles | 170 kV Peak |
| 24. | One minute power frequency withstand voltage (RMS) across isolating distance to earth and between poles |  |
|  | i) Across isolating distance | 80 kV (RMS) |
|  | ii) To earth between poles | 70 kV (RMS) |

**GUARANTEED TECHNICAL PARTICULARS**

**FOR 11 kV 400A CONVENTIONAL TYPE AB SWITCHES**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Details** | **11 kV 400A** |
| 1. | Whether single break or double break | Single break |
| 2. | No. of poles | 3 |
| 3. | Frequency | 50 Hz |
| 4. | Voltage rating | 11 kV |
| 5. | Current rating in A |  |
|  | i) Normal | 400 A |
|  | ii) Maximum with duration | 400 A |
| 6. | Temperature rise of the following at full rated current in Degree over ambient temperature |  |
|  | i) Copper contract with coating | Within the limits as specified in IS. |
|  | ii) Terminals of switches intended to be bolted to  the external conductor |
|  | iii) Metallic parts acting as springs |
| 7. | Whether contacts are silver coated or tin coated | Tin plated, 12-15 microns |
| 8. | Volt drop across terminals of poles | Not more than 20 mV at 100A DC |
| 9. | Short time current and duration | 16.0 kA for 1 second |
| 10. | Material of fixed contract & size | Hard drawn electrolytic copper flat |
| 12. | Material of moving blade & size | Hard drawn electrolytic copper flat |
| 13. | Material of terminal connector | LM-6 Alloy |
| 14. | Type diameter and length of operating pipe | 6.1 m, 32mm N.B. Class B G.I. Pipe |
| 15. | Material of arcing horns | 6mm dia stainless steel |
| 16. | Size & Length of base mounting channel (Hot dip Galvanized) | 75X40mm channel  609.6mm long |
| 17. | Whether dimensional drawing is enclosed with the tender | Yes, enclosed |
| 18. | Whether the air break switch is complete with all accessories | Yes, Complete with all accessories. |
| 19. | Minimum clearance between phases (The center distance between the insulators of adjacent phases in the assembled position of switch) | 914.4mm |
| 20. | Center to center distance between insulators of the consecutive poles of the same phase in the assembled position of switch (in mm) | 457.2mm |
| 21. | Whether mechanical interlock has been provided for arcing switches | Yes, Provided. |
| 22. | Types of bearing used in |  |
|  | i) Rotating insulators stack | Gunmetal, Bush bearing |
|  | ii) Operating shaft | Guide bracket |
| 23. | Impulse withstand voltage (peak) with 1/50 MS wave positive and negative polarity |  |
|  | i) Across isolating distance | 85 kV (Peak) |
|  | ii) To earth between poles | 75 kV (Peak) |
| 24. | One minute power frequency withstand voltage (RMS) across isolating distance to earth and between poles |  |
|  | i) Across isolating distance | 32 kV (RMS) |
|  | ii) To earth between poles | 28 kV (RMS) |
| 25. | PARTICULARS FOR INSULATORS |  |
|  | i) Type of insulators | Post type |
|  | ii) Name of manufacturer of insulators | Allied/IPL/JSI |
|  | iii) Height of the insulators | 254mm |
|  | iv) Diameter of the largest shell | 152mm |
|  | v) No. of units per stack | One |
| 26. | Electrical characteristics (For one insulator) |  |
|  | A) Flash over voltage |  |
|  | i) Dry Power frequency (kV) | 70 kV |
|  | ii) Wet power frequency (kV) | 45 kV |
|  | iii) Impulse voltage of 1/50 micro seconds  (+Ve) (kVPeak)  iv) Impulse voltage of 1/50 micro seconds  ( - Ve) (kVPeak) | 95 kV(Peak)  120 kV(Peak) |
|  | B) Withstand Voltage |  |
|  | i) Dry Power frequency (kV) | 65 kV |
|  | ii) Wet power frequency (kV) | 40kV |
|  | iii) Impulse voltage of 1/50 micro seconds  (+Ve) (kV (Peak))  iv). Impulse voltage of 1/50 micro seconds  (- Ve) (kV (Peak)) | 90 kV (Peak)  105 kV (Peak) |
| 27. | Power frequency puncture withstand voltage of unit | 110 kV |
| 28. | Mechanical characteristics |  |
|  | i) Cantilever strength upright | 600 kgf |
|  | ii) Cantilever strength under hung | 350 kgf |
|  | iii) Torsinal strength (kgfm) | 34 kgfm |
|  | iv) Tensile strength | 2050 kgf |
| 29. | General characteristics |  |
|  | i) Minimum creepage distance mm | 320 mm |
|  | ii) weight of complete unit (kg) | 3.5 kg approximately |
| 30. | Standard to which insulator conforms | IS 2544 and IS 5356 |

**GUARANTEED TECHNICAL PARTICULARS**

**FOR 11 kV 200A CONVENTIONAL TYPE AB SWITCHES**

|  |  |  |
| --- | --- | --- |
| S. No. | **Details** | **11 kV 200A** |
| 1. | Whether single break or double break | Single Break |
| 2. | No. of poles | Three |
| 3. | Frequency | 50 Hz |
| 4. | Voltage rating | 12kV |
| 5. | Current rating in A |  |
|  | i) Normal | 200A |
|  | ii) Maximum with duration | 200A |
| 6. | Temperature rise of the following at full rated current in 0C over an ambient temperature | Within the limits of IS-9921. |
|  | i) Copper contract with coating | Within limits as specified in IS |
|  | ii) Terminals of switches intended to be bolted to the external conductor |
|  | iii) Metallic parts acting as springs |
| 7 | Whether contacts are silver coated or tin coated | Tin plated |
| 8. | Volt drop across terminals of poles | Within the limits of IS:9921 (Not more than 20m V at 100V DC) |
| 9. | Short time current and duration | 16kV RMS for one second. |
| 10. | Material of fixed contact | HDEC Flat |
| 12. | Material of moving contact | HDEC Flat |
| 13. | Material of terminal connector | Rigid type pad type A1. Terminal connector made out of LM6 Alloy with bi-metallic strip. |
| 14. | Type diameter and length of operating handle | 32mm NB GI pipe of 6.1mlong with intermediate couplings. |
| 15. | Material of arcing horns | G.I.Rod 6mm dia. |
| 16. | Size & Length of base mounting channel | 75\*40\*6mm MSHDG 610mm length. |
| 17. | Whether dimensional drawing is enclosed with the tender | Yes |
| 18. | Minimum clearance between phases (The center distance between the insulators of adjacent phases in the assembled position of switch) | 915mm |
| S. No. | **Details** | **11 kV 200A** |
| 19. | Center to center distance between insulators of the consecutive poles of the same phase in the assembled position of switch (in mm) | 457.2 mm |
| 20. | Whether mechanical interlock has been provided for arcing switches | No |
| 21. | Types of bearing used in |  |
|  | i) Rotating insulators stack | Bush Bearing |
|  | ii) Operating shaft |
| 22. | Impulse withstand voltage (peak) with 1/50 MS wave positive and negative polarity |  |
|  | i) Across isolating distance | 85 kV |
|  | ii) To earth between poles | 75 kV |
| 23. | One minute power frequency withstand voltage across isolating distance to earth between poles | 28 kV (RMS)  32 kV (RMS) |

**XIII.LIGHTNING ARRESTORS:**

The lightning arrestors shall be of metal oxide, heavy duty type and should have impulse flash over characteristic and other technical parameters as per IS 3070 or any other equivalent international standards.

The lightning arresters shall be of metal oxide, heavy duty type and should have impulse flash over characteristic and other technical parameters as per IS 3070 or any other equivalent international standards.

**SCHEDULE OF TECHNICAL AND GUARANTEED PARTICULARS**

**FOR LIGHTNING ARRESTORS**

|  |  |
| --- | --- |
| Sl.No. | Description |
| 1. | Name of Manufacturer |
| 2. | Type |
| 3. | Model |
| 4. | Number of units |
| 5. | Rated Voltage |
| 6. | Nominal discharge current |
| 7. | Power frequency sparkover voltage |
| 8. | Impulse spark over voltage 1/50 micro secondWave |
| 9. | Maximum front of wave impulse sparkover voltage |
| 10. | Virtual steepness for front of wave for above |
| .``11. | Maximum residual voltage for discharge current – 8/20 micro second Wave |
|  | i) 1500 A |
|  | ii) 2500 A |
|  | iii) 5000 A  iv) 10000 A |
| 12. | High current 4/10 micro second wave test value |
| 13. | Long duration current tests |
|  | i) Current peak |
|  | ii) Virtual duration |
|  | iii) Pressure relief device |
| 14. | Weight of complete unit |
| 15. | Height of complete unit from base of the line side |
| 16. | Minimum recommended spacing between arresters centre to centre |
| 17. | Clearance required from grounded equipment at various heights of arresters unit |
| 18. | Earthing arrangement provided for earthing side of arrestor(s) |
| 19. | Mounting flange dimensional details |
| 20. | Equipment to be protected |

## XIV. FOR 11 kV & 33 kV HG FUSE SET

**1. SCOPE:**

This specification provides for the manufacture, testing before dispatch, supply and delivery of 11 kV HG Fuse sets for use on the distribution side as per the particulars given in the schedule attached.

**2. STANDARDS:-**

The HG Fuse sets shall conform in all respects to the clause (4) Technical particulars given below. The Insulators conform to IS: 5350 and IS: 731/1971 (latest version).

**3. CLIMATE CONDITIONS:**

The climatic conditions under which the equipment shall operate satisfactorily are as indicated in Page (3) of General and Financial terms and conditions for supply of materials.

**4. CONSTRUCTION.**

All ferrous parts shall be hot dip galvanized as per IS:2633. The fuse sets are meant for mounting on a structure at a height of 4.5 meters to 5.0 meters from ground level suitable for single pole distribution transformer structure.

The porcelain parts shall be permanently secured at the centre in a metal support

be mounted on the supporting structure. They shall be made up of interchangeable units and shall be capable of being mounted on the supporting structures. Suitable bolts, washers required shall also be supplied with the insulators. The portion of the central metallic support where it grips the insulator should be insulated to that level of the insulator to avoid bird faults.

The porcelain shall be sound and homogenous, free from defects, laminations and other flaws or imperfections which might effect the mechanical or dielectric strength. These should be thoroughly verified and shall be tough, impervious to moisture and smoothly glazed.

All the ferrous metal parts excluding mounting angles shall be hot dip galvanized. The mounting angles shall be painted with double coat of red oxide paint. The porcelain and metal parts shall be assembled in such a manner that any thermal expansion differential between the metal and porcelain parts throughout the range of temperature variation shall not loosen the parts or create undue internal stresses which may effect the electrical or mechanical strength and rigidity. The insulators shall conform in all respects to IS:5350 and IS:731/1971.

All the bolts and nuts shall be hot dip galvanized.

**5. TECHNICAL PARTICULARS 11 kV & 33 kV HG FUSE SET:**

5.1.1. Rated Current : 50 A

5.1.2. Rated Voltage : 36 kV

5.1.3. Rated Insulation level **11 kV 33 kV**

a) Power frequency withstanding voltage :

i) To earth and between poles : 28 kV (RMS) 36 kV (RMS)

ii) Across isolating distance : 32 kV (RMS) 75 kV (RMS)

b) Impulse withstand voltage :

i) To earth and between poles : 75 kV (Peak). 175 (Peak)

ii) Across isolating distance : 85 kV (Peak). 190 (Peak).

5.1.4. Temperature rise : 50°C above ambient temp.

5.1.5. Resistance across the terminals. : 1 m. Ohm. 0.5 m. Ohm

(excluding fuse wire resistance)

5.1.6. The Gap for the fuse wire shall be : 203 mm. 457.5 mm

Phase to phase clearance of the : 600 mm 1524 mm

Fuse set shall be.

Insulator support height including : 254 mm. 508 mm

Insulator diameter shall be

(30x5 mm MS Flat)

Arcing horn bending portion shall be : 75 mm 200 mm

Arcing horn bending portion shall be : 383 mm. 351 mm

(i.e., from 60° angle)

**5.2.0. INSULATORS:**

5.2.1. Make : Any standard make.

5.2.2. Type : Solid Core insulators.

Power frequency with stand voltage : 35 kV (RMS) 75 kV (RMS)

Dry/Wet.

Impulse withstand voltage : 75 kV (RMS). 170 kV (RMS)

Visible discharge voltage : 9 kV (RMS) 36 kV (RMS)

Creepage distance : 260 mm. 580 mm

(Moderately polluted atmosphere)

Flash over voltage Dry/Wet. : 60kV/ 40 kV.

Total length of the insulator shall be : 350 mm ± 5 508 mm ± 5

Dia of the insulator shall be : 85 mm ± 5. 200 mm ± 5

**6.0. TESTS:**

**6.1. TYPE TESTS:**

i) Lightning Impulse withstand test.

Power Frequency voltage withstand test (Dry)

Power Frequency voltage withstand test (Wet)

Temperature rise test.

Measurement of resistance

**6.2. ACCEPTANCE TESTS.**

i) Verification of Dimensions

Galvanizing test

Temperature rise test

Measurement of resistance

Dielectric test (with 1000 V Megger)

Power frequency voltage withstand test (Dry)

**6.3. ROUTINE TESTS:**

i)Verification of Dimensions

Temperature rise test

Measurement of resistance

Dielectric test (with 1000 V Megger)

Power frequency voltage withstand test (Dry)

**7. TESTS & TEST CERTIFICATES:**

The tests shall be carried out as per clause (6) above and relevant ISS for both HG Fuse sets and the insulators before despatch and the test certificates shall be furnished for approval.

8. **INSPECTION**: All the Routine and acceptance tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed to by the manufacturer and purchaser at the time of purchase. The manufacturer shall be offer the inspector representing the purchaser all reasonable facilities, without charge, to satisfy him that materials are being furnished in accordance with this specification.

The purchaser has the right to have the tests carried out at supplier cost by an independent agency whenever there is dispute regarding the quality of supply.

**9. PACKING**: the 11kV HG Fuse sets shall be delivered suitably packed. Although the method of packing is left to the discretion of the manufacturer, it should be robust for rough handing, that is occasioned during transportation by rail/ road.

**10. GUARANTEED TECHNICAL PARTICULARS:**

The technical particulars as specified at clause (5) above shall be guaranteed and a statement of guaranteed technical particulars covering those listed in the enclosure to this section also shall be furnished along with the tender.

**11. GENERAL**:

i) Only standard make solid core insulators are to be used in the manufacturer of HG Fuse set and not post type insulators with local cementing. This shall be clearly confirmed in the tender.

ii) Any design other than one specified herein may also be offered. However, the TGSPDCL reserves the right to make purchase according to specification.

**XV. 33 kV & 11 kV POTENTIAL TRANSFORMERS**.

1. **SCOPE:** - The specification covers the design, manufacturer, assembly testing at manufacturer’s works and supply and delivery at destination of outdoor oil immersed 33kV and 11 kV Voltage Transformers suitable for mounting externally at various substations in TGSPDCL.

2. **STANDARDS:** The equipment shall conform in all respects to the latest version of relevant IS indicated below as applicable.

i) Voltage Transformers : IS 3156 (Part-I & II).

ii) Oil : IS 335.

iii) Galvanization : IS 2633.

iv) Primary Terminals. : IS 10601.

The tenderer shall go through the above IS thoroughly before making his offer.

3. **CLIMATIC CONDITIONS**: The climatic conditions under which the equipment shall operate satisfactorily are as indicated at page (12) 0f General Terms and Conditions for supply of materials.

**4. 33 kV POTENTIAL TRANSFORMERS:**

4.1 TYPE: The Voltage transformers shall be outdoor oil immersed self cooled vacuum impregnation type suitable for operation in 3Ph. 33 kV or 11 kV 50 Hz solidly grounded system under the normal service conditions specified in IS 3156 and as indicated, in the Section – IV “ Schedule of Materials”.

4.2. The Voltage transformer shall have the following ratings.

**33 kV PTs 11 kV PTs**

a) Rated voltage: 33 kV 11 kV

b) No. of Phases/ connection: 1-ø 3-ø

Star / Star

c) INSULATION LEVEL:

i) Nominal system voltage. 33 kV 11 kV

ii) Highest system voltage. 36 kV 12 kV

iii) Standard Impulse withstand voltage. 170 kV 75 kV

iv) One minute power frequency

withstand voltage.

a) Primary 70 kV 28 kV

b) Secondary. 3 kV 3 kV

v) Rated voltage factor and

corresponding rated time. 1.2 1.2

d) Rated transformation ratio : As indicated in Sec. IV

“Schedule of Materials”.

i) Class of Accuracy 0.5 0.5

ii) Rated Burden’/Phase 100 VA 100 VA

e) Type of Transformer: -------- Earthed --------

f) No. of windings/phase. Two

4.3 Each voltage transformer shall be capable of carrying without injury continuous burden of 25% above the rated burden in respect of 33 kV Potential Transformers and 50% above the rated burden in respect of 11 kV Potential Transformers . The Potential Transformers shall have adequate protection with fuses on primary and secondary side.

**5. CONSTRUCTION:**

5.1. The core shall be high grade non-ageing electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy, at both normal and over current/ voltage.

The secondary terminals shall be brought into a compartment on one side of voltage transformers for easy access. The secondary taps shall be adequately reinforced to withstand normal handling, without damage.

The voltage transformers shall be suitable for mounting on steel structures or concrete pedestals. The necessary flanges, bolts, etc. for the base of the Potential Transformers shall be supplied and these shall be galvanized. The tank and other metal parts shall be galvanized.

All winding shall be of insulated high grade Electrolytic copper wire and the manufacturing of the units shall be done in completely closed and air-conditioned room otherwise Fiber glass insulation sleeves are to be provided for primary winding. Details of winding and core shall be furnished.

The Potential Transformers shall be completed in all respects with first filling of oil conforming to IS 335 and with oil level indicator with minimum/maximum oil levels. The top cover and terminal box cover should be such that rain water does not enter even through the gaskets.

5.2. PRIMARY & SECONDARY TERMINALS: Primary terminals of Potential Transformers to which the line connections are to be made shall have dimensions as per IS 10601:1983.

The secondary terminals shall be brought out into suitable compartment, which shall have a removable cover. The terminal box with the cover closed and tightened and the cable/conduit in position when supplied shall have a degree of protection conforming to IP 54 of IS 2147.

5.3. TERMINAL AND EARTH CONNECTORS: Terminal connectors suitable for Panther ACSR Conductor shall be supplied. Suitable earth connectors for earthing connections shall also be supplied.

5.4. EARTHING: The earthing terminals shall be adequate size protected against corrosion and metallically clean and identified by means of the sign marked in a legible and indelible manner on or adjacent to the terminals.

5.5. SEALING ARRANGEMENT: Provision for sealing secondary terminal compartment, primary ratio change strips (if any) and tank effectively shall be made such that no fraud etc. Such as tampering of the ratio or circuit (current/voltage) is possible. The holes provided for the above sealing provision shall be of adequate size and pass the sealing wire of about 14 SWG.

5.6. NAME / RATING PLATE: Each Potential Transformer shall have the following particulars indelibly marked on it or on a label permanently secured to it or its casing.

Manufacturer’s name

Year of manufacture

Manufacturer’s Sl.No. and / or type designation

Rated transformation ratio

Rated frequency

Rated output and the corresponding accuracy class

Highest system voltage

Rated voltage factor and corresponding rated time

Type of transformer

Number of phases and method of connection

5.7.1. Each instrument Transformer shall be provided with prismatic type oil sight window at suitable location so that the oil level is clearly visible with naked eye to an observer standing at ground level.

5.7.2. For compensation of variation in volume of the oil due to temperature variation nitrogen cushion or stainless steel bellows shall be sued. Rubber diaphragms shall not be permitted for this purpose.

5.7.3. The units of vacuum shall be filled with oil, after processing and thereafter hermetically sealed to eliminate air and moisture from entering the tank.

5.7.4. Oil filling and / or oil sampling cocks if provided to facilitate factory processing shall be permanently sealed before despatch of the instrument transformer.

**6. TESTS:**

6.1. 33 kV and 11 kV POTENTIAL TRANSFORMERS:

6.1.1. TYPE TESTS: The following Type Tests as per IS: 3156 (Latest Version) shall be conducted and Type Test Certificates for the Tests carried out on Prototype of same specification shall be enclosed with the tender. **The date of type tests shall not be earlier than ten years.**

Verification of terminal marking and polarity

High voltage Power frequency wet withstand voltage test

Power frequency dry withstand tests on Primary winding

Power frequency dry withstand test on Secondary winding

Determination of errors according to the requirements of the appropriate accuracy class

Temperature rise test

Impulse Voltage test

Accuracy test

6.1.2 ACCEPTANCE & ROUTINE TESTS: The following shall be conducted as per IS:3156 (Latest version).

Verification of Terminal marking and polarity

Power frequency/ dry withstand tests on primary windings

Power frequency dry withstand tests on secondary windings

Determination of errors according to the requirements of the appropriate accuracy class

Accuracy Test

**7. INSPECTION:** All acceptance tests shall be conducted at the time of inspection and inspection shall be made at the place of manufacturer unless otherwise specifically agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charges to satisfy him that the material is being furnished in accordance with the specification.

The purchaser has the right to have the tests carried out at supplier’s cost by an independent agency whenever there is a dispute regarding the quality of supply.

**8. GUARANTEED TECHNICAL PARTICULARS**: The technical particulars as per IS (Latest Version) shall be guaranteed and guaranteed technical particulars as per Annexure – I shall be furnished by the Tenderer along with his offer.

**9. DRAWINGS & LITERATURE**: Drawings and Technical Literature of Potential Transformers shall be enclosed to the offer. Sectional view and dimensions for all parts to the extent possible shall be indicated in the drawings. Tenders not accompanied by the above are liable to be rejected. These drawings and literature are to be supplied @ 2 copies along with each unit in the event of order.

**10. OVERALL DIMENSIONS AND FOUNDATION DETAILS:** The manufacturer shall give the necessary information as regards the overall dimensions of the transformer and foundation details.

**11. SCHEDULE OF REQUIREMENTS, DESIRED DELIVERY AND PRICES:**

11.1 The schedule of requirements and desired deliveries are indicated in Sec. – IV.

11.2 The schedule of prices shall indicated as per Form – III

Note: The tenderer shall indicate the source of all materials. He shall also indicate the name of the supplier and make of conductor, Transformer oil Electrical Steel Laminations, Construction Steel etc.

**XVI.SPECIFICATION OF BAY EXTENSION AT EHT WITH BOOM STRUCTURE**

**Schedule 5- Bay extension works at EHT SS**

The scope of supply includes supply, fixing testing and commissioning of 33 kV breaker at 132/33 kV SS including the cost of breaker etc as detailed below.

* Supply and erection of TC Structures & BD Booms 4 Nos. TC towers (each 578 kg), 3 Nos. BD Booms (225 kg each) & 1 No. Cantilever 110 kg including bolts and nuts.
* Supply & Fabrication & Galvanization of raw steel such as MS Angles, Plates, Channels, RS Joists, MS Rounds etc, and fabrication and galvanization of main and auxiliary structures stub setting template and foundation bolts 'U' Bolts with suitable galvanized nuts for foundations bolts including cost of steel and transportation to substation site.
* Providing & Fixing galvanized Bolts and nuts including cost of material for erection of tower.
* Erection of main and auxiliary structures.
* Excavation of pit of size 1.6x1.6x1.275 m =3.264 m³ X 4 Nos.
* Concrete PCC (1:4:8) 1.6x1.6x0.075 m=0.192 m³ x 4 Nos.
* Concrete RCC (1:2:4) (1.6x1.6x0.3+1x1x1.05) =1.818 m³ x 4 Nos.
* Plastering = 1x1x1+4x1x0.15 = 1.6 mm² x 4 Nos.
* Back filling (2x0.3x1.6x0.9+2x0.3x1x0.9 = 1.6 mm² 4 Nos.
* Reinforcement (RTS) 10mm Dia = 12 Nos. x 4.86, 14Nos. x3.88 = 73.84 R m x0.62 =45.78 kgx4Nos.
* Supply, erection and commissioning and testing of 33 kV 25 kA, 3 Sec VCB including Current transformers with 800-400/1-1 A, including the control and Relay panel of 220 V DC.
* Excavation in all types of soils (2.1x1.5x1.1x1.65) = 6.5 m³
* Cement concrete PCC (1:4:8) = 2x1.5x1.1x0.1 = 0.33 m³
* RCC (1:2:4) = 2x1.5x1.1x0.3 + 2x0.5x0.9x(1.2+0.35) = 4.34 m³
* Smooth plastering of VCB plinth (0.5x0.9+2x0.35x0.9+2x0.35x0.5) = 2.23 m³
* Back filling 6.5 - 4.67 = 1.83 m³
* Reinforcement (RTS) 10mm Dia = 16 Nos. x1.4x4+10 Nosx1x4=129.60R m=129.62x0.62 kg=80.352 kg
* Supply and Jumpering with Zebra conductor from A.B Switch to breaker,breaker to C.T. and C.T to A.B Switch (total 9 jumpering locations).
* Supply & erection of 33kV 800 A AB switch fixing of guide pipes and alignment, Jumpering of AB Switch, earthing with MS Flat cutting to size and making holes and spot welding and complete including cost of bolts & nuts.
* Supply & Erection of 33kV LAs with Bolts and nuts and fixing of guids with clamps, on structure, jumpering and earthing of LAs with MS flat (including cutting to size, making holes and spot welding).
* Supply & Laying of earth mat including excavation of trenches, welding and fixing lugs, connecting to equipment and connecting lighting shield to earth mat and earthing of fence posts, drilling and connecting earth rods including connecting cast iron pipes as per Drg. No. SET(P) 149/82 with the following sizes of MS/GI Flats including supply of MS Flat and GI Flat with 100 x 16mm MS Flat, 100 x 16mm GI Flat, 50 x 8mm MS Flat, 50 x 8mm GI Flat.
* Supply of Earth Electrode & Excavation of earthpit, putting cast iron pipe with flange on one end of nominal dia" 125mm and 2.75 m long inside the pit including supply and fixing RCC collar 4 m dia" and 0.6 m length inside the pit backfill the pit with mixture of Bentonite and Black cotton soil and earth of 300mm thick around the earth pipe of 150mm on all the sides of the pipe including cost and conveyance of BH coke and RCC collars, labour charges for all operational and incidental items of work etc., complete but including cost of CI pipes.
* Supply & Erection of twin control & relay panel in the Control Room duly maintaining them on channels and grouting them with foundation bolts including cost of channels and foundation bolts.
* Supply and Laying of control cables of all sizes from 2 Cx2.5 mm² copper control cable trenches including running of cables in control room when cable are run on cable racks in cable duct.
* Supply and Laying of control cables of all sizes from 4 C x2.5mm² copper control cable trenches including running of cables in control room when cable are run on cable racks in cable duct.
* Supply and Laying of control cables of all sizes from 10 C x2.5mm² copper control cable trenches including running of cables in control room when cable are run on cable racks in cable duct.
* Supply of ACSR Zebra Conductor.
* Connecting equipment to bus and/or another equipment including measuring, cutting, clamping and hosting of suspension insulators assembly to support the conductor with twin/single zebra and other items of work, With Single Zebra without PASD, With Single Zebra with PASD with Twin Zebra without PASD.
* Hoisting of insulators and hardware stretching of 33kV Auxiliary Bus comprising three conductors with twin zebra conductor to a tension of 900 kg. Including fixing of spacer clamps, 3-bolted tension hardware for twin zebra with Twin zebra spacer clamps, T clamps for twin Zebra, Tension clamps for twin zebra, pad clamps.
* Supply Erection of Marshalling boxes on the structures of equipment in full shape including cost of marshalling boxes.
* Cable termination to the Switchgear, marshalling boxes/panel terminal blocks/control and relay panels, LTAC panel, including cost of suitable ferrules and lugs each on at both ends.
* Supply & Erection of Tubular Poles (30 feet Height) for yard Lights.
* Installation of lighting fixtures on switchyard structures including cost of lighting fixtures of Metal halide 150W/LED 100 and cabling and connections complete.
* Supply & Provision of Earthbonds including cost of Earthbonds.
* Cable ducts for laying of power & control cables for Switch yard, Control Room, Earth excavation & removing of earth boulders & leveling of the yard of the yard in the following soils, Red earth or hard gravel soil, Removing of Hard rock boulders by bendhin, chiseling, wedging and boring in rock in foundation complete for finished item & cleaning the removed boulders away from the site,
* Metal Spreading in the Yard with 20 mm Metal

**XVII.SPECIFICATION BAY EXTENSION WORKS AT EHT SS**

**1.Schedule of Bay extension works with RS joists**

The scope of supply includes fixing testing and commissioning of 33 kV breakers at EHT SS with 150 x 150 mm RS joists as detailed below.

* 33 kV Bay Extension at 132/33 kV SS with RS joist pole 150 X 150 mm 9.0 m including the cost 100X50 MS channel supply connecting with zebra conductor,T clamps,earthing complete.
* Erection and commissioning and testing of 33 kV VCB including CT’s.
* Supply Erection, of 33 kV 800 A AB switch earthing with MS Flat cutting to size and making holes and spot welding and complete.
* Supply Erection of Marshalling boxes on the structures of equipment in full shape including cost of marshalling boxes and cable termination to all equipment with suitable lugs and ferrules complete.
* Earthing with earth electrodes by providing of CI pipe and shall be identical with the existing earthing system of EHT substation by fabrication and punching holes wielding brackets for fixing CI strip including supply and back filling mixture of Bentonite and black cotton soil , complete.
* Earthing of breaker with MS flat and shall be identical with the existing earthing system including cutting of MS Flat to size, making of holes and post wielding and connecting to earth grid, double earthing as per IS 3043 as per the scope of supply complete.
* Supply and Laying of control cables 2 core, 4 core , 10 core (2.5 mm² copper) of all sizes in cable trenches including running of cables in control room when cable are run on cable racks in cable duct.

XVIII.SPECIFICATION OF K, L, M TOWERS

**Erection of Towers** / **Sub-Station Structures**

* During erection of towers only the minimum' number' of workers shall be deployed to minimize risks of objects falling on workmen especially when work is carried out at two or more levels of towers or structures. The workmen shall invariably use safety devices such as helmets and safety belts during erection of towers and sub-station structures.
* Tie ropes shall be used wherever necessary for holding steel sections or tower parts in position.
* The devices such as pulley blocks and wire ropes, used for erection of towers structures shall be of good quality and shall \*be tested. They shall be inspected by experienced officers before use.
* During erection of towers using hoisting equipments such as cranes and

tripartite adjacent to existing transmission lines, the lines shall be de‑energized wherever possible. When this is not possible special precautionsshall be taken to maintain minimum clearances from live lines.

* Whenever cranes or tripartite are used for erection,they shall be set on firm foundations / level ground. The wheels of ‘mobile machines shall be in locked position to prevent dislocation during operation.
* Tie ropes shall be used to maintain control of tower sections being raised and positioned wherever possible. Care shall be taken to prevent the ropes from creating hazards themselves.
* Erection or maintenance shall not be carried out during high velocity wind, heavy rainfall and thunderstorms.

Precautions pertaining to traffic control shall be taken during work including at highway crossings and railway crossings.

**XIX.CONSTRUCTION STANDARDS FOR 11 kV AND 33kV OVER HEAD LINES**

**1. Scope:**

The Scope covers the survey of the proposed route marking pole locations, tree cutting and obtaining way leave clearance wherever necessary, transport of material to the locations, erection of line, testing of the line and handing over the line to the Employer as per specification.

**2. General:**

The Contractor should be conversant with Indian Electricity Act 2003, Indian Electricity Rules 1956 and Indian Telegraph Act 1989 as amended from time to time.

**2.1 Site work:**

All works to be carried out in workman like manner to minimize interference to farming. In particular excavations must be guarded. Watercourses, drains etc., must be kept clean and must not be allowed to become blocked with site material. Adequate precautions must be taken to prevent damage or injury to persons and live stock.

**Animals:**

No animal shall be brought on or near to the site.

**Site Damage**

Land damage should be confined to as small an area as possible. Poles and other materials should be placed alongside access routes as close to pole position as possible and neatly stacked. Where the making of conductor joints necessitates the cutting back of conductor strands, tarpaulin sheets must be used for the collection of conductor strand trimmings etc. any dangerous material such as wire trimmings, barbed wire, crates etc must not be left on site.

**Storage**

Way leave and / or access facilities do not allow for long term storage of materials on site. Materials must be tidily stored. All waste material must be removed from site by the end of the working day. .

**Pumping:**

The Contractor is responsible for piping or channeling all pumped water from excavations to the nearest ditch, to avoid damage to crops and neighbouring land and they will be held responsible for the cleaning out the ditch should this become silted up due to pumping operations.

**Care of soils in un-surfaced land**

When the carrying out of works will have an adverse effect on the physical condition of agricultural and other un-surfaced land, the works should be planned to reduce the occupation time to a minimum.

Low ground pressure vehicles to be used by the Contractor to minimize damage to the soil structure. All excavated soils should be reinstated in the correct sequence.

When back filling is completed sufficient top soil should be heaped over the excavation(s) to allow for settlement.

**Site Maintenance**

Particular attention should be paid by the Contractor and his workmen to public relations. These involve ensuring that farm roads or tracks kept clear of obstructions. No Dogs or other animals are to be brought on site.

**3. Definitions**

The following definitions apply to the specification, design and construction of over headlines:

**Auxiliary Equipment**

Equipment other than that forming part of this line design which may be placed on supports, such as transformers, switchgear etc.

**Average Span**

The arithmetic average length of a number of spans in a line or section of line.

**Basic Span / Ruling Span**

The span length adopted for sag / tension calculations.

**Maximum Span**

The maximum span length permitted using normal conductor spacing.

**Conductor**

Any conductor of electrical energy

**LTDistribution Line**

A line fed from a distribution transformer, providing a supply to more than one customer, separately tapped.

**Conductor Down pull**

The vertical loading imposed by the conductors corresponding to a gradient measured between adjacent points of support.

**Engineer**

Means the person appointed by the Employer (TGSPDCL) to act as Engineer for the purposes of this contract.

**Contractor**

Contractor is the person whose tender has been accepted by the Employer and the legal successors in title to the Contractor but not (except with the consent of the Employer) any assignee of the Contractor.

**Failure Containment**

Provision of a double pole structure and stays at strategic points along the line to prevent cascade failure along the entire line.

**Flying Stay**

Flying Stay is providing a horizontal load to an angle support where it is impractical to use the conventional method of staying.

I**ntermediate Support**

A support in a straight run of a line on which the conductors are supported on pin insulators.

**Offset Arrangement**

An arrangement where the conductors are supported offset from the pole by means of a side arm and strut

**Over Tensioning**

Excess tension applied above normal theoretical design tension at the time of erection.

**Pre Tensioning**

The tension treatment applied to a conductor before final erection tension is established.

**Recommended Span**

The average span length in any section to which the line should be planned individual spans will normally be within +10% to -20% of the chosen basic span.

**Sag**

The vertical distance, under any system of conductor loading, between the conductor and a straight line joining adjacent supporting points, measured mid-span.

**Span**

The horizontal distance between two adjacent supports.

**Stay**

High tension steel wire with insulators and fittings that transfers the pole top conductor tension to the ground anchor maintaining the balance of the structure.

**Strut**

Any support that carries a compressive force caused by conductor tension.

**11 kV Trunk Line**

Main 11 kV line from the 33 kV substation to the tail end of the 11 kV line.

**11 kV Spur Line**

All tapping 11 kV lines from the 11 kV trunk line.

**Cum-a-long clamp**

A clamping device which is attached to and holds the conductor during tensioning.

**Terminal support or Dead End Support**

A support at which the conductors are terminated on one side of the support only.

**Termination**

The end of the conductor which is securely fixed to an end fitting.

**Wind loading span**

The wind loading span associated with any support is half the sum of the spans adjacent to the support.

**4.Survey of the Route**

Over head lines are mainly routed over private property consisting of farm land, gardens, buildings, forests, play grounds and parks. Hence it is the duty of the Contractor to carry out site work with due care and attention to avoid any type of inconvenience to land owners or public.

The Contractor is required to conduct reconnoiter survey of the area in which the line has to pass. The main aim of the survey is to find out most economic route. While surveying the following points should be kept in view.

Shortest route practicable as near to the road as possible to facilitate easy transport of materials, easy erection and easy maintenance.

Future load growth

The number of angle points should be minimum.

Failure Containment – Cutpoints / DP angle poles.

The areas to be avoided are Proximity to aerodromes

Natural hazards like steep valleys, hills, forests etc and lakes, gardens, playing grounds.

Difficult crossings such as rivers, railway lines.

Restricted access for transport vehicles.

Buildings containing explosives

Sensitive areas such as wild lands, bird or wild life sanctuaries, bird habitants, culturally and historically important resources.

Care to be taken to see that tree cutting and compensation is minimum.

Having provisionally fixed the route on the survey map, Contractor has to carry out the detailed survey with theodalite and angle points are to be fixed and marked with survey stones. Then a route map is to be prepared by the Contractor showing the proposed line and various railway lines, communication lines, EHT lines, rivers and stream crossing on Survey of India map 1:50,000.

All LT lines along with pole locations ae to be marked on Adangal map / Patwari map of that particular village (16” = 1 mile)

After fixing the angle points, intermediate spans are to be fixed, keeping the spans uniform in length. They shall be as near as possible to the basic design span, indicated in the schedule.

In hilly areas poles are to be provided on ridges to maintain proper ground clearance. Poles should not be placed along the edges, cuts or embarkment or along the banks of creaks of streams.

Failure containment poles are to be provided at 1.0 km length for 11 kV and 33 kV lines.

For 11 kV and 33 kV lines, the Contractor must provide a ground profile with pole positions. Conductor sags and ground clearances marked for approval by the Engineer.

Contractor is responsible for any damage caused due to protruding pegs marked during survey.

**4.1 Provide Failure Containment**

A failure containment structure shall be provided every 1000m to prevent cascade failure along the entire line. A failure containment structure shall be one of the following.

An in-line double pole stayed in both directions – Drawing No H9 and H 16

A double pole section angle DRG No H 13 and M 15

A four pole section angle Drawing H 14 and M7

A double pole dead end drawing H 15.

**4.2 Way Leaves**

After finalization of the route, the Contractor shall submit proposals for way leaves and right of way to TGSPDCL for approval by the following bodies:

State level power telecommunication coordination committee.

Railway authorities if it involves railway crossing.

Forest authorities if it passes through forest areas.

Airport authorities if the line is nearer to airport.

If the line has to pass through prohibited areas (like pulicot lake etc.,) permission to be taken from competent authorities.

**4.3 Tree Cutting**

Tree cutting shall be done by the Contractor as mentioned below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No** | **Voltage** | **Tree Clearance Required** | **Relaxation** |
| 1. | LT | All growth within 3.1 m on either side of the line and all trees that may fall and foul the line | NIL |
| 2. | 11 kV Spur lines | All growth within 4.6 m on either side of the line and all trees that may fall and foul the line | In case of betal leaf gardens 3.1 m on either side of the line. |
| 3. | 11 kV trunk lines and 33 kV lines | All growth within 6.1 m on either side of the line and all trees that may fall and foul the line | NIL |

The Contractor has to mark the trees for felling, by a ring of white paint at one meter height from ground level and submit the proposals to the Engineer for obtaining permission from competent authorities.

If the line has to pass through gardens, orchards requiring tree cuttings, TGSPDCL must pay compensation to the owners as fixed by the concerned authorities (Department of Horticulture or department of forest etc.,) before tree cutting.

The Employer will obtain permission within reasonable time after submission of proposals by the Contractor. The Contractor shall arrange for tree cutting or tree branches cutting also without any extra claim.

The Contractor shall take all possible steps to see that standing crops etc. are not damaged while attending to tree cutting. When such damage is inevitable, the Contractor shall inform and obtain the prior permission of the Engineer for the financial commitment and trees shall not be cut, until the Employer has made necessary arrangements with the authorities concerned and permission is given to the Contractor to fell such trees. The Contractor shall arrange to remove the cut trees as soon as possible, stack them neatly in one place and hand over to the Employer.

TGSPDCL will endure to obtain rights of way for excavation of pole pits, Tree cutting etc prior to Contractor starting the work. Where the necessary permissions are delayed by the owner of the land TGSPDCL shall not be liable for any delay caused to the Contractor’s work programme and the Contractor shall be expected to shift gangs to other areas.

The rates quoted shall cover all such contingencies and no extra payment is allowed.

**4.4 Final Approval for Commencement**

The Engineer shall give final approval in writing for the route before the Contractor may start work.

The Contractor shall not commence the work until the final approval of the route map is given by the Engineer in writing to the Contractor.

**4.5 Liaison with other authorities**

Before undertaking any work on trunk roads, railways or telecommunication lines, permission is to be obtained from relevant authority.

**5.0 Clearances**

Minimum clearances to power conductors are to be maintained as per I.E Rules 1956. These minimum clearances are statutory and shall be maintained at all times.

For the purpose of arriving at the vertical clearance, the maximum sag is to be calculated taking into account the highest conductor temperature as specified in the sag tables.

For the purpose of arriving at the horizontal clearance, the maximum deflection of conductor based on the maximum wind pressure in the zone is to be taken into account or deflection upto 45o from the vertical towards the object is to be assumed and clearances measured. The clearances apply in any direction.

The angle of crossing of power and telecom lines shall be as near to the right angle but not less than 60o in any case.

Standard guarding is to be provided and earthed at crossings of telecom lines and power lines.

Special consideration needs to be given to all clearances in the vicinity of recreation sites.

For crossing any railway track Indian Electricity Rules and the regulations of railway authorities are to be followed.

An additional vertical clearance of 300 mm must be allowed to compensate for long term creep than those mentioned in the charts.

**5.1 Clearances to Ground and Roads**

**(Distance in Meters)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No** | **Item** | **LT** | **11 kV** | **33 kV** |
| 1. | Minimum vertical clearance to over head line conductor |  |  |  |
|  | a) Across the street | 5.8 | 6.1 | 6.1 |
|  | b) Along the street | 5.5 | 5.8 | 5.8 |
|  | c) At other places than mentioned in (a) and (b) | 4.6 | 5.2 | 5.2 |

**5.2 Maximum Span**

In case of overhead lines carrying LT, 11 kV and 33 kV voltage conductors, when erected in, over, along or across **any street**. The maximum span shall not exceed **60 m**.

**5.3 Clearances to Buildings**

**(Distance in Meters)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No** | **Item** | **LT** | **11 kV** | **33 kV** |
| 1. | Minimum Vertical clearance to Buildings | 3.0 | 3.7 | 3.7 |
| 2. | Minimum Horizontal clearance to buildings | 1.22 | 1.22 | 1.82 |

**5.4 Clearances to communication lines**

**(Distance in Meters)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No** | **Item** | **LT** | **11 kV** | **33 kV** |
| 1. | Minimum Vertical clearance between power and communication lines | 1.38 | 2.14 | 2.44 |

**5.5 Clearances between Power Lines when crossing each other**

**(Distance in Meters)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.No** | **Voltage** | **LT** | **11 kV** | **33 kV** |
| 1. | LT lines | 2.44 | 2.44 | 2.44 |
| 2. | 11 kV and 33 kV | 2.44 | 2.44 | 2.44 |
| 3. | 132 kV | 3.05 | 3.05 | 3.05 |
| 4. | 220 kV | 4.58 | 4.58 | 4.58 |
| 5. | 400 kV | 5.49 | 5.49 | 5.49 |
| 6. | 800 kV | 7.94 | 7.94 | 7.94 |

**5.6 Clearances to Railway Track**

Railway crossings are classified into three categories as mentioned below:

|  |  |  |
| --- | --- | --- |
| Category ‘A’ | : | Tracks electrified on 1500 volts DC System (E.g.: Bombay city area) |
| Category ‘B’ | : | Tracks already electrified and likely to be electrified on 25 kV AC System in near future. |
| Category ‘C’ | : | Tracks not likely to be electrified in the foreseeable future. |

**Special Note:**

These are the minimum clearances to be maintained to the lowest portion of any conductor of crossing including guarded wire under conditions of maximum sag.

Lines drawn upwards from the outer most guard wire to the center at an angle of 45o to the vertical, shall totally enclose the power conductors.

The structures are to be located in such a way that from the centre of the nearest railway track the distance shall be height of the structures +6 meters.

The span of crossing is to be restricted to 80% of the normal span.

No jointing is permitted in the crossing span.

The crossing shall be in accordance with approved designs and drawings of Railways.

UGCable pipe structure should be at 5 m away from Railway Power Support to be located by the Railway Authorities

Spun concrete pipe encasing cable under tracks should be laid at not less than 1 meter below

**5.7 Method of crossing**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No** | **Voltage** | **Category** | **Method of Crossing** |
| 1 | LT | A,B,C | Cable crossing |
| 2 | 11 kV | A,B,C | Cable crossing |
| 3. | 33 kV | A,B,C | Cable crossing or over head crossing as preferred by the owner (Transco) |

**5.8 Minimum clearance between Railway track and overhead lines**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No** | **Voltage** | **Inside Station limits** | **Outside station limits** |
| 1 | LT | Only by cable crossing | Only by cable crossing |
| 2 | 11 kV | Only by cable crossing | Only by cable crossing |
| 3. | 33 kV | 15.3 m | 14.1 m |
| 4. | 132 kV | 16.2 m | 14.6 m |
| 5. | 220 kV | 17.1 m | 15.4 m |

**5.9 Insulators to be used**

|  |  |  |
| --- | --- | --- |
| S.No | Category | Type of Insulators |
| 1. | A,B | Double set of strain insulators strings shall be used in the crossing span in conjunction with a yoke plate wherever necessary. In each string one strain insulator shall be provided extra than the normal design of over head line. |
| 2. | C | Insulators as per normal design to be used. |

**5.10 River Crossing**

In the rivers on which the crossing is to be done, the data of highest flood level of atleast 20 previous years is to be obtained from the Revenue / Irrigation department.

Minimum clearance of 3 m would be required for the conductors over the highest flood level.

Double pole, tripole or towers would be required to be specially designed, depending upon the span and conductor size for the river crossing.

Structures should be located at such places that they could be approached under flood condition also. The foundation of structure should be sound so that it may not get eroded or damaged due to rain water.

In case of navigable rivers, consultation with navigation authorities is necessary. The structures should be designed as to give sufficient clearance between lowest conductor and the highest flood level.

**6.0 Excavation of pits for poles and stays**

After receipt of approved, route map from the Engineer and after marking the pole locations with pegs, the Contractor has to commence the excavation work in accordance with the approved route map. The excavation is to be done by manual or mechanical tools. At locations where blasting is involved using explosives, prior approval of the Engineer is to be taken. Due to any special reasons if the permission is not given for blasting, it is the responsibility of the Contractor to use other methods and complete the excavation as per the specification.

The rate for excavation of pits for poles, stays quoted by the Contractor shall be the same for all types of soils including de-watering of pits, shoring, shuttering and blasting where ever necessary. No extra rate for dewatering, shoring, shuttering and blasting will be entertained.

The pits for the supports shall be excavated in the direction of the line, as this will facilitate the easy erection of supports, in addition to giving greater lateral stability. The pits are to be excavated to a size of 1.2 meters x 0.6 meters with its longer axis in the direction of line. Planting depth of pole over the base concrete shall be as mentioned below.

**Planting depth of poles**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Length of pole (m)** | **Planting depth in ground (m)** | **Exceptions** |
| 1 | 8.0 | 1.5 | In wet soil and black cotton soil depth may be increased by 0.2 to 0.3 m and wind span limited |
| 2 | 9.0 | 1.5 |
| 3 | 9.5 to 11.0 | 1.8 |
| 4 | 11.5 to 13.0 | 2.0 |

The excavation of stay pits shall be as per the “GUY ASSEMBLY” drawing enclosed to the specification (G6 to G12).

**6.1 Foundations**

Depending on type of soils, the sub soil water table and the presence of surface water five types of foundation designs will be used for locations classified in the following manner.

**6.1.1 Wet type**: To be used for locations

Where sub soil water is met at 1.8 meters or more below the ground level.

Which are in surface water for long period with water penetration not exceeding one meter below the ground level e.g.: paddy fields.

In black cotton soils

**6.1.2 Partially Submerged Type**

To be used at locations where sub soil water is met at more than 0.90 meters from the ground level.

**6.1.3 Fully Submerged Type**

To be used at locations where sub-soil water is met at less than 0.90 meters from the ground level.

**6.1.4 Rocky Type**

To be used at locations where hard rock is met with and where the bond strength between the rock and the concrete will be very high.

**6.1.5 Dry Type**

When the subsoil water is met at more than 1.8 meters below the ground level and only dry crops are raised and soils are normal dry cohesive or non cohesive.

The Contractor shall furnish a statement of type of foundations to be used for each location for approval by the Engineer. The factor of safety for foundations shall be atleast 2.20

**6.2 Base Concreting**

After the excavation of pole pits is completed, their alignment is to be checked once again. After satisfying with their alignment a pre cast R.C.C Base plate of size 450x450x75 mm (Drawing No G7) shall be put in the pit.

Alternatively cement concrete padding of 75 mm depth with 1:2:4 mix (M15 grade) may be laid, to increase the surface contact between the pole and the soil.

The leveling of Base plate / cement concrete padding shall be checked to ensure a level base for erection of the pole. The design details of the R.C.C Base plate are furnished in the enclosed drawing (G7). If cement concrete padding is provided, curing of concrete is to be done for a period of 14 days by covering the concrete with gunny bags.

**6.3 Pole Erection**

The Contractor should provide a method statement detailing the proposed method of erecting each size of pole for approval by the Engineer before erecting any poles.

**For the guidance of Engineer**

The general methods adopted for pole erection are mentioned below:

### Derrick Pole Method

The pole is laid out along the line route in such a way that the bottom of the pole is above the pit. For smooth sliding and perfect placement of pole in the pit an inclined trench to suit the pole width may be dug as shown in the sketch. A piece of MS Channel of size 100 x 50 mm may be placed in the inclined position at the end of the pit for enabling the pole to slip smoothly inside the pit.

The trench would facilitate pole to skid smoothly into the pit without jerks.

Derrick pole supported by a rope is erected vertically so that its leg is near the bottom of the pole. The pole is to be oriented so that strongest side takes the load during lifting.

Two side pulling ropes (Rope 1) are connected near the top of the pole so that the pole does not bend laterally during erection. Another rope (Rope 2) is tied at the top of the support and passes over the Derrick pole over a pulley and is pulled manually in the direction shown in the figure. A rope 3 is tied at the top of the pole and is pulled when the pole has risen about 45o from the ground level. To raise the support in position rope 2 is pulled and the pole slides down the pit on the channel. Finally rope 3 is also pulled till the pole stands vertical. Rope one is all the time kept tight. The pole is held vertical by means of ropes 1, 3 and 4. When the pole reaches the vertical position it is plumbed and adjusted if necessary by means of various ropes so that the pole comes in complete alignment and is in plumb. The pit is back filled in layers taking care to Ram the earth in one layer at a time. In loose soil special foundation may be necessary. Boulders may be used to give additional support to the poles wherever necessary.

It should be ensured that at the time of erection, four men are at the ropes and the superior should be at a distance for guiding correct position so that in the event of breaking of rope, if the pole falls, it will not result into an accident.

Erection procedure for double pole structures also is similar to the one described above except that 2 pits are made in the ground and two Derricks and two sets of ladders as necessary are required.

If required, cross arms and top cleats also may be fixed to the poles before they are erected. After the first rainy season inspection shall be made of the foundation and the pits shall be back filled with the earth and rammed well whenever the first filling is sunk due to the rains.

As the poles are being erected from one cut point to the next angle point the alignment of poles should be checked and set right by visual check. The verticality of the pole should be check with spirit level. The facing of the pole in the transverse direction also shall be checked carefully, so that the cross arm will be exactly at right angle to the line direction. After the poles have been set in position pit is to be filled with earth / concrete as per the requirement and the temporary anchors and ropes are to be removed.

### Deadman’s Method

The pole is laid out along the line route. Channel is placed vertically at the back of the pit and the pole is moved forward till it rests against the channel. The pole is then raised manually and is supported on the dead man. The ropes are attached to the pole at a distance more than half the length of the pole from the butt. The pole is raised and the Deadman is moved forward until the pole spike or a ladder approximately three meters in height can be put in.

The ladder is used to take the first lift and Deadman is moved forward. The ladder is moved forward and another ladder approximately four meters in height or a pole-spike is put in. Deadman is now removed and the side guys are tightened to prevent the pole from swinging. Another ladder of approximately five meters height is introduced and lifts are taken alternatively with each ladder until the pole reaches an angle approximately 70o from the horizontal. The back and side guys are slackened. The front guy is tightened and the back guy is slack to the pole is pushed upto vertical position. The 5 meter ladder will be required only if the pole height is more than about 12 meters. The pole is then carefully plumbed with the help of guy rope and the butt of the pole is lined in with the poles already erected and the next to be erected. The pit is then filled in with the soil and rammed. Special boulders may be used to give additional support to the poles.

**7. Position of Pole**

All poles in the tangent / intermediate locations shall be positioned in the pit that the bigger section modulus of the pole is always transverse to the length of the line. At tension points the bigger section modulus of the pole shall be in the length of the line.

**8. Back Filling**

Back filling shall normally be done with excavated soil, unless it consists of large boulders / stones in which case the boulders shall be broken to a maximum size of 80mm. The back filling materials should be clean and free from organic or other foreign materials. The earth shall be deposited in maximum 200 mm layers, levelled and wetted and rammed properly before another layer is deposited.

**9. Erection of Double pole (D.P) Structure**

For 11 kV and 33 kV lines tension points are to be provided at angle points where the angle of deviation is more than 10 degrees. In straight runs tension points are to be provided at intervals of one Kilometer. Double Pole structures shall be provided at all tension points. The materials to be used and their sizes and measurements are shown in the enclosed drawings.

Double pole structure is to be erected in the bisection of the angle of deviation. The center to center spacing of the supports shall be 1500 mm. Double pole structures is to be erected as per the drawings enclosed to the specification (H9 for 11 kV and M6 for 33 kV)

The Contractor shall provide a method statement detailing the proposed method of erecting the DP structure for approval by the Engineer before erection.

After erection of the D.P Structures, earthing of these supports is to be done as per the specification and the poles are to be concreted with 1:3:6 ratio cement concrete using 20/38 mm granite metal.

**Locations to be concreted**

All angle locations to be concreted.

All tension locations to be concreted

All tapping poles to be concreted

Locations in the valleys where uplift is anticipated are to be concreted.

All fully submerged locations to be concreted

Alternate poles of partially submerged and wet locations to be concreted.

Every fourth dry location to be concreted.

The size of concrete shall be as mentioned below:

|  |  |  |
| --- | --- | --- |
| **S.No** | **Size of Support** | **Size of Concrete** |
| 1. | 8.0 m PSCC | 0.76 x 0.76 x 1.52 m |
| 2. | 9.0 m to 9.5 m PSCC | 0.76 x 0.76 x 1.83 m |
| 3. | 11.0 m spun poles | 0.75 x 0.60 x 2.0 m |

Curing of concrete is to be done for 14 days by covering the concrete with gunny bags and the balance portion of the pit shall be back filled with earth. The back filling shall be done as per the specification.

**10. Anchoring and Providing Guys for Supports**

Guys are to be provided to counter balance the load on the supports due to pulling of the conductors, so that the supports remain straight in vertical position without bending in any direction.

The guys shall be provided at the following locations.

Angle locations

Dead end locations

Tee off points

Steep gradient locations to avoid uplift on the poles

Two numbers storm guys to the central pole between two cut points perpendicular to the line direction.

The installation of stay will involve the following works:

Excavation of pit

Fixing of base plate to the stay rod and concreting and back filling of the pit.

Fastening guy wire to the support along with stay clamp and turn buckle, after fixing guy insulator(s) as per the drawing.

Tightening guy wire and fastening to the anchor.

The marking of the guy pit for excavation, the excavation of pits and setting of the anchor rod must be carefully carried out. The stay rod shall be placed in a position such that the angle of inclination of the rod with the vertical face of the pit is 45o.

The anchor plate shall be of size 450 x 450 x 75mm, made of RCC with 1:2:4 ratio and using 20mm machine crushed granite metal. Alternatively MS Plate of size 450 x 450 x 10mm may also be used. The pit shall be filled with 1:2:4 cement concrete using 20mm granite metal. The size of concrete block shall be 600x600x600mm at the bottom covering the anchor plate completely. The concrete shall be cured for 14 days and balance portion of the pit back filled with earth as per the specification 10.0.

Proper form of moulds adequately braced to retain proper shape shall be used. The moulds should be made water tight so that cement cream will not come out. After concreting to the required height the top surface should be finished smooth, with 1:6 slope towards the outer edge to drain off water.

In wet locations, submerged locations and marshy locations the site shall be completely dewatered during concreting and for 24 hours after completion. Moulds shall not be removed before a lapse of 24 hours after completion of concreting. After removal of form boxes, the concrete surfaces where ever required shall be plastered with a rich mix of cement and sand mortar in the shortest possible time.

After the curing time of concrete is over, the free end of the guy wire is passed through the eye of the anchor rod, bent back parallel to the main portion of the guy and bound after inserting the GI Thimble. The loop is protected by GI Thimble where it bears on the anchor rod. Where the existence of guy wire proves hazardous, it should be protected with suitable asbestos pipe of 50 mm dia and 2 m length, filled with concrete, duly painted with black and white stripes with enamel paint of approved quality and make, so that it may be visible at night.

The Turn buckle shall be mounted at the pole end of the stay and guy wire so fixed that the eye bolt is half way in the working position, thus giving the maximum movement for tightening or loosening.

Guy insulators shall be provided to prevent the lower part of the guy from becoming electrically energized by contact with the upper part of the guy, when the conductor snaps and falls on them or due to leakage. No guy insulator shall be located at less than 3.5 m (vertical distance) from the ground. The minimum distance along the stay between the point of contact with the pole and the top of stay insulator is 1.8 m.

Guy insulators shall comply with IS:5300.

Where stay angles of less than 45o are unavoidable the use of stay angles from 30o to 44o or bow guys or flying stays shall only be done with the approval of the Engineer. The anchoring and providing of guys for supports shall be done as per the drawing no G11.

Two numbers guy insulators are to be provided for 33 kV line.

The stay wires used for anchoring shall conform to IS:2141. The individual wire used to form “stranded stay wire” is to be of tensile grade 4 having minimum tensile strength of 700N /mm2.

11.1 The Sizes of stay wire used shall be as mentioned below:

|  |  |  |
| --- | --- | --- |
| **S.No** | **Size of Wire** | **Safe working load** |
| 1. | 7/2.5 or 7/12 | 920 kg |
| 2. | 7/3.15 or 7/10 | 1450 kg |
| 3. | 7/4.0 or 7/8 | 2340 kg |

**11.2 Stays for 55 mm2 AAAC**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 11kV 55 mm2 AAAC3 Wire | | | | | |
| Pole Type | **Angle of Deviation** | **30o Stay Angle** | | **45o Stay Angle** | |
|  |  | **No** | **Size** | **No** | **Size** |
| Single H6 | 10o | 1 | 7/8 | 1 | 7/10 |
| Single H13A | 20o | 3 | 7/8 | 3 | 7/10 |
| Single H13A | 30o | 3 | 7/8 | 3 | 7/10 |
| Double H13B | 40o | 5 | 7/10 | 5 | 7/10 |
| Double H13B | 50o | 5 | 7/10 | 5 | 7/10 |
| Double H13B | 60o | 5 | 7/10 | 5 | 7/10 |
| Four pole H14 | 70o | 4 | 7/8 | 4 | 7/10 |
| Four pole H14 | 80o | 4 | 7/8 | 4 | 7/10 |
| Four pole H14 | 90o | 4 | 7/8 | 4 | 7/10 |
| Double H15 | Dead End | 4 | 7/8 | 2 | 7/8 |
| **11kV 55 mm2 AAAC 3 Wire + 30mm2 Earth Wire** | | | | | |
| Pole Type | **Angle of Deviation** | **30o Stay Angle** | | **45o Stay Angle** | |
|  |  | **No** | **Size** | **No** | **Size** |
| Single H6 | 10o | 1 | 7/8 | 1 | 7/10 |
| Single H13A | 20o | 3 | 7/8 | 3 | 7/10 |
| Single H13A | 30o | 3 | 7/8 | 3 | 7/10 |
| Double H13B | 40o | 5 | 7/10 | 5 | 7/10 |
| Double H13B | 50o | 5 | 7/10 | 5 | 7/10 |
| Double H13B | 60o | 5 | 7/10 | 5 | 7/10 |
| Four pole H14 | 70o | 4 | 7/8 | 4 | 7/10 |
| Four pole H14 | 80o | 4 | 7/8 | 4 | 7/8 |
| Four pole H14 | 90o | 4 | 7/8 | 4 | 7/8 |
| Double H15 | Dead End | 4 | 7/8 | 2 | 7/8 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **11 kV 55 mm2 AAAC 4 Wire** | | | | | |
| Pole Type | **Angle of Deviation** | **30o Stay Angle** | | **45o Stay Angle** | |
|  |  | **No** | **Size** | **No** | **Size** |
| Single L7/8/9/10 | 10o | 1 | 7/8 | 1 | 7/8 |
| Single L11 | 20o | 2 | 7/8 | 1 | 7/8 |
| Single L11 | 30o | 2 | 7/8 | 2 | 7/8 |
| Single L12 | 40o | 3 | 7/8 | 2 | 7/8 |
| Single L12 | 50o | 3 | 7/8 | 2 | 7/8 |
| Single L12 | 60o | 4 | 7/8 | 3 | 7/8 |
| Single L13 | 70o | 4 | 7/8 | 3 | 7/8 |
| Single L13 | 80o | 4 | 7/8 | 3 | 7/8 |
| Single L13 | 90o | 5 | 7/8 | 3 | 7/8 |
| Single L15/16/17 | Dead End | 4 | 7/8 | 2 | 7/8 |
| **11 kV 55 mm2 AAAC 5 Wire** | | | | | |
| Pole Type | **Angle of Deviation** | **30o Stay Angle** | | **45o Stay Angle** | |
|  |  | **No** | **Size** | **No** | **Size** |
| Single L7/8/9/10 | 10o | 2 | 7/8 | 1 | 7/8 |
| Single L11 | 20o | 2 | 7/8 | 2 | 7/8 |
| Single L11 | 30o | 3 | 7/8 | 2 | 7/8 |
| Single L12 | 40o | 3 | 7/8 | 2 | 7/8 |
| Single L12 | 50o | 4 | 7/8 | 3 | 7/8 |
| Single L12 | 60o | 4 | 7/8 | 3 | 7/8 |
| Single L13 | 70o | 5 | 7/8 | 4 | 7/8 |
| Single L13 | 80o | 5 | 7/8 | 4 | 7/8 |
| Single L13 | 90o | 6 | 7/8 | 4 | 7/8 |
| Single L15/16/17 | Dead End | 4 | 7/8 | 3 | 7/8 |

**11. 3 Stays for 100 mm2 AAAC**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 11& 33 kV 100 mm2 AAAC3 Wire | | | | | |
| Pole Type | **Angle of Deviation** | **30o Stay Angle** | | **45o Stay Angle** | |
|  |  | **No** | **Size** | **No** | **Size** |
| Single H6 | 10o | 1 | 7/8 | 1 | 7/8 |
| Double H13B | 20o | 5 | 7/10 | 5 | 7/10 |
| Double H13B | 30o | 5 | 7/10 | 5 | 7/10 |
| Double H13B | 40o | 5 | 7/10 | 5 | 7/10 |
| Double H13B | 50o | 5 | 7/8 | 5 | 7/10 |
| Double H13B | 60o | 5 | 7/8 | 5 | 7/10 |
| Four pole H14 | 70o | 8 | 7/8 | 4 | 7/8 |
| Four pole H14 | 80o | 8 | 7/8 | 4 | 7/8 |
| Four pole H14 | 90o | 8 | 7/8 | 4 | 7/8 |
| Double H15 | Dead End | 4 | 7/8 | 4 | 7/8 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **11& 33 kV 100 mm2 AAAC 3 Wire + 55mm2 Earth Wire** | | | | | |
| Pole Type | **Angle of Deviation** | **30o Stay Angle** | | **45o Stay Angle** | |
|  |  | **No** | **Size** | **No** | **Size** |
| Single H6 | 10o | 2 | 7/10 | 1 | 7/8 |
| Double H13B | 20o | 5 | 7/10 | 5 | 7/10 |
| Double H13B | 30o | 5 | 7/8 | 5 | 7/10 |
| Double H13B | 40o | 5 | 7/8 | 5 | 7/10 |
| Double H13B | 50o | 5 | 7/8 | 5 | 7/8 |
| Double H13B | 60o | 6 | 7/8 | 5 | 7/8 |
| Four pole H14 | 70o | 8 | 7/8 | 8 | 7/8 |
| Four pole H14 | 80o | 8 | 7/8 | 8 | 7/8 |
| Four pole H14 | 90o | 8 | 7/8 | 8 | 7/8 |
| Double H15 | Dead End | 6 | 7/8 | 4 | 7/8 |

**11.4 Stays for 148 mm2 AAAC**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 11 & 33 kV 148 mm2 AAAC3 Wire | | | | | |
| Pole Type | **Angle of Deviation** | **30o Stay Angle** | | **45o Stay Angle** | |
|  |  | **No** | **Size** | **No** | **Size** |
| Single H6 | 10o | 2 | 7/8 | 1 | 7/8 |
| Double H13B | 20o | 5 | 7/8 | 5 | 7/8 |
| Double H13B | 30o | 5 | 7/8 | 5 | 7/8 |
| Double H13B | 40o | 5 | 7/8 | 5 | 7/8 |
| Double H13B | 50o | 6 | 7/8 | 5 | 7/8 |
| Double H13B | 60o | 7 | 7/8 | 5 | 7/8 |
| Four pole H14 | 70o | 8 | 7/8 | 8 | 7/8 |
| Four pole H14 | 80o | 8 | 7/8 | 8 | 7/8 |
| Four pole H14 | 90o | 8 | 7/8 | 8 | 7/8 |
| Double H15 | Dead End | 6 | 7/8 | 6 | 7/8 |
|  |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **11 & 33 kV 148 mm2 AAAC 3 Wire + 55mm2 Earth Wire** | | | | | |
| Pole Type | **Angle of Deviation** | **30o Stay Angle** | | **45o Stay Angle** | |
|  |  | **No** | **Size** | **No** | **Size** |
| Single H6 | 10o | 2 | 7/8 | 2 | 7/8 |
| Double H13B | 20o | 5 | 7/8 | 5 | 7/8 |
| Double H13B | 30o | 5 | 7/8 | 5 | 7/8 |
| Double H13B | 40o | 6 | 7/8 | 5 | 7/8 |
| Double H13B | 50o | 7 | 7/8 | 5 | 7/8 |
| Double H13B | 60o | 8 | 7/8 | 6 | 7/8 |
| Four pole H14 | 70o | 8 | 7/8 | 8 | 7/8 |
| Four pole H14 | 80o | 12 | 7/8 | 8 | 7/8 |
| Four pole H14 | 90o | 12 | 7/8 | 8 | 7/8 |
| Double H15 | Dead End | 8 | 7/8 | 6 | 7/8 |

**12. The details of main components of guy assembly to be used are:**

1. **Anchor Plate**: R.C.C plate of size 450x450x75mm with M150 grade

2. **Anchor Rod**: 16 φ 1800mm length for 7/12 stay wire.

20 φ 1800mm length for 7/8 or 7/10 stay wire

3. **Eye Bolt** 20 φ 450 mm length with two Nos hexagonal nuts

4. **Turn buckle** 16 φ rod for 7/12 stay wire

20 φ rod for 7/8 and 7/10 stay wires

|  |  |
| --- | --- |
| **Cross channel for turn buckle** | 75 x 40 channel or 65x65x6 angle for 7/12 stay wire  100 x 50 mm channel for 7/10 and 7/8 stay wires. |
|  |  |

The measurements of each component shall be as per the drawings enclosed.

**13.0 Fabrication of pole fittings:**

All the pole fittings are to be fabricated with the approved quality steel conforming to IS:2062 and IS:1852by using suitable machines for cutting, drilling, bending, welding and for grinding the sharp edges. The finished products shall appear neatly and elegantly to the satisfaction of Engineer in charge of works. Fabrication shall conform to clause 32 to 39 of IS : 800.

All M.S.Parts shall be hot dip galvanished conforming to IS:2629 and IS:4759

**13.1 Fixing of Cross-Arm and Top Clamp**

Type design of ‘V’ cross arms and tapping cross arms for 11 kV and 33 kV lines, ordinary cross arms for LT lines, top clamps (top fittings) for 11 kV and 33 kV lines along with the materials to be used are shown in the enclosed drawings. The steel material used for manufacture of the pole fittings shall conform to the relevant ISSpecifications. Fixing of ‘V’ cross arm and top cleat shall be in accordance with the spacing detailed in the drawings.

**13.2 Fixing to the support**

Fixing of cross arms and top cleats before the pole erection is also permissible. These are to be fixed to the support as shown in the drawings. Only GI bolts and nuts and GI Flatwashers and spring washers shall be used for fixing the pole fittings. The bolts and nuts and washers used shall conform to relevant I.S.Specifications. (IS : 67)

**13.3 Fixing of cross arms after pole erection**

For fixing the cross arms after the pole erection, by a skilled workman is also permissible. The Contractor shall provide a method statement detailing the proposed method for fixing to each size and type of pole for approval by the Engineer.

In this method extra care is to be taken to align the pole properly at the time of erection or else the erected pole has to be turned or twisted In back filled earth at a later date when the cross-arm is erected and this will weaken the foundation of the erected pole.

All the materials should be lifted or lowered through the handline and should not be dropped.

**13.4 Fixing of top cleat**

Top cleat for fixing to the support should be as per the drawings enclosed. It shall be hotdip galvanised neatly before fixing.

Additional stay clamp may be provided for better grip in addition to the two numbers through bolts & nuts. Only GI Bolts & nuts and GI Washers shall be used for fixing the top cleat.

**13.5 Offset Arrangement**

Where it is not possible to maintain clearances to Buildings etc., line conductors shall be supported offset from the pole by means of a side arm and strut. In such cases ‘A’ type pedastals fabricated with 50x8 flat shall be used for fixing pin insulators. The rate quoted by the contractor shall include such contingent expenditure also and no extra claim will be entertained on this account. The ‘A’ type pedastal to be hotdip galvanished before fixing.

**13.6 Size of Flat for clamps**

|  |  |
| --- | --- |
| **Voltage** | **Size of Flat** |
| LT | 50 x 6 mm |
| 11 kV | 50 x 8 mm |
| 33 kV | 75 x 8 mm |

All clamps shall be of hot dip galvanised conforming to IS : 2629 & IS : 1852

**13.7 Special note to spun poles**

Where the cross arm is to be fixed to the spun (circular) pole, additional arrangement is to be made by the contractor to increase the contact area between support and cross arm. The Contractor shall deisgn and submit drawings for this additional arrangement for approval by the Engineer before erection. The cross arm along with this additional arrangement shall be hotdip galvanised before fixing.

The rates quoted by the contractor shall include this additional arrangement also.

**13.8 General**

A rubber packing of 3 to 4mm thickness is to be provided between back clamp and the support. The cross arm shall be perpendicular to the line direction and both ends shall be horizontal to the spirit level.

The contractor shall submit with his bid full specification the quality of zinc to be used stating its percentage purity and the process of galvanisation adopted by him.

**14. Fixing of Insulators**

The pins for insulators shall be fixed in the holes provided in the cross arm and the pole top brackets. The hexogonal nut provided to the pin shall be tightened fully. Spring washer shall necessarily be provided to the pins. The insulators shall be mounted in their places over the pins and tightened. Slacken the Pin and align the top groove of the insulator to the conductor direction – Retighten pin. Strain fittings are to be provided at all tension points. One strap of the strain fittings is placed over the cross arm before placing the bolts in the hole of the cross arms. The nut of the straps is so tightened that the strap can move freely in horizontal direction, as this is necessary to fix the strain insulator. The insulators shall be cleaned and examined for defects before fixing. Insulators with cracks or chips shall not be used. Disc insulators are to be used for 11 kV and 33 kV lines and shackle insulaors for LT lines at all tension points.

**15. Stringing of line conductors**

In conductor erection the main operations are:

Transport of conductor drums to work spot

Paving off the conductor

Jointing of conductors

Tensioning and sagging of conductors

Fixing of tension clamps, pin binding and jumpering.

**15.1 Transport of conducotr drums**

The conductor drums shall be transported to tension point by using motor vehicles. The conductor drums should never be dropped from the vehicles. They are to be unloaded with cranes or by using skids as in the case of loading. In handling transportation and unloading conductor drums shall be protected against injury / damage. If it becomes necessary to roll the drum on the ground for a small distance, it should be slowly rolled in the direction of the arrow marked on the drum.

**15.2 Paving off the conductor**

The paving off (reeling out) the conductors to be done by pulling the conductors from stationery reels. The reels (drums) are to be raised off the ground and fixed at one end of the tension point. The reels are to be supported in their carriages in such a way that they are free to rotate. The conductors are to be pulled out, there by rotating the reels and unwinding the conductors.

The conductor should never be paved out from a non rotating drum or coil as each turn removed gives the conductor a complete twist which may cause kinks or other damage. While unreeling, the conductor should not rub against any metallic fittings of the pole or ground. As the conductor is paved out it is passed through the gloved hands and examined for defects and damage by feel. When the defect is found, paving out is discontinued and the faulty section is either cut out or repaired.

While unreeling, the conductor is to be suspended in air in tension so that it will not touch the ground. The conductor should be passed over the poles on wooden or Aluminum snatch pulley blocks provided with low friction bearings.

Each conductor drum is to be supported on a shaft which permits the reel to rotate while wire is being strung. Each reel shaft shall be provided with an external brake band which is adjusted to prevent over running when wire is being unreeled.

The work shall be so arranged by the contractor that before the end of the day the conductor shall be raised to a minimum height of 5 meters above the ground, by rough sagging

**15.3 Jointing of conductors**

After paving off the conductors, mid span jointing of conductors is to be carried out.

Care to be taken to see that there shall be no joint nearer than 20 m distance to the support.

It is also to be ensured that there shall be no Joints in the Road Crossing or communication lines crossing spans.

The mid span jointing of conductors shall be carried out by using a Spring Loaded automatic splice for all AAAC Conductors.

The Contractor shall provide a method statement detailing the proposed method of Jointing for approval by the Engineer before Jointing, along with manufacturers specification.

Precautions to be followed while jointing

Clean the conductor and sleeve thoroughly to remove the oxides, with a wire brush.

Apply conductor jointing grease to the portion of conductor to be inserted into the joint and repeat the wire brushing through the grease to remove any remaining surface oxide.

Measure and mark the conductor to determine how much must be inserted to reach the center of the splice.

Insert the conductor smoothly to the center stop, referring to the mark to assure complete insertion.

After both ends have been inserted, pull down on the splice to set the Jaws for permanent installation.

Ensure that, after Jointing the conductor and splice are in straight alignment.

**15.4 Tensioning and Sagging**

After paving off and jointing of conductors is completed tensioning operation should be commenced. The Contractor shall provide a method statement detailing the proposed method of tensioning and sagging for approval by the Engineer before commencing tensioning work.

Conductor to be pre-tensioned for two hoursat the 10o C sag; then increase sag to the rated temperature on that day.

**For the guidence of the Engineer**

**Procedure for tensioning and sagging**

First step is to connect one end of the conductor at one end of the tension point (Fixed end) firmly by fixing the tension insulators and tension metal parts as per the standards. Care should be taken kto see that sufficient conductor is left for jumpering. Temporary guys have to be provided for both the anchoring supports in the section. Aluminum tape to be wrapped over conductor at the tension metal parts for proper grip.

As the conductors are reeled out they are hoisted upto the cross arm. This may be done by means of a hand line. Since the cross arms are steel, the conductor should not be allowed to rest on the cross arm, since the conductor would get damaged when drawn over the cross arms during the unreeling and tightening process. Hence the conductors should always be hung in snatch blocks.

A snatch block is a single sheave block so arranged that it opens on as one side there by permitting the conductors to be inserted or removed. The snatch block also aids the conductor in taking a uniform tension through out its length when the conductor is pulled up.

When the conductors are hoisted in their place they are ready to be pulled up. To carry out this operation a come a long clamp is to be fastened to the other end of the line conductor.

The conductor may be pulled from the ground by using manilla rope for initial tensioning and tirfor or chain pulley block or any other pulling and lifting machine of sufficient safe working load for final tensioning. It is better, easier and faster to pull from the ground, since the chain block or tirfor can be operated more easily on the ground than on the pole.

Care should be taken in pullying up that splices and sleeves donot catch in the sleeves of snatch blocks. Any catch of this sort may prevent the conductor from coming up as it should .

At tensioning end, one of the conductors is to be pulled manually upto a certain point and then come a long clamp is fixed to the conductor to be tensioned. The grip of the come a long clamp is attached to the pull lift machine and gradually tensioned.

Immediately after pulling the tension is some what greater near the pulling end than it is at the fixed end. Hence the conductor should be pulled up to pretension (10o C) and allowed to settle for 2–3 hours, otherwise the sag will not be uniform. Also the conductors will be too tight near the pulling end and too loose near the fixed end. If they should be tied in this condition, it should place an unbalanced strian on the poles, cross arms, pin insulators, tie wires and conductors, which might lead to ultimate failure.

The initial stress of the conductor also has to be taken out in order to avoid the gradual increase in sag, due to setting down of the individual wire. This may be done by pulling up the conductor to a tension a little above the theoretical tension for the prevailing temperature and fixed up at that tension with a corresponding reduced sag. After certain time the conductor will settle down to the corect sag and tension. A tension of six to seven percent more than the theoretical value mentioned in the sag tables needs to be given.

Final tensioning and sagging shall be in accordance with the sag and tension chart of the particular conductor used.

It shall be ensured that

Maximum Tension at 0oC with maximum wind pressure and no ice loading not to exceed 50% of the ultimate strength.

Tension at 32.2oC (90oF) and still air not to exceed 25% of the ultimate strength.

The sag should be adjusted in middle span in short sections of line of about five to six spans and at two spans in other sections. Even when the sheaves are used it may be necessary to bounce the conductor at intermediate points with a handline in order to equalise the tension in the various spans. Soaping the conductor grooves at the supports so that the conductor will slide more freely may also be resorted to.

**Method of Measuring sag**

Sagging can be accomplished by sighting. In sighting for sag it is well to select a span near the middle of the length pulled up, which is of similar length to the basic / ruling span. Measurement is by use of targets placed on the poles below the cross arm. The targets may be light strip of wood clamped to the pole at a distance equal to the sag below the conductor when the conductor is placed in snatch block. The line man sees the sag from the next pole. The tension of the conductor is then reduced or increased until, the lowest part of the conductor in the span coincides with the lineman line of sight.

In lengthy sections more than six spans, sag shall be checked in two spans.

**15.5 Fixing of conductor to the support**

The Contractor shall provide a method statement detailing the proposed method of fixing the conductors to the support after tensioning to the desired sagging is done for the approval by the Engineer.

Traditional wrapped terminations may be used to terminate LT Conductors.

Three bolt Anchor clamps shall be used for termination of HT lines upto 80 mm² conductor size and four bolt Anchor clamps shall be used for 100 mm² and above sizes.

For the guidance of the Engineer normal procedure is mentioned below:

When sagging is completed, the tension clamps shall be fixed. The clamp can be fitted on the conductor without releasing the tension. A mark is made on the conductor with PVC steel grip tape at a distance from the cross arms equal to the length of complete strain insulator assembly. Before the insulator set is raised to position all nuts should be free. A come-a-long clamp is placed on the conductor beyond the conductor clamp and attached to the pulling unit. The conductor is pulled in sufficiently to allow the insulator assembly to be fitted to the clamp. After the conductor is clamped to the insulator assembly, the tension may be released gradually. If the tension is released with a jerk, an abnormal stress may be transferred to conductor and support, which may result in the failure of the cross arms, stay or pole in some cases.

After stringing is completed, all poles, cross arms, insulators, fittings conductor joints etc are to be checked up to ensure that there have been no deformities etc.

The temporary guys provided at the anchoring supports may be removed .

The excess conductor is to be cut by leaving sufficient length for jumpering. The ends of the conductor shall be taped properly before cutting.

Once again it shall be checked and ensured that sag is uniform through out the length and sufficient ground clerances are maintained as per IE rules.

**15.6 Tying of conductor on pin insulators**

Helically formed ties conforming to IS : 12048 – 1987 shall be used for securing the conductor on Pin insulator. These ties shall be of a material compatable with the conductor material and dimentions suitable for conductor size.

**Elastomer** tie pad for insulator shall be used with the formed ties to avoid abrasion of the conductor and to prevent conductor coming into direct contact with the insulator.

The Contractor shall provide a method statement detailing the method of pin binding for approval by the Engineer, along with manufacturers specifications.

Precautions

Helical formed ties are precision devices which should be handled carefully to prevent distortion or damage.

Ties should be stored in cartons under cover preferably shelf storage – until used.

1. Helical formed ties should be used.

2. Ensure that correct size tie is used.

3. The lay direction of the tie must be the same as that of the outer layer of the conductor to which it is applied.

## Procedure

The Contractor must use correct size helical formed ties manufactured for the conductor being used (100 mm ties can only be used on 100 mm conductor – they are not range taking). The Elastomer tie pad is placed around the conductor when it rests on the insulator with the slit upper most, there by preventing the contact between the conductor and the insulator. The Contractor should not use undue force or have to bend the ties to make them fit – if he does it is the wrong tie or he is installing it incorrectly. Note also that on small angle the conductor sits on the side of the insulator, than a special side tie has to be used which is different in design from the top tie used in in-line poles when helical formed ties are used there is no need to reinforce the conductor, as is common practice with hand bound ties.

**For guidance of Engineer the normal procedure for hand bound ties (without formed ties ) is mentioned below:**

After the conductor is fixed at the tension points, the next step is to place the conductor on the top of the pin insulators, from the snatch blocks and removing the snatch blocks. This can be done by one person sitting on the cross arm. If it is felt necessary a hand line may be used for this purpose. For placing the conductor in position the pin insulators are provided with top groove and also side groove.

In straight runs of line, the conductos are placed on the top groove of the insulators. When there is a small angle of deviation upto 10o the conductor is placed on the side groove. The conductor shall occupy such a position on the insulator as will produce minimum strain on the tie wire.

Before tying the conductor to the insulators two layers of Aluminum tape should be wrapped over the conductor in the portion where it touches the insulator. The width and thickness of Aluminum tape to be used shall be as specified in the hand books of Aluminum conductor manufacturers. For 11 kV and 33 kV lines main conductor to be reinforced with another conductor piece of 500 mm length and same size and quality as that of main conductor, bent upwards at right angles at both ends to a height of 50mm. The ends of the stiffner piece to be wrapped with Aluminum tape or provided with binding.

# Rules of tying

Only fully annealed tie wire to be used.

SWG No 6 sizeof Aluminum tie wire shall be used.

Sufficient length of tie wire for making the complete tie including an end allowance for gripping with the hands shall be used. Normally the wire length varies from one meter for LT lines to 4 meters in 33 kV lines. The extra length should be cut at each end after the tie is completed. The binding shall be for 400mm length on stiffner piece and 30mm on either end of the stiffner piece.

Tie should provide a secure binding between line conductor, insulator and stiffner piece.

There shall be positive contacts between the line wire and the tie wire so as to avoid any chafing contacts.

Use of pliers shall be avoided

Nicking the line conductor shall be for bidden.

Tie wire which has been previously used shall not be used

Harddrawn or AAAC wires or fire burned wires shall not be used, since they are either partially annealed or injured by over heating.

## Steps for making tie

Bend tie wire around the insulator above conductor to form ‘U’

Holding the tie wire tightly against insulator throw two tight close wraps around the conductor on each side of insulator keeping these wraps snugly against the conductor

Cross the legs of the tie wire around the insulator, right to left and left to right.

With both legs of the wire crosses tightly wrap each leg around the conductor upto the end of sliffner piece.

**15.7Jumpering**

After the stringing is completed jumpering shall be given at the tension points with the same line conductor by using P.G.Clamps. Two numbers double bolted P.G.Clamps shall be provided for each jumper. Under no circumstances P.G.Clamps or binding, to the main line conductors shall be permitted while providing jumpering except at Tee-off poles, where jumpers are to be given on the main conductor. Hence the contractor shall take all required precautions to leave sufficient conductor at each tension point for jumpering purpose.

While making jumpers chromite or graphite conducting, oxide inhibiting grease should be applied in the P.G.Clamps and also to the conductor where jointing takes place. Then the P.G.Clamps and conductor shall be cleaned with wire brush.The wire brushing should be done through the Conductor grease to rpevent oxide instantly reforming.

The material used for PG Clamps should be Aluminum alloy and the bolts must be galvanised.

The rate quoted by the contractor shall include all the above items including fittings and necessary accessories.

15.8 Do’s and Don’t’s

For the guidance certain DO’S and DON’TS are given below while stringing the conductor.

Do’s

Use proper equipment for binding Aluminum conductors at all times.

Use skids or similar method for lowering conductor drums from transport.

Examine reel before unreeling for presence of nails or any other object which might damage conductor.

Rotate the reel while unwinding the conductor in the direction marked on the reel.

Grip all strands while pulling out the conductor.

Control the unreeling speed with a suitable braking arrangement.

Use wooden rods for suitable braking arrangement.

Use long straight, parallel jaw grip with suitable liners when pulling conductor, thus avoiding nicking or kinking of the conductor.

Use free running sleeves or blocks with adequate grooves for drawing / paving conductors.

Use proper sag charts.

Mark conductors with adhesive tape which will not damage the strands.

Make all splicing with proper tools

Chromite or graphite conducting oxide inhibiting grease should be applied before cleaning with wire brush, where ever jointing takes place.

Don’ts

Donot handle conductor without proper tools at any stage.

Do not pull conductors without ensuring that there are no obstructions on the ground.

Do not pull out excess quantity of conductor than is required.

Do not make jumper connections on dirty or weathered conductor; clean the conductor using wire brush.

Do not handle Aluminum conductor in a rough fashion but handle it with a care it deserves.

**15.9** Tapping spans from Substation

**16**. The following precautions shall be taken while erecting (stringing) 33 kV and 11 kV Over head lines from the substation structures.

**16.1 Maximum Tension**

Maximum tension in each line conductor strung from substation structure is

450 kg.

**16.2 Maximum Span**

Maximum permissible first span from the substation structure in 60 m

**16.3 Uplift on Adjacent spans**

Maximum slope (mean of three conductors) at the point of attachment in 1:8 above horizontal

**16.4 Earthing**

Earthing shall be provided by the contractor in accordance with the requirements of Indian Electricity Act 2003 and in particular as mentioned below.

All metallic supports shall be provided with earthing as per drawing G3

For PSCC / RCC poles, the metal cross arms and insulator pins shall be bonded and earthed at every pole with earthing as per drawing G3.

All special supports on which AB Switches etc are mounted shall be provided with pipe earth as per drawing G4.

Supports on either side of the road, railway track or river crossing shall be provided with pipe earthing as per G4.

At all tension points at double pole locations the steel and metal parts are to be provided with pipe earthing as per G4.

All AB Switch handles to be earthed with pipe earth plus operators earth mat as per G4.

**16.5 Bentonite** shall be used as shown in the drawing Nos G3 and G4. Charcoal and salt shall not be used under any circumstances.

The earth resistance shall be less than 20 ohms

The earthing shall be as per the drawings enclosed to the specification (Drawing No G3 & G4)

**16.6 Works relating to road crossings**

Guardings shall be erected at all road crossing locations, communication lines crossings as per the standards and as per the drawings enclosed to the specification. All these guardings are to be provided with pipe earthing. These guardings shall comply with I.E Rules 1956 maintaining minimum required clearances as mentioned in Clause 5.0 of the specification.

**16.7** For crossing any railway track, Indian Electricity Rules and the regulations of railway authorities are to be followed.

**16.8** Works such as erection of support underneath an existing powerline and paying out of conductor and earth wire and stringing the power line crossing span or a railway crossing span or road crossing span will have to be done only after receipt of the line clear from TGSPDCL authorities and approval from the concerned departmental officers. Such special works, sometimes may not match with the programme of the contractor. In such cases, the Contractor shall execute such works as and when approvals are received.

The rates quoted by the Contractor shall take into consideration such contingencies also.

**17.0 Concreting**

17.1 The cement concrete used for the foundations shall be of 1:3:6 Grade or as per the schedule of quantities.

The sand used for the concrete shall be composed of hard silicon materials and well sieved. It shall be clear and of a sharp angular grit type and free from earthy or organic matter and deleterious salts.

The aggregate shall be of clean broken hard granite approved by the Engineer. It shall be hard, close grained quality. It shall also be as far as possible cube like, preferably angular, but not flaky, perfectly clean and free from earth, organic or other deleterious matter. 20mm aggregate shall be used for base concreting and 38 mm aggregate for pole concreting.

The water used for mixing concrete shall be fresh and conform to IS Specifications and it should be clean and free from oil, acids and alkali. Salty or brackish water should not be used.

The concrete should be mixed as stiff as the requirement of placing the concrete in the form of moulds and the degree to which the concrete resists segregation will permit. Hence, the quantity of water ascertained by the slump test only shall be used. Curing shall be done as per standards for a minimum period of 14 days.

Proper forms of moulds adequately braced to retain proper shape while concreting should be used. The mould should be made water tight so that cement cream will not come out leaving only sand and jelly consequently forming honey-combing in the concrete.

The rate for concrete should be inclusive of form box. Sufficient number of form boxes for each type of foundation should be made so that the works are not held up on this account.

After concreting to the required height, the top surface should be finished smooth, with slight slope towards the outer edge to drain off the rain water falling on the concrete.

In wet locations, the site must be kept completely de-watered both during the placing the concrete and for 24 hours after completion. There should be no disturbances of the concrete by water during this period. No extra rate will be paid for the de-watering and the rate for concrete shall be inclusive of dewatering charges.

The forms of moulds shall not be removed before a lapse of about 24 hours after the completion of concreting. After removal of the form moulds, the concreted surfaces, wherever required, shall be repaired with a rich cement and sand mortar in the shortest possible time.

Concreting to be done at locations as per Item no 11 of specifications to the sizes as mentioned below.

**Size of concrete**

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Size of Support** | **Concrete size** |
| 1. | 8.0 m PSCC | 0.76 x 0.76 x 1.52 m |
| 2. | 9.0 m to 9.5 m PSCC | 0.76 x 0.76 x 1.83 m |
| 3. | 11.0 m spun poles | 0.75 x 0.60 x 2.0 m |
| 4. | Stay concrete | 0.45 x 0.45 x 1.265 m |

For any other supports concreting shall be done as per the directions of field Engineer.

If auger is used for excavation of pole pits only base concreting shall be done and there is no need for mass concreting, provided the ground conditions are firm. Augering not suitable for running sand / Marshys soils

**18. Miscellaneous Items**

Location numbers for each pole shall be painted on the pole with black enamel paint on white enamel paint base. Two coats of paint are to be provided. Alternatively prenumbered metallic plates may be punched on to the supports at a height of 1.5 m from ground level.

Pole schedules are to be prepared by the Contractor with proforma mentioned in clause 23 of specification and hand it over to the Engineer. All approach roads available and power lines crossing locations shall be marked in the drawings.

Anticlimbing devices and enamel danger boards are to be provided at all railway crossings, road crossings and double pole structures. No extra charges shall be admissible even though separate gangs may have to be sent by the Contractor for fitting these accessories and attachments on the support at the appropriate time. Only G.I materials shall be used.

1. **Workman ship**

The Contractor shall entirely be responsible for the correct erection of line as per specification / approved drawings and their correct setting and alignment, as approved by the Engineer. If the supports and DP Structures after the erection are found to differ from approved route maps and drawings or to be out of alignment, the Contractor shall dismantle and erect them correctly at his own cost without extension of time. The supports must be truly vertical and in plumb after erection and no straining will be permitted to bring them to vertical position. Verticality of each support shall be checked by the Contractor and furnished to the Engineer.

Maximum permissible tolerance is **50** mm in respect of verticality.

**20. Final checking, testing and commissioning**

After the completion of the works final patrolling and checking of the line shall be done by the Contractor to ensure that all the foundations works, pole erection and stringing has been done as approved by the Engineer and also to ensure that they are complete in all respects. All works shall be thoroughly inspected keeping in view of the following main points.

Sufficient back filled earth is lying over each foundation pit and it is adequately compacted.

Concreting of poles is in good and finally shaped condition.

All the accessories and insulators are strictly as per the drawing and are free from any defects or damages, whatsoever.

All the bolts and nuts and pole fittings are galvanized and as per contractual provisions.

The stringing of the conductors has been done as per the approved sag and clearances as per IE rules are available.

No damage, minor or major to the conductor, earth wire, accessories and insulators strings, still unattended are noticed.

At all tension points, jumpers are provided to each phase with two Nos Aluminum alloy PG clamps.

Any additional tests as required by the Engineer to prove that the works are as per the specification are to be carried out by the Contractor at no extra cost.

The Contractor shall submit a report to the above effect to the Engineer. In case it is noticed later that some or any of the above are not fulfilled, the Engineer has option to get such items rectified through other agencies and recover the cost of such works from the bills payable to the Contractor against that contract or any other contract executed by him for the Transco.

In addition to the above, the contractor shall be responsible for testing and ensuring that the total and relative sags of the conductors are within the specified tolerance. Such tests shall be carried out at selected points along the route as required by the Engineer and the contractor shall provide all necessary equipment and labour to enable the tests to be carried out.

Should any pole found to be leaning at a later date within 12 months from the date of handing over, the Contractor shall rectify the same without any extra cost.

Should any cross arm, top cleat or insulator found to be out of alignment / leaning at a later date within 12 months from the date of handing over, the contractor shall rectify the same without any extra cost.

The Engineer reserves the right to demand replacement of poles, clamps etc., for rectification of such defects.

The TGSPDCL staff must make a final check of the complete line, after the contractor confirms that he has carried out all the checks required for energizing the line. The Engineer shall take full responsibility of checking the Contractor’s work as per the specification and furnish a certificate to that effect.

After satisfactory tests on the line and approval by the Engineer the line shall be energized at full operating voltage before handing over.

**21.0 POLE SCHEDULES**

The contractor shall hand over the pole schedules in the following formats

* 1. **33 kV Line Pole Schedules**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sl.  No | Loc. No | Type of support | Height (m) | SP/DP/4P | Struct pole | Type / HT | Span length | Ground clearance | Size of conductor | ‘V’ cross arm |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

**33 kV Line Pole Schedules**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Top cleat | Horizontal ‘x’ arm | Strut for X-arm | Pedestal clamps | Pins with insulators | Discs | Metal parts | Bracing sets | Back clamps | Stay clamps | Guy insulators (No.) |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |

**33kV line Pole Schedules**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stay wire size | Coil earth | Pipe earth | Pole concrete full/sleeve/nil | Danger boards | Anti climbing devices | Bolts & nuts (No.) | P.G.Clamp | Conductor joints | Road crossing (Specify road name) | River / canal crossing (specify name) |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |

**21.2 11 kV line Pole Schedules**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S.No | Loc.  No | Type of support | Span length | Size of conductors HT | No of LT conductors LT | Size of LT conductor | Ground clearance | Clearance between HT&LT | ‘V’ cross arm | Top cleat | LT 3 φcross arm (Type) | LT Sφ x-arm (Type) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Horizontal X-arm | Strut for X-arm | 11 kV pins with insulators | 11 kV discs | 11 kV metal parts | LT pins with insulators | Bolts & nuts (No.) | L.T shackles | C.I.  Knobs | L.T.  Straps | Back clamps | Stay clamps | Strut pole |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stay sets | Stay wire size | Guy insulators No | Pipe earth | Coil earth | ‘A’type pedestals | Top channels for special structures | Bracing sets for DPS | Pole concrete full/sleeve/nil | P.G.Clamps | Conductor joints | Danger boards | Anticlimbing devices | Guarding | Road crossing (Name) | Canal crossing (Name) |
| 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |

**21.3 POLE SCHEDULE FOR CABLE CROSSINGS**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S. No | Loc.  No | Voltage | Type of support | Span | Size of cable | Length of cable | Angle of crossing | End of terminal | | Pipe earth | LAS | Size and length of GT Pipe used | Stays | Strut | Size of stay wire | Back clamps | Cable below ground level | Loop length provided |
|  |  |  |  |  |  |  |  | No | Details |  |  |  |  |  |  |  |  |  |

**Guarding Details**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sl.  No | Loc | Voltage | Type of support | Height of support | Span length | Distance between guard wire & ground | Distance between guard wire & phase conductors | Phase conductors & earth | Between guard wire & telecomm wire | Size of guard wire | Size of lacings | No of guard wires | No of lacings | Length of guarding X-arm | Earth resistance | Angle of crossing |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. **ARecommended Pre-Stressed Cement Concrete (PSCC) poles**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Dimensions | | | |  |
| Length  m | SWL  kg | Type | Base  mm | | Top  mm | | No of steel wires |
|  |  |  |  |  |  |  |  |
| 8 | 200 | Solid | 290 | 90 | 145 | 90 | 12 |
| 8 | 300 | Solid | 380 | 100 | 145 | 100 | 12 |
|  |  |  |  |  |  |  |  |
| 9 | 200 | Solid | 315 | 105 | 115 | 105 | 12 |
| 9 | 300 | Solid | 355 | 105 | 185 | 105 | 16 |
| 9 | 400 | Solid | 395 | 105 | 225 | 105 | 20 |
|  |  |  |  |  |  |  |  |
| 9.1 | 280 | ‘I section’ | 350 | 150 | 130 | 150 | 16 |
|  |  |  |  |  |  |  |  |
| 11 | 500 | Spun concrete | 393 |  | 228 |  | 11 |

9.1m/280 kg or 500kg spun concrete poles are to be used at all angle, section and terminal poles to withstand compression loads due to stays and side winds.

GUIDELINES FOR OBTAINING FOREST CLEARANCE

**Forest Clearance**

In accordance with the provisions contained in the Forest (Conservation) Act 1980, it is unlawful to start the work of laying lines in the forest area without the approval of forest department.

Hence the proposal for obtaining permission should be initiated sufficiently in advance, i.e., atleast six months, so that permission from forest department is available at the time of taking up the work.

In case of sub transmission and distribution lines, the line should be proposed along fire protection lines, forest Roads, PWD Roads. If it is not possible, then possibility of laying the line through thin forest should be explored. As a last chance, the line should be proposed through dense-forest.

**23. Prior Permission from forest department**

For the purpose of obtaining prior permission the lines have been divided into three categories.

**Category I**: The lines passing along the fire protection lines, forest roads and PWD Roads. In this case no tree shall be cut. Only chopping of tree branches upto 1.5 mts on either side of the line is permissible. The permission in respect of these cases will be accorded by the Additional Chief Conservator of Forest.

**Category II**: The cases in which nominal tree cutting is involved. The permission in respect of this category will be accorded by the SECRETARY (Forest) Government of the state (Govt. of AP) on the recommendations of Additional Chief Conservator of Forest.

**Category III**: Lines passing through dense forest, involving extensive tree cutting shall come in this category. Under this category the cases processed by the forest department shall be referred to the Government of India for according permission.

**Procedure for obtaining forest Route Clearance in respect of Category I and II**

Prior permission to survey the proposed line is to be obtained from the forest department by addressing a letter as mentioned below.

**T&P TO BE SUPPLIED BY THE CONTRACTOR**

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Description** | **Qty.** |
|
| 1 | Chain Pulley 3 T | 1 No. |
| 2 | Ladder 20` (Al) | 1 No. |
| 3 | Test Lamp, Rechargeable torch light | 1 No. each |
| 4 | Clamp meter (MECO) | 1 No. |
| 5 | Meggar 2000 ohms ( 0-2.5 kV) | 1 No. |
| 6 | Rain Coats, Gumboots | 2 Nos. each |
| 7 | Line Earthing Rods | 2 Sets |
| 8 | Tool Box (20 x 10 x 15), DE Spanners set (No. 6 to 20),  Ring spanners set (No. 6 to 20) | 1 No. each |
| 9 | Cable Rollers | 20 No |

**23.1 General:**

The erection of structure and equipments, cable laying and earthing has to be done by the contractor using his own T & P, a list of materials / equipment that will be required for erection are to be procured by the contractor.

**23.2 SAFETY:** The contractor shall provide and make all necessary arrangements for the safety of the staff and labour, at site of work. The TGSPDCL will not in any way be responsible for any accident, minor or fatal to any person at the site of works or for any damages arising there from during erection and this shall be the contractor’s responsibility. The staff insurance charges, if any, shall be borne by the contractor himself.

**23.3 ERECTION OF STRUCTURES:** The structures shall be erected by piecemeal method on the foundation, after allowing the required curing time for the foundations. The members shall not be strained or bent during the course of erection. Care shall be taken to see that the jointing surfaces are clean and free from dirt or grit and fit properly. The structures shall be erected strictly in accordance with the approved drawings.

The bolts and nuts, spring washers and pack washers required for the work will be supplied by the contractor.

After erection of structures the bolts shall be checked to ascertain that all nuts are fully tight. The contractor shall ensure that all the bolts are in position and fully tightened.

The structure must be truly vertical after erection and no straining will be permitted to bring them to vertical position.

**24. FINAL CHECKING, TESTING AND COMMISSIONING**

**24.1 FINAL CHECKING:** After completing the works, the contractor shall ensure that following points are not missed:

1. Backfilling is completely done and compacted along with leveling.
2. Coping / Muffing / Plinth surfaces are done to proper shape.
3. Bolts of the structures are properly tightened.
4. Cables are properly dressed.
5. Equipment such as breakers, isolators is properly operated.

**24.2 TESTING:** The contractor shall give necessary assistance to the TGSPDCL Engineers at the time of testing the equipment by providing required labour and testing equipment at the test location. Any defects found during testing shall be rectified by the contractor forthwith without any charges to the Board.

**24.3 COMMISSIONING:** All the tests shall be completed by the contractor successfully before commissioning of Sub-Station.

**25. RECTIFICATION OF DEFECTS DURING THE DEFECTS LIABILITY PERIOD:**

The defects liability period of the Sub-Station is 12 months from the day of commissioning and acceptance by the TGSPDCL. Defects if any, noticed during the above period shall be rectified by the contractor free of cost of the Board on hearing from the TGSPDCL.

Note: The Contractor has to follow REC standard for the work where ever it is not specifically mentioned above.

**XX.DC DISTRIBUTION PANEL**

**Scope of supply**: The scope of supply includes supply erection and testing, commissioning of 2000mm X1750 mm X 300 mm AC distribution panel with 16 gauge CRC steel sheet, Powder coated Siemens grey with the following accessories including the internal earth with 25 X 3 mm plated copper and external earth with 25 X 6 mm GI Earth flat complete as detailed below.

* Two Nos. one red and one green LED indicating lamps preferably Siemens/Technique/ Vaishno for breaker close and open positions for each breaker shall be incorporated.
* One No LED Amber lamp with Pushbutton preferably Siemens/Technique/Vaishno for each breaker for monitoring Healthy trip circuit remotely shall be incorporated.
* One No. Amber/Blue/white lamp for “Spring charged” indication preferably Siemens/Technique/Vaishno shall be incorporated.
* Two Nos. one red and one green push buttons preferably Siemens/Technique/Vaishno for control of breaker close and open positions for each breaker shall be incorporated
* Voltmeter selector Switch Make: L&T, Kaycee/ Switronfor 33 kV and 11 kV selections shall be incorporated.
* Auxiliary relays of VAA 31 -4 Nos for transformer protection including the indication accept reset for transformer alarm shall be incorporated
* One No. Digital ammeter of 0.5 class of 110V Auxiliary preferably AE/ ENERCON/Rishab of 96x96 with a facility to select automatically the CT ratio based on the primary CT ratio shall be provided
* Digital Frequency meter shall be incorporated 96 x96 mm make:AE/Enercon/Rishab
* Hooter Make ALAN/Target/Vaishno shall be incorporated for each individual breaker and each transformer protection including the facility of bell test to be provided.
* Connectors make connect well to be provided.
* Wiring 1.5 mm² make fenolex/polycab for control wiring shall be provided

The D.C. remote Panel with all accessories detailed above shall be mounted in a metal sheet steel, abide for OUTDOOR, floor mounting free standing type with following features: -

1. Made of cold rolled sheet steel of thickness not less than 16 SWG.
2. It shall be completely dust and vermin proof and all the doors shall be hinged type with suitable gaskets for the mating surfaces, in-corner, and all the feeders shall be provided with hinged doors individually.
3. Provision of glands for incoming and outgoing cables, suitable lugs for the terminators.
4. Shall be painted with 2 coats of the Siemens grey powder coated.

Indicating lamps shall be 22 mm diameter type. It shall be possible to replace the lamp element from the front.

Push buttons shall match the indicating lamps in style. They shall be 22 mm type.

Control and selector switches shall match lamps and push buttons in style. They shall be 22 mm type.

The number of contact blocks on each push button or selector switch shall be limited to two.

XXI. INSULATORS

1. SCOPE:

This specification covers design, manufacture, testing at manufacturer’s works before dispatch, supply and delivery of porcelain insulators.

2. APPLICABLE STANDARDS:

2.1 The materials shall comply in all respects with the relevant Indian Standard Specifications with latest amendments indicated below or with relevant IEC publications or any other authoritative standards. The materials shall be suitable for use on three phase 50 c/s power system.

a) IS 731-1971(Latest Amendment thereof) Disc insulators

b) IS 3188 – 1965 Pin insulators

2.2 Material confirming to any other internationally accepted standard which ensures equal or higher quality than the standards indicated above will also be acceptable. Where the material offered is according to any such international standard, an English Version of the specification shall be attached to the tender.

3. CLIMATIC CONDITIONS

3.1 i. Max. Temperature of air in shade : 50°C

ii. Min. Temperature of air in shade : 7.5°C

iii. Max Temperature of air in Sun :70°C

iv. Max humidity :100%

v. Average no. of thunder storms day per annum :50

vi. Average no. of dust storms per annum :10

vii. Max rainfall per annum :3000 mm

viii. Average rainfall per annum :925 mm

ix. Limits of ambient temperature

over period of 24 hours : 47 °C and 27 °C in summer and 30 & 7.5 °C in winter.

x. Max wind pressure : 260kg/m²

xi. Altitude not exceeding : 1000 m above MSL

The materials offered shall be suitable for operation in tropical climate in which they will be subject to the full rays of the sun and inclement weather and should be able to withstand wide range of temperature variations. The humidity may be as high as 100% during rainy season and as low as 10% during dry season. The prevailing weather conditions are given above

# 3.2 33kV & 11kV INSULATORS

All materials used in the manufacture of the disc insulators shall be of the best quality.

Unless otherwise specified, the glaze shall be brown in colour. The glaze shall cover all porcelain parts of the disc insulator except those areas which serve as supports during firing or are left unglazed for the purpose of assembly.

Cement used in the construction of disc insulators shall not cause fracture by expansion or loosening by contraction and proper care shall be taken to locate the individual parts correctly during cementing. The cement shall not give rise to chemical reaction with metal fittings and its thickness shall be as uniform as possible.

All fitting shall be designed so that the harmful bimetallic corrosion is avoided and effects of vibration both on conductors and fittings itself are minimized. All ferrous parts exposed to atmosphere in service except those made of stainless steel shall be protected by hot dip galvanizing. All castings shall be free from blow holes and other casting defects such as cracks etc.

The socket portion and shank pin of the disc insulator shall be made of high quality steel duly forged.

The “W” clips shall be made of good quality phosphor bronze or stainless steel, or copper alloy to give proper spring action and to provide locking arrangement.

## 3.3. DESIGN AND TYPE

Type “B” insulators shall be offered. Type “B” insulator is one in which the length of the shortest puncture path through solid insulating material is less than half the length of the shortest flashover path through air outside the insulator.

The technical particulars of the disc insulators required and the system requirements are indicated in Appendix. The design of insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

The disc insulators shall be ball and socket type in respect of 70 kN for 33kV and 45 kN for 11kV and also C&T type 45 kN for 11kV. The ball and socket of the disc insulator shall be heavily galvanized and mechanically strong. The ball shall move free in the sockets, but shall be so designed that they do not give way while in service.

The sockets shall be made of copper bearing drop forged steel. These shall be free from cracks, shinks air holes, burs and rough edges. The socket shall be circular, with inner and outer surfaces concentric and of such design that they will not yield or distort under the stress to the porcelain shells.

The ball pin shall be a single piece made of drop forged steel and shall be free from laps, folds, burs and rough edges. All bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly. The ball pins shall be of such a design that they will not yield or distort under loaded condition. The pins shall not be made by joining, welding, and shrink fitting or any other process from more than one piece of material.

Security clips for use with ball and socket coupling shall be made of suitable material of stainless steel or copper alloy or phosphor bronze. The security clips shall provide positive locking of the coupling. The logs of the security clips shall be spread after installation to prevent withdrawal from the socket. C & T type disc insulators shall comply in all respect with the relevant IS.

3.4. PORCELAIN

The porcelain used in the manufacture shall be sound, free from defects, thoroughly vitrified and smoothly glazed. The porcelain shall not engage directly with the hardware.

3.5. GLAZE

The finished porcelain shall be glazed in brown colour. The glaze shall cover all exposed porcelain parts of the insulators, shall have a good luster, smooth surface and a good performance even under extreme weather conditions of tropical climate. It shall not get cracked or chipped by ageing under normal service conditions. The glaze shall have coefficient of expansion as that of the porcelain body throughout the working temperature range.

## 3.6 WORKMANSHIP

The insulators covered by this specification shall be of latest design and conform to the latest scientific methods and shall be suitable for use on 11 kV 33 kV & 132 kV lines. Sound design, latest manufacturing processes and proper material quality control shall be ensured at various stages. Good finish and elimination of sharp edges and corners shall also be ensured. The disc insulator shall be free from all sorts of defects. All exposed surfaces shall be smooth and free from imperfection.

The forged metal sockets and shank pins shall be free from cracks, seams, shrinks, air-holes and rough edges. Metal pins shall be free from laps, folds, seams bars and rough edges. All surfaces of metal parts shall be perfectly smooth with no projecting points or irregularities.

All the ferrous parts shall be hot dip galvanized in accordance with the latest edition of IS. The zinc coating shall be adherent, smooth, reasonably bright, continuous and free from such imperfections such as flux, ash, rust stains, bulky white deposits and blisters. Bituminous paint coating shall be provided on the metal portion in contact with the cementing. The insulator units after assembly shall be concentric and co-axial within the limits as permitted by the relevant Indian Standard

3.7 TYPE OF INSULATORS

Over head line insulators shall be of Type “B” as defined in Indian Standards. Type “B” Insulators or Insulator unit is the one in which the length of the shortest puncture path through solid insulating material is less than half the length of the shortest flashover path through air outside the insulator.

3.8 INSULATOR CHARACTERISTICS

The insulators shall have the electrical and mechanical characteristics which are given in the table given below:

ELECTRICAL:

The test voltage of insulators shall be as under:

|  |  |  |  |
| --- | --- | --- | --- |
| Highest System Voltage | Wet Power frequency withstand test | Power frequency puncture withstand test | Impulse Voltage withstand test |
| kV (RMS) | kV (RMS) | kV (RMS) | kV (PEAK) |
| 12 | 35 | 105 | 75 |
| 36 | 75 | 180 | 170 |

In this standard, power frequency voltages are expressed as peak values divided by 1 ½ and impulse voltages are expressed as peak values.

The flash over and withstand voltages are referred to the reference atmospheric conditions.

The minimum failing load of insulators shall be 5 kN.

CREEPAGE DISTANCE:

The minimum creep age distance shall be as under:

|  |  |
| --- | --- |
| Highest system Voltage | Normally polluted atmosphere |
| kV | mm |
| 12 | 230 |
| 36 | 580 |

4. TESTS

* + 1. TYPE TESTS :

All type tests shall be conducted as per the relevant Indian Standard specifications and a copy of the test certificate shall be furnished invariably along with the tender.

4.2. ACCEPTANCE AND ROUTINE TESTS:

All routine tests shall be conducted as per the relevant Indian Standard specifications in the presence of purchaser’s representative.

4.3. MARKING:

Marking on the materials shall be done as per the relevant Indian Standard Specification.

5. INSPECTION:

All acceptance tests and inspection shall be made at the place of contractor unless otherwise especially agreed upon by the contractor and purchaser at the time of purchase. The contractor shall afford the inspector representing the purchaser all reasonable facilities without charge, to satisfy him that the material is being furnished in accordance with this specification. The purchaser has the right to have the tests carried out at his own cost by an independent agency wherever there is a dispute regarding the quality of supply.

6 PACKING:

The packing shall be done as per the manufacturer standard practice. However, he should ensure the packing is such that, the material should not get damaged during transit by Rail/Road.

7. GUARANTEED TECHNICAL PARTICULARS:

The guaranteed technical particulars shall be given as per Appendix. Dimensional drawings shall be furnished wherever necessary.

APPENDIX

GUARANTEED TECHNICAL PARTICULARS OF

11 kV DISC INSULATORS (B&S)

|  |  |  |
| --- | --- | --- |
| 1 | Type of Insulators | Ball & Socket Type-B |
| 2 | Nominal system voltage | 11 kV |
| 3 | Highest system voltage | 12 kV |
| 4 | Visible discharge test voltage (minimum) | 9 kV |
| 5 | Dry on minute power frequency withstand voltage | 70 kV |
| 6 | Wet one minute power frequency withstand voltage | 40 kV |
| 7 | Power frequency puncture withstand voltage | 110 kV |
| 8 | Impulse voltage withstand test voltage | 110 kV |
| 9 | Impulse (1.2/50 microsecond wave) flash over voltage  Position  Negative | + 115 kV  -220 kV |
| 10 | Dry Power frequency flashover voltage | 75 kV |
| 11 | We power frequency flashover voltage | 45 kV |
| 12 | Mechanical characteristics of insulators electro mechanical strength | 45 kN |
| 13 | Colour and surface of porcelain portion | Brown |
| 14 | Standard according to which porcelain insulators shall be manufactured and tested | IS : 23188-1980 &  IS:731-1971 (latest amendment) |
| 15 | Size of Insulators |  |
|  | a) Height | 145mm |
|  | b) Overall outside diameter | 255mm |
|  | c) Minimum creepage distance | 280mm |
|  | d) Protected creepage distance | -- |
| 16 | Tolerance in dimensions, if any | As per IS:731-1971  (latest amendment) |
| 17 | Ferrous parts | Zinc, Galvanized (B&S) & Phosphor Bronze ‘W’ clip. |

APPENDIX GUARANTEED TECHNICAL PARTICULARS FOR 11 kV DISC INSULATORS (C&T)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sl. No. | Characteristics | | Hardware for C&T Discs (11 kV) | |
| 1. | Manufacturer | | ---- | |
| 2. | Standard to which the Hardware fitting conform | | IS:2486 (part-II)/1989 | |
| 3. | Type of steel Head (Large or Small) | | Clevis & tongue Type | |
| 4. | Minimum failing load | | 3000 kg | |
| 5. | Standard to which the straps conform | | IS:2486 (PT-II)/1989 | |
| 6. | Type of washers with size | | Spring washer: 2.5 mm & 3 mm  Flat washer : 2.5mm & 3mm | |
| 7. | Type of clamps fixed and size of conductor | | Clevis & tongue Type  ACSR Squirrel Conductor 6 Nos. of 2.11 mm dia  ACSR Weasel conductor 6 Nos. of 2.59mm dia  ACSR Rabbit conductor 6 Nos. of 2.25mm dia | |
| 8. | Weight of hardware fittings | | 1.2 kg | |
| 9. | Tolerance in dimension | | ± 5% in length and ± 2% in diameter | |
| 10. | Other particulars if any | | Packed in double gunny bags containing not more than 50 kg per bag | |
| Materials used for various component parts | | | | | | |
| 1. | | Cross arms straps | | MS (Clause-IV) | |
| 2. | | Tension clamps | | Aluminum Alloy LM-6 | |
| 3. | | Ball Eye | | MS (Clause-IV) | |
| 4. | | Rivet Pin | | MS (Clause-IV) | |
| 5. | | Security Clip | | Phosphorus Bronze | |
| 6. | | Split Pin | | Brass | |
| 7. | | Socket | | Forged steel | |
| 8. | | ‘U’ Bolt | | MS (Clause-IV) | |
| 9. | | Bolt & Nut | | MS (Clause-IV) | |
| 10. | | Flat washer | | MS | |
| 11. | | Spring washer | | Spring Steel | |
| Mounting arrangement: 100X50 mm Channel | | | | | | |
| Application Standards | | | |  | |
|  | | IS: 2486 (part-I) 1972 | |  | |
|  | | IS: 2486 (part-II) 1989 | | Hardware | |
|  | | IS: 2486 (part-III) 1997 | |  | |
|  | | IS: 2121/192 | |  | |
|  | | IS: 2629/1966 | | Hot Dip Galvanization | |
|  | | IS: 3063/1972 | | Spring Washer | |
|  | | IS: 1363/1967 | | Nuts | |
|  | | (Latest version thereof for all the IS Nos.) | | | | |
|  | | Tolerance | | ± 5% in Length and ± 2% in diameter | |
|  | | Galvanizing | | As per IS: 2629/1972 | |
|  | | Thickness of spring washer | | As per IS: 3063/1972 | |
|  | | Embossing | | S.I.I. embossed in each set | |
|  | | Packing | | Double gunny bags containing not more than 50 kg per bag | |

GUARANTEED TECHNICAL PARTICULARS FOR

11 kV & 33 kV PIN INSULATORS

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Maker’s Name & Address | ---- | ---- |
| 2. | i) Rating of pin insulators | 11 kV | 33kV |
|  | ii) Electrical characteristics of insulators |  |  |
|  | a) Normal system voltage kV | 11 kV | 33kV |
|  | b) Highest system voltage kV | 12 kV | 36 kV |
|  | c) Visible discharge test voltage  (Power frequency) kV (RMS) | 9kV (RMS) | 27 kV |
|  | d) Dry one minute withstand voltage kV (RMS) | 40 kV (RMS) | 95 kV |
|  | e) Wet power frequency withstand voltage kV (RMS) | 35 kV (RMS) | 75 kV |
|  | f) Power frequency puncture withstand voltage kV (RMS) | 105 kV (RMS) | 180 kV |
|  | g) Impulse withstand voltage (1/50 Micro second wave) kV (PEAK) | 75 kV (Peak) | 170 kV |
|  | h) Impulse flashover voltage (1/50 micro second positive voltage) kV (PEAK) | 105 kV (Peak) | 200 kV |
|  | i) Impulse flashover voltage (1/50 micro second negative voltage) kV (PEAK) | 105 kV (Peak) | 210 kV |
|  | j) Dry flashover voltage kV | 60 kV | 100 kV |
|  | k) Wet flashover voltage kV | 40 kV | 80 kV |
| 3. | Mechanical characteristics of insulators   1. Min. failing load kN 2. Min. creep age distance mm | 5 kN  230mm | 10 kN  580 mm |
| 4. | Colour of glaze | Dark Brown | Brown |
| 5. | Weight per unit | 1.3 kg (Approx.) | 7.0 kg (Approx) |
| 6. | Size of insulator | Small | 215 mm X 255 mm |
| 7. | Material of thimble | Lead | LEAD |
| 8. | Whether pin insulator is suitable for use with small steel head/large steel head | Small steel head | LARGE STEEL HEAD |
| 9. | Standard to which the insulator shall be manufactured and tested | IS : 731 | IS: 731-1971 with latest amendment. |
| 10. | Contents of each package and packed weight | 12 Nos. & 20.5 kg approx. | 2 Nos. 14 kg (Approx) |
| 11. | Tolerance in dimensions, if any | ± (0.04d + 1.5mm) | As per IS |
| 12. | Other particulars if any | NA | Drawing No. BPPL-21-B |

# XXII. TECHNICAL SPECIFICATION FOR 33 kV, 11 kV AND LT INTERCONNECTING UNDERGROUND CABLES

**1 GENERAL:**

**1.1 SCOPE**:

1.1.1 The scope of this specification is intended to cover the installation, testing and commissioning of underground electricity network.

1.1.2 The shall cover complete installation of all the equipment and accessories covered under this contract.

1.2 Installation work pertaining to equipment, cabling, etc. should be in accordance with the applicable standards, safety codes, etc.

1.3 Installation shall be carried out strictly in accordance with the approved drawings, modifications, if any, required to suit site conditions, shall be carried out only with the prior approval of the Engineer. All such changes shall be incorporated in “As built” drawings to be furnished by the contractor.

1.4 It shall be the responsibility of the contractor to store, move / transport from stores / storage yard etc. relevant items and accessories to the place of installation and wherever necessary assemble all parts of the equipment. In accordance with the specific installation instructions as desired by Engineer, the contractor shall transport, unload, and install all the equipment and accessories included in the contract.

1.5 All tools, welding equipment, crane, scaffolding, rigging material, ladders, winch, rollers consumables, hardware etc. required for installation shall be provided by the contractor.

1.6 It shall be the responsibility of the contractor to engage specialist to supervise installation work for cables, RMUs etc where felt essential. Such services shall be arranges by the contractor at no extra cost to the employer.

1.7 The contractor shall ensure that the equipment under erection as well as the work area and the site are kept clean to the satisfaction of the Engineer., In case, the Engineer is not satisfied about the cleanliness he will have the right to carry out the cleaning operation and expenditure incurred by him in this regard will be to contractor’s account. Packing cases and packing materials shall be cleared from sites.

1.8 In order to avoid hazards to personnel moving around the equipment such as switchgear etc which is kept charged after installation before commissioning such equipment shall be cordoned off by suitable to prevent accidental injury.

1.9 Where assemblies are supplied in more than one section, the contractor shall make all necessary mechanical electrical connections between sections including the connections between bus / wires. The contractor shall also do necessary adjustments alignment necessary for proper operation.

1.10 Care shall be taken in handling instruments, relays and other delicate devices where instruments and relays are supplied separately they shall be mounted only after the associated switchgear / control panels are erected and aligned.

1.11 Standards:

GENERAL STANDARDS AND CODES

Electricity Rules, 1956

Indian Electricity Act 1910

Indian Electricity (Supply) Act 1948

Electricity Act, 2003

Indian Factories Act

IEC-540: Test methods for insulation and sheaths of electric cables and cords

IEC 60: High Voltage Test Techniques

IS-1255 (1991) Code of practice for installation and maintenance of power cables, upto and including 33 kV rating

IEC-287 (P1 to P31995)Calculation of the continuous current rating of cables (100% load factor).

IS-5216 Guide for safety procedures and practices in electrical works.

IS-5, 1994 Colors for Ready Mixed Paints and Enamels

IS-617, 1991 Aluminum and Aluminum Alloy Ingots and Castings for General Engineering Purposes

IS-2071: (P1 to P3) Methods of High Voltage Testing

IS-3043 (Reaffirmed 1991): Code of Practice for Earthing

IS 10810: Methods of testing cables

IEC 66: Environmental Test

IEC-117: Graphical Symbols

Materials shall conform in all respects to the relevant Indian Standard Specifications with

Latest amendments there to

Title IS. No.

1. Code of practice for installation and maintenance of transformers IS-10028

2. Cement IS269

3. Erection of over head lines IE Rules 1956

4. Earthing REC Standards

5. Steel IS6003/1970

6. Fasteners IS6639/1972

7. Galvanizing IS2629, IS4759

8. Aggregate IS383

9. Concrete Mix IS1343

10. RCC IS456

11 Cable Jointing IS1255

12 LT PVC Sheathed Aluminum cable IS694

Materials conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above would also be acceptable. In case the bidders who wish to offer materials conforming to other standards, salient points of difference between standards adopted and specific standards shall be clearly brought out in the schedule. 4 Copies of such standards with authentic English translations shall be furnished along with the offer.

1.12 MATERIAL/ WORKMANSHIP

1.12.1 General Technical Requirement

1.12.1.1 Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade, of the best quality of their kind, proper strength conforming to best engineering practice and suitable for the purpose for which they are intended.

1.12.1.2 When required by the specification or when required by the Employer the Bidder shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the contractor.

1.12.1.3 The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses.

In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the employer’s engineer.

1.12.1.4 All materials and equipment shall be installed in strict accordance with the manufacturer’s recommendation(s) and relevant IS codes of practices. Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting and placing into position, grouting, leveling, aligning, welding, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer’s tolerances, instructions and the Specification.

1.13 Information and data.

a) The Information furnished is the best available, however the Employer does not guarantee the correctness of interpretations, deductions or conclusions which are given supplementary information in the Bid Documents or in any reports, maps drawings, diagrams or in other reference information available to the bidder from the Employer or otherwise.

The information has been produced as found, communicated to, ascertained or otherwise learned by the Employer.

b) It will be the Bidder’s responsibility to satisfy himself from the “Reference Information” supplied and or inspection of the site that sufficient quantities of construction materials required for the works shall exist in the designated borrow areas or quarry sites.

The Employer does not accept any responsibility either in handling over the quarries or procuring the materials or any other facilities. The tenderer will not be entitled for any extra rate or claim for the misjudgment on his part for the quantity of materials available in the quarries.

c) The contractor shall make his own enquiries regarding the availability of other materials and make his own arrangements for procuring them.

d) Climatic conditions.

The Climatic conditions prevailing in the area are as per the details given below.

i) Location : In the state of A.P.

ii) Maxambient air temperature (°C) : 50

iii) Min ambient air temperature (°C) : 7.5

iv) Average daily ambient temp(°C) : 35

v) Relative humidity % : 100

vi) Average annual rainfall (mm) : 925

vii) Max altitude above mean sea level (meters) : 1000

viii) Max wind pressure (kg/mm²) : 200

ix) Isoceramic level (days / year) : 50

x) Seismic level (Horizontal accelerations) : 0.10 q.

Note: Moderately hot and humid tropical climate is conducive to rust and fungus growth. The climatic conditions are also prone to wide variations in ambient conditions. Smoke is also present in atmosphere. Heavy lightning also occurs during June to October.

1.14 Approaches: The approaches to the site of work, if necessary will have to be formed by the contractor at his own cost and will be an access both for personnel and equipment.

1.15 Water and power: The contractor has to make use of Water Supply available if any at the substation site for construction purpose. Transport of water from the source to the working area will be contractor’s responsibility .It is essential that the contractor shall prevent misuse and wastage of water at all times failing with necessary charges will be collected from the contractor. In case, water is not available at site, the contractor has to make his own arrangements and any extra claim on this will not be entertained. Power required for construction will be made available at one point on chargeable basis. The power shall be used exclusively for substation works only.

1.16 Supervisor, Skilled and Unskilled labour: The Contractor shall provide experienced technically qualified supervising engineers for supervision. The contractor shall engage only competent skilled workers.

1.17 Site Stores: The contractor shall establish temporary stores at his own cost at the Substation site for storing cement and equipment. The stores should be dismantled and site cleared after the work is completed.

1.18 Construction Materials:

1.18.1Cement:

a) The Contractor has to make his own arrangements for the procurement of cement of required specifications required for the works and shall make his own arrangements for adequate storage of cement.

b) The contractor shall procure cement in standard packing e.g. 50 kg bag or drums.

c) The Contractor shall forthwith promptly remove from the works area any cement that the Engineer may disallow for use.

d) The contractor shall further, at all times satisfy the engineer on demand by production of records and books or by submission of returns and other proofs as directed. The cement being used is tested and approved by Engineer for the purpose and the contractor shall at all times keep his records up to date to enable the engineer to apply such checks as he may desire.

e) Cement which has been unduly long in storage with the contractor or alternatively hasdeteriorated due to inadequate storage and thus become unfit for use in the works will be rejected by the employer and no claim will be entertained. The contractor shall forthwith remove from the work area. Any cement the Engineer may disallow for use on work and replace it by cement complying with the relevant Indian Standards.

1.18.2 Steel:

MS Channel, MSAngle, MS Flat and MS rod required for fabrication of Cross – arms, top cleats clamps etc. have to be procured by the contractor. Fabrication of materials is to be arranged including one coat of red oxide and two coats of Aluminum paint.

**2**. **RMU’S**

RMU’s shall be installed as per the specified code of practice and the manufacturer’s instructions. The RMU’s shall be installed on concrete plinth. Care shall be taken in handling instruments, relays etc. Any damage to relays and instruments shall be immediately reported to the Engineer. It should be earthed by two separate and direct earth connections through two separate earth electrodes.

2.1 Fabrication of structures: Straightening, cutting, assembly, bolting and welding shall be as per IS 800

2.2 Bolts and nuts: Nominal nut size Proof stress (N/mm²)

M 16 490

M 20 500

The bolts and nuts shall be hot dip galvanized as per IS-1367

2.3 Spring washers shall be of type B and shall conform to IS-3063. The spring washers shall be made from high quality spring steel conforming to IS-4072. The spring washers shall be electro galvanized with a coating thickness of 25 microns.

2.4 Galvanizing: All members of structures “U” bolts etc shall be hot dip galvanized.Galvanization shall be done by hot dip process and metal modules and there shall be no clogging of bolts holes due to the stay of zinc in the holes.

2.5 Marking: Each part of steel structure shall be clearly stamped with 20mm steel stamping die with the identification number mark or symbol to facilitate erection.

2.6 The structures shall be erected by piece-metal method on the foundations after allowing the required curing time for the foundations. After erection of the structures, the bolts shall be checked to ascertain that all nuts are fully tight. The contractor shall ensure that none of the bolts are left out. The structure shall be truly vertically after erection and no straining will be permitted to bring them to vertical position. The tolerance for verticality is one in 360 structure height.

2.7 Cabling: Cables shall be laid in trenches and the cables required for the job will be issued by the employer.

The length of each cable issued shall be judiciously cut minimizing the wastage. Cable laying shall also include termination of cables i.e. at both ends of cable at equipment control and protection panels etc. as well as equipment to marshalling boxes and marshalling boxes to switch gear panels. Cable lugs, cable terminating accessories like jointing ferrules, cable clamps, cable grips, cable compound flux, tapes etc. as necessary shall be procured by the contractor.

Cable lugs shall be compressed over the conductor ends with crimping tool. Insulating sleeves shall be provided and covered over the bare ends of the connections so as to prevent accidental contact with the adjacent terminals. The insulating sleeve shall be fire resistant and long enough to over pass the conductor insulation and shall be of correct size to the conductor used. The cables entering the control room from Outdoor shall be sealed.

Standard cable grips and seals shall be utilized for cable pulling after laying the cable. Cable markers shall be put at both ends of the cables and at the RMU to be removed. The cable number and other data shall be punched and the cable markers are to be securely attached to the cables. Sharp bending and kinking of cables shall be avoided. In each cable run, some extra length shall be kept at a suitable point.

**3. Erection of Under Ground Cables:**

**3.1**CABLING AND OTHER EQUIPMENT:

3.1.1 Design, engineering, testing at works, type/acceptance/routine testing, packing, loading, transportation, transit insurance, unloading at site, supply and delivery, storage insurance, installation and pre-commissioning, testing at site (including commissioning) of 33 /11 kV cable double run, 33 kV SF6 Ring main Units, Cable jointing / termination kits and other accessories in respective 220kV 132kV /33/11 kV sub-stations to termination in 33 kV RMU’s

The cable and its accessories shall be complete with all fittings and components necessary for the satisfactory performance and ease of maintenance under the various operating conditions specified.

The commissioning of underground cable network shall be taken up in a coordinated manner so as to ensure minimum shut down time.

The contractor shall also be responsible for payment of any statutory taxes and duties arising out of this to the appropriate authority and employer shall not assume any liability for the same.

3.1.2 The scope also covers the complete laying (including civil works), jointing and termination, testing and commissioning at site of the equipment, cable and accessories. This shall mainly consist of:

a) Excavation of trenches and laying of cable.

b) Trenchless laying of Cable wherever required

c) Cable route markers of approved design shall be provided all along the route at a maximum distance of 100 meters and other important locations as per statutory requirements and Employer’s instructions. Also the location of underground cable with reference to permanent benchmarks shall be clearly indicated on the marker.

d) In addition, cable joint markers shall be provided at locations where straight through joints have been provided.

e) Bonding of screen/armour at both ends to the earth system.

f) Design, fabrication, and erection of steel structures [including its civil foundation] for supporting cable end terminations, foundation and structure for RMUs with all necessary accessories.

g) Backfilling of trenches & restoration as per requirements.

h) Testing and commissioning of equipments and systems under the scope of this bid

3.1.3 Documentation/SLD& Layout/ Equipment identification / O&M Manuals:

Underground cable route shall be generally along the overhead line route or the routes indicated in the bid. However Contractor shall carry out the design and finalize the routing of underground distribution network. Besides, the contractor shall furnish the following drawings, diagrams and data and also perform certain jobs for identification of equipment installed. Contractor shall supply four sets of hard copy and four sets of soft copy of these documents.

The following single line diagrams are to be supplied in Auto Cad format:

1.33/11 kV HT Net work with the following details

a) Length of each section;

b) Type and size of cable;

c) The substation points showing location and code number of the substations;

d) Number and Capacity of the existing transformers;

e) Location of the isolating point, if any and the normal cut-off point in the ring system

2. Land Based Map

a) The indicative route map to be provided to the contractor would indicate the proposed underground system.

b) The map is to be converted by the contractor in Auto Desk map format to “as built” by updating it with the details of the lines and the equipment actually installed.

c) IDENTIFICATION PAINTING (by enamel based water proof paint)

After completion of the job each equipment shall be painted with identification painting apart from providing data in the usual name plate such as

i) Code Number

ii) Incoming Source

iii) Destination of the outgoing circuit

iv) Location

3.1.4 Statutory Clearances:

The installation of cables and equipment shall be as per established code of practice and fulfill the requirements of statutes.

The bidder shall maintain all statutory clearances from other utility services, like telephones, water supply, power supply etc. The bidder shall obtain all necessary approvals from local authorities on behalf of TGSPDCL. However the road cutting charges will be paid **directly** to the concerned authority /the local body by TGSPDCL.

**3.2** Any other items not specifically mentioned in the specification but which are required for installation, testing, commissioning and satisfactory operation of the network as per Indian standards/IE Rules/IE Act and local authority regulations are deemed to be included in the scope of the specification and no deviation in this regard shall be accepted.

**3.3** Before proceeding with the work the Contractor shall fully familiarize himself with the site and route conditions etc. Though the Employer shall endeavor to provide all the information, it shall not be binding for the Employer/ to provide the same.

The bidders are advised to visit the sites and acquaint themselves with the topography, infrastructure etc. The bidder shall be fully responsible for providing all equipment, materials, system and servicesspecified or otherwise which are required to complete the erection and successful commissioning of underground cable works and other equipment as specified in the bid schedule in all respects. All materials required for the Civil and construction/installation work shall be supplied by the Contractor including sand and brick for cable laying.

The Contractor, based on conceptual tender drawings, shall do then complete design and detailed engineering.

**3.4** The Contractor shall also be responsible for the overall coordination with internal/external agencies, project management, training of Employer’s manpower, loading, unloading, handling, moving to final destination for successful erection, testing and commissioning of the 33 /11kV underground cables and other equipment

**3.5** The scope includes construction power and water. The contractor shall arrange construction water and power during construction stage at his own cost.

**3.6** PHYSICAL AND OTHER PARAMETERS

3.6.1 Location of the site

3.6.2 Meteorological data

The equipment to be installed shall be suitable for continuous satisfactory operation in tropical area in and around Hyderabad with high humidity and following prevailing climatic conditions.

A Average Grade Atmosphere Dry

B Ambient Air Temperature: Highest 50° C, Average 40° C

C Relative humidity 100% Maximum & 10% Minimum

D Rainfall 600 mm (Concentrated in 4 months)

E Basic wind speed as IS: 875 44m/s

F Seismic Zone 4

G Atmosphere Tropical in close proximity with high humidity and foggy and dusty condition

3.6.3 System Parameter

The brief particulars of the 33 system parameters are given here under:

(i) Nominal system voltage: 33 kV

(ii) Highest system voltage: 36 kV (RMS)

(iii) Impulse withstand voltage: 170 kV peak 1.2/50 micro seconds wave of positive/negative polarity

(iv) System Frequency: 50 Hz

(v) No. of phase per circuit: Three

(vi) System Earthing: Solidly grounded

(vii) One minute power frequency: 75 kV (RMS) withstand voltage

(viii) Rated short time current: 25 kA

(ix)Duration of fault current: 3 second for RMU/Breaker and one second for cable.

The brief particulars of the 11 system parameters are given here under:

(i) Nominal system voltage: 11 kV

(ii) Highest system voltage: 12 kV (RMS)

(iii) Impulse withstand voltage: 75 kV peak 1.2/50 micro seconds wave of positive/negative polarity

(iv) System Frequency: 50 Hz

(v) No. of phase per circuit: Three

(vi) System Earthing: Solidly grounded

(vii) One minute power frequency: 75 kV (RMS) withstand voltage

(viii) Rated short time current: 25 kA

(ix)Duration of fault current: 3 second for RMU/Breaker and one second for cable.

INSTALLATION DATA:

Brief particulars of installation data are as under:

Location:

Route: Please refer enclosed drawing.

Type of laying: Direct burial in ground

Max. Soil temperature: 35 °C at cable depth

Characteristics of soil: Hard rock and Hard gravel but generally leveled. Presence of micro-organisms in the soil shall be taken into account.

Thermal resistivity of soil: 100/120°C cm/w[for information only, however exact value to be assessed by bidder ]

Type of the road surface: To be physically examined by bidder based on route layout.

3.6.4 Soil Data

The bidder shall be responsible for carrying out the required tests and should fully satisfy him about the nature of soil including the earth resistivity expected to be encountered prior to the submission of bid. Any variation of soil data during detailed engineering or construction stage shall not constitute a valid reason in affecting the terms and conditions of the bid or any extra price.

**3.7** SCHEDULE OF QUANTITIES

The detailed bills of quantity of major items/works are indicated in the Bid Price Schedules (BPS).

Wherever the quantities of items/works are not indicated, the bidder is required to estimate the quantity required for entire execution and completion of works and incorporate their price in respective Bid Price Schedules. Any material/works not specifically mentioned in the description in BPS, as may be required shall be deemed to be included in the bid itself and shall be provided at no extra cost to Employer.

**3.8** BASIC REFERENCE DRAWINGS

The enclosed indicative drawings give the basic scheme, layout etc. In case of any discrepancy between the drawings and text of specification, the requirements of text shall prevail in general.

However, the Bidder is advised to get these clarified from Employer, before submission of bids, in case of any doubt.

**3.9** TOOLS AND TACKLES

The bidder shall make the deployment of all special tools and tackles required for erection, testing, commissioning and maintenance of equipment.

**3.10** SPECIFIC REQUIREMENT

The bidder shall be responsible for safety of human and equipment during the working. It will be the responsibility of the Contractor to co-ordinate and obtain required clearance before commissioning. Any additional items, modification due to observation of such statutory authorities shall be provided by the Contractor at no extra cost to the Employer.

**3.11** RESTORATION OF ROADS:

a) The authorities owning the road en route would allow Road cuttings along the road, sides and on all the crossings.

b) Road cuttings are to be done by the contractor whereas the road cutting charges will be paid directly to the concerned authority /the local body by TGSPDCL.

c) Contractor shall be responsible for back filling and compaction of the trenches dug for laying of the cable.

**3.12** SHUT DOWN PLANNING:

Contractor shall carry out careful and detail pre- planning for the shut down schedules to minimize the number and duration of shut down in consultation with TGSPDCL.

• Shut down conditions shall be clear specifying designation of person responsible for giving LC (line clear)

• Authorization of personnel from the contractor’s side.

• Contractor shall fix the times for shut down preferably early morning and not later than 5 PM in the evening.

• All safety precautions for public and dept personnel, restoration of supply should be readily explained while returning LC.

**3.13** Additional items: In case any additional equipment is required to be installed which is not covered in tender document, the payment (rates) for such equipment shall be made at “Standard Estimate & Schedule of Rate” prevailing at the date of bid opening.

**3.14 CABLE ROUTES:**

Contractor shall carry out site survey and finalize cable routing by carrying out modification to the drawings enclosed with tender documents to take into consideration the design criteria.

1.1 Optimization of Cable lengths: Based on the tender drawings, route survey to be checked by the contractor and taking into consideration of transport limitation Wastage up to 1% of total length of cable length laid for each type/rating shall be permitted individually. Recovery shall be made for wastage of cable in excess of 1%.

Cable as per scope indicated in this specification, shall be laid underground in flat formation throughout the route.

• In DWC/GI/Hume pipe.

• In air at terminations.

• At varying depths due to obstructions.

• As per approved drawings;

• Railway crossing;

• Road crossing;

The bidder may visit the site and get him acquainted with the proposed cable route and soil condition to enable him to submit a realistic offer.

**3.15 EARTHING**

All metal parts including cable amour not intended for carrying current or not alive shall be connected to duplicate earthing system. Earth continuity conductors shall be provided down to the ground level for earth connection to earth pit. It shall have sufficient cross sectional area to afford a low resistant path for the full fault current envisaged.

The size of the earth continuity conductor shall also be large enough to reduce the potential rise of the metal frame of the equipment in the event of fault to minimum but in any case not more than 10V. The size of the earth terminals and conductors shall be adequate to restrict the temperature rise without causing any damage to the earth connection in the case of fault. No riveted joints in the earth conducting path shall be permissible and only bolted joints of adequate size shall be provided with GI nuts, bolts and plain and spring washers. The surfaces to be jointed shall be perfectly flat without any unevenness to ensure that there is no contact resistance.

An earth bus bar of copper strip of adequate size shall be provided inside all RMUs. The earth bus bar shall be terminated into two earthing terminals of adequate size with GI nuts, bolts and washers for connecting to earth continuity conductor mentioned above to which all earthing connections must be made.

The earth pit shall be made by digging pit of size 600\* 600\*2000mm and planting a 2 meter 80 mm dia CI earth pipe therein. The Earth pit shall be back filled with a mixture of Bentonite and black cotton soil to improve the earth conductivity. The earth electrode shall be connected SS earth riser from the earth pipe shall consist of GI flat of 25\*6 mm. The GI flat shall then be connected to the earth continuity conductor mentioned above and also the armour of the cables.

The CI pipe mentioned above would project 50 mm above the ground level as it should be visible and can be used for pouring water during the dry seasons.

All earthing shall strictly follow the provisions of Indian Electricity Rules 1956.

**3.16 DANGER PLATES**

Danger plates shall be provided on all equipment as per the statutory

**3.17 GENERAL REQUIREMENT**

3.17.1 The bidders shall submit the technical requirements, data and information as per the technical data sheets provided in the bid documents.

3.17.2 The bidders shall furnish engineering data, technical information, design documents, drawings etc fully.

3.17.3 It is recognized that the Bidder may have standardized on the use of certain components, materials, processes or procedures different from those specified herein. Alternate proposals offering similar equipment based on the manufacturer’s standard practice will also be considered provided such proposals meet the basic designs, standard and performance requirements and are acceptable to the TGSPDCL. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

3.17.4 Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the work unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost.

All similar standard components/parts of similar standard equipment provided, shall be inter-changeable with one another.

**3.18** STANDARDS

3.18.1 The works covered by the specification shall be designed, engineered, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

3.18.2 The Bidder shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC.

3.18.3 When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.18.4 Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. Copies of such standards shall be submitted by the bidder along with the bid.

3.18.5 The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

**3.19**DRAWINGS

All titles, noting, markings and writings on the drawing shall be in English.

All the dimensions should be in metric units.

**3.20** TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

3.20.1 His duly authorized representative and/or outside inspection agency acting on behalf of the TGSPDCL shall have at General Technical Requirement all reasonable times free access to the Contractor and the Subcontractor’s premises or Works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the Works during execution or erection.

Inspection may be made at any stage of execution of work, or at site at the option of the Employer and if found unsatisfactory due to bad workmanship or quality, TGSPDCL reserves the right to stop the such work and appropriate action may be initiated as per rules in vogue.

3.20.2 In all cases where the Contract provides for tests whether at the premises or at the works of the Contractor or the Sub-contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity,

fuel, water, stores, apparatus and instruments as may be reasonably demanded by the or his authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the or to his authorized representative to accomplish testing.

**3.21** TESTS AT SITE

3.21.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the and the contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed shall be included in the Contractor’s quality assurance programme.

3.21.2 Commissioning Tests

3.21.2.1 All required instrumentation and control equipment will be used during such tests and the contractor will use all such measuring equipment and devices duly calibrated as far as practicable. However, the Contractor, for the requirement of these tests, shall take immeasurable parameters into account in a reasonable manner. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The contractor will apply proper corrections in calculation, to take into account conditions, which do not correspond to the specified conditions.

3.21.2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning tests shall be provided by the contractor, free of cost.

3.21.2.3 The specific tests to be conducted on equipment have been brought out in the respective chapters of the technical specification. However where the pre-commissioning tests have not been specified specifically they shall be as per relevant IS code of practice or as mutually agreed.

3.21.3 The Contractor shall be responsible for obtaining statutory clearances excluding the road cutting charges from the concerned authorities for commissioning and operation of the equipment.

The Contractor shall be responsible for any loss or damage during transportation, handling and storage.

**3.22** All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all cables, valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

**3.23FINISHING OF METAL SURFACES**

3.23.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized or subjected to weatherproof painting after fabrication. High tensile steel nuts & bolts and spring washers shall be electro galvanized to service condition 4. All steel conductors including those used for earthing/grounding (above ground level) shall be with anticorrosive Bituminous paint.

**3.24 HOT DIP GALVANISHING**

3.24.1 The minimum weight of the zinc coating shall be 610 g/m² and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM.

**3.25 PAINTING**

3.25.1 Oil, grease, dirt and swarf shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by sand/shot blasting and thereafter by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

3.25.2 The exterior color of the paint shall be as per shade no: 697 of IS-5 and inside shall be glossy white for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.

**3.26 HANDLING, STORING AND INSTALLATION**

3.26.1 In accordance with the specific installation instructions as shown on manufacturer’s drawings or as directed by the or his representative, the Contractor r shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, and square are properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

3.26.2 In case of any doubt/misunderstanding as to the correct interpretation of manufacturer’s drawings or instructions, necessary clarifications shall be obtained from the TGSPDCL. The Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer’s drawings/instructions correctly.

3.26.3 The Contractor shall be fully responsible for the equipment/material until the same is handed over to the TGSPDCL in an operating condition after commissioning. Bidder shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over to the TGSPDCL, as well as protection of the same against theft, element of nature, corrosion, damages etc.

3.26.3 Where material/equipment is unloaded by before the Contractor arrives at site or even when he is at site, by right can hand over the same to Contractor and there upon it will be the responsibility of Contractor to store the material in an orderly and proper manner.

3.26.4 The Contractor shall be responsible for making suitable outdoor storage facilities, to store all equipment, which require outdoor storage or installation.

3.26.5 The words ‘erection’ and ‘installation’ used in the specification are synonymous.

3.26.6 Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes and Indian Electricity Rules, 1956 and Electricity Act.

3.26.7 The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances as given in clause 12.10 the Contractor shall immediately proceed to correct the discrepancy at his risks and cost.

**3.27 TOOLS AND TACKLES**

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly General Technical Requirement and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

**3.28 NAME PLATE/ LABELS:**

All apparatus shall be clearly labeled. Details of name plate/ labels of major equipment shall be submitted to for approval.

**3.29 EARTHING**

Each non alive metal parts of all equipment shall be double earthed in accordance with I E Rules, 1956. They shall include the following:

i. RMU, Double Extensible on Load Switch with breaker

ii. The steel structural parts, where provided;

iii. Cable armour/metallic screen.

**4. LAYING AND INSTALLATION**

**CABLE LAYING (33/11 kV)**

4.1 Cable as per scope indicated in this specification, shall be laid underground in flat formation throughout the route as per relevant IS and approved drawing. However, as per requirement of the field, the cables shall also have to be laid:

* Digging of trenches would have to be done in all types of surfaces, which may include soft soil, hard soil, rocky soil or even along the side of the road with a width 0.45 X 1.20 m for single trench and 0.50 X 1.20 m depth for double trench from road level.
* In many cases the digging of trenches and cable laying are to be done along narrow road with high traffic.
* Filling with sand for 75 mm

As per requirement of the field, the 33 kV- 3 X 400 mm² XLPE UG cable shall also have to be laid:

1. In Hume Pipe or GI pipe.

2. In air at terminations in GI pipe of length 2.5 m.

3. At varying depths due to obstructions.

4. The cost of Hume pipe/GI pipe and accessories such as clamp etc. should be included in the bid price.

In general, the cables would be laid along the road and in certain cases along the sides of the roads in case such berm is not available in narrow roads.

* Covering the laid cable with a sand layer of 200mm on the laid cable
* Providing of protective cover of shabad stones (0.3x0.5m) with 2 inch thickness over the sand
* The cable has to be rerouted for laying along roads even if not shown in the bid document drawing, in consultation with Employer site engineer.

4.2 The route plan of the cable is enclosed with bid documents to enable the bidder to have a correct assessment of the work involved. The final route shall however be site specific. The contractor shall prepare the final route drawing based on the design and planning criteria provided in this document and get the same approved from Employer before starting the cable laying work.

4.3 **TRENCHING**

The cable trench work involves earth excavation for cable trench, back filling and removal of excess earth from site. The work site shall be left as clean as possible. The trench shall be excavated using manual and mechanical methods including air compressor driven pneumatic drill as per field conditions.

Most main roads are of asphalt surface and some of the roads with cement concrete surface.

An air compressor with pneumatic drill or equivalent mechanical tool will be essential if the road crossings are to be speedily made. Special system of laying Hume pipe under road without digging the surface may be adopted if feasible.

Where paved footpaths are encountered, the pavement slabs shall be properly stored and reinstated. Identification markers of other services shall be properly stored and restored.

The sides of the excavated trenches shall, wherever required, be well shored up with timber and sheeting.

**4.4 Cable Laying and Installation**

* Suitable wooden/ sheet steel barriers should be erected between the cable trench and pedestrian/ motorway to prevent accidents.
* The barrier could be made out of sheet steel or wood planks. These could be portable types of size 1.5 m long by 1.2 m (height).
* These should be painted with red and white coloured cross stripes.
* Warning and caution boards should be conspicuously displayed.
* Red lights as warning signal should be placed along the trench during the nights.
* The excavated material shall be properly stored to avoid obstruction to public and traffic movement.
* The bottom of the excavated trench should be levelled flat and free from any object, which would damage the cables. Any gradient encountered shall be removed.

**4.5 TRIAL HOLES**: The bidder shall excavate trial holes, for alignment purpose at appropriate distance apart as warranted by the local conditions, keep a record of findings and close the trial holes properly to avoid hindrance / accidents to pedestrian traffic.

The final route alignment of cable shall be decided based on the finding of the trial hole.

It is the responsibility of the contractor to maintain as far as possible the required statutory clearances from other utility services.

Any damage caused, inadvertently to any utility services shall be the sole responsibility of the contractor.

The scope also includes the Trench less laying of HT Cables

**4.6 CABLE HANDLING**

The inspection of cable on receipt, handling of cables, paying out, flaking, cushioning with sand or sieved compacted native soil, back-filling, reinstatement of road surfaces, providing and fixing joint markers, route markers , precautions of joint pits, sump holes and all necessary precautions that are required shall be carefully planned and in general conform to IS 1255-1983 or its equivalent.

**4.7 DAMAGE TO PROPERTY**

The contractor shall take all precautions while excavation of trench, trial pits etc., to protect the public and private properties and to avoid accidental damage. Any damage so caused shall be immediately repaired by contractor at his own cost and brought to the notice of the concerned persons and to the Employer.

- Contractor shall arrange third party liability insurance for the above purpose.

- The contractor shall bear all responsibilities and liabilities and shall bear all costs of the damages so caused by him or by his workman or agents.

- At places where the cables cross private roads, gates of residential houses or buildings, the cables shall be laid in RCC hume pipes.

**4.8 CABLE ROUTE MARKERS/CABLE JOINT MARKERS**

Permanent means of indicating the position of joints and cable route shall be fabricated, supplied and erected.

Route Marker shall be provided at every 100 meter and at the turning points. Markers provided shall be as per the field requirement. If the route passes through open fields, markers should be conspicuously visible and above ground surface and particularly along the Road berms except on road & pavements where they may interfere in the movement of traffic or pedestrians*.*

The markers should incorporate the relevant information. The name of the owner, voltage shall be marked on the route marker.

The markers shall be of stone or tile construction. The design shall be such that it cannot be pulled out. Tile type marker shall be used along the pavement. Stone/ PCC markers shall be used at other locations. The stone/PCC markers shall be cut into proper size as per drawing,covered with cement plaster with engraving of the information required.

**4.9 DEPTH OF LAYING & SPACING BETWEEN CABLES:**

Minimum depth of laying from ground shall be as following:

33kV Cable: 1.20 meter

11 kV cable: 1.05 meter

Wherever the proper depth is not achievable due to presence of other services or for other reasons, the cable shall be laid deeper or in hume pipe or GI pipe as required depending upon the site condition.

**The pipes shall be supplied by the Contractor at no extra labour cost.**

**4.10 PAYING OUT THE CABLE**

The excavated cable trench shall be drained of all water and the bed surface shall be smooth, uniform and fairly hard before paying out the cable. The cable shall be rolled in the trench on cable rollers, spaced out at uniform intervals. The paying out process must be smooth and steady without subjecting the cable to abnormal tension. The cable on being paid out shall be smoothly and evenly transferred to the ground after providing the sand cushion. The cables shall never be dropped. All snake bends shall be straightened. Suitable size cable stocking pulling eye shall be used for pulling the cable. While pulling the cable by winches or machines, the tension loading shall be by tension indicator and shall not exceed the permissible value for the cable. The cable laying shall be performed continuously at a speed not exceeding 600 to 1000 meter per hour.

The cable end seals shall be checked after laying and, if found damaged, shall immediately be resealed. Sufficient number of heat shrinkable cable end sealing caps shall be stocked at site stores for testing and jointing work. The integrity of the outer sheath shall be checked after the cable is laid in position.

**4.11 SAND BEDDING AND BRICK**

The cable shall be completely surrounded by well-compacted sand to such a thickness and of such size that the cable is protected against damage. The thickness of the cable sand should normally be a minimum of 250 mm depth. Cable sand with a grain size less than 8 mm shall be preferred to offer good protection to cable.

A brick (of brick class designation 75) layer of thickness 70 mm brick shall be provided between the cables for cable separation for every 10 meters.

**4.12 FLAKING**

The cables shall be flaked and left with slight extra lengths at jointing bays for expansion and flexibility.

**4.13** Sand Bedding shall be provided as detailed in section 4.11 and no special thermal back filling is required.

**4.14 BACK FILLING**

Normally back filling shall consist of the material earlier excavated. However, bigger stones or pieces of rock should be removed.

**4.15 PREVENTION OF DAMAGE DUE TO SHARP EDGES**

After the cables have been laid in the trench and until the cables are covered with protective covering, no sharp metal tool shall be used in the trench or placed in such a position that may fall into the trench.

Straight and curved rollers used shall have no sharp projecting parts liable to damage the cable.

While pulling through pipes and ducts, the cable shall be protected to avoid damage due to sharp edges.

The cables shall never be bent, beyond the specified bending radius.

**4.16 ROAD, RAILWAY TRACKS, WATER PIPE LINE CROSSINGS**

DWC/GI pipe shall be used for crossing of Road for railway track and water pipe line. One spare pipe at each location of 33kV & 11 kV cable crossing shall be laid. Cable pipe size/ laying details shall be as per IS 1255-1983. The road cutting for cable trench, whether cement concrete, asphalt or macadam road surface shall be undertaken after obtaining approval for cutting from the road owning authorities, traffic police, telephone authorities and work should be planned to be completed in the shortest possible time. Where necessary the work shall be planned during night or light traffic periods. The railway track crossing design shall be got approved from the railway authorities and the contractor shall do work in coordination with them.

In the excavated trench across the road the pipes shall be laid, excavation backfilled compacted and surface shall be redone in the shortest possible time.

Open Drain Crossing: Where ever the cable has to cross open drains, with long span, the cable shall be laid in suitable size GI pipe properly joined with suitable collars. The GI pipe shall be firmly supported on pillars, columns, or suitable support of RCC foundation.

**4.17 FOOT PATH CUTTING**

The slabs, kerbstones, on the roads/ footpath shall be removed and reinstated without damage.

**4.18 REINSTATEMENT**

After the cables and pipes have been laid and before the trench is backfilled, all joints and cable positions should be carefully plotted in drawing and preserved and provided to the Engineer of TGSPDCL.

The protective covers shall then be provided, the excavated soil riddled, sieved and replaced. It is advisable to leave a crown of earth not less than 50 mm and not more than 100 mm in the centre and tapering towards the sides of the trench.

The temporary reinstatement of roadways should be inspected at regular intervals, more frequently in rainy season and immediately after overnight rain for checking settlement and if required, the temporary reinstatement should be redone.

After the subsidence has ceased the trench may be permanently reinstated and the surface restored to the best possible condition.

In case of the road surface is cement concrete, asphalt or tarred macadam, resurfacing may be done by the civic authorities against payment of the restoration charges to be made by the contractor.

**4.19 JOINTING BAYS**

The bidder shall identify the location of the joint bays after carrying out detailed survey of the cable route and excavation of the trial pits. The delivery lengths of the cables shall match the location.

The joint bay should have a flat and level surface. At the bottom in a corner, a sump pit shall be made, if necessary, for bailing out water.

The contractor shall follow standard practice in making joint bay, jointing and back filling after making joint and testing for the voltage class required.

All works shall be carried out in presence and supervision of the Engineer of TGSPDCL

**4.20 TOOLS AND PLANTS**

The successful bidder shall have all necessary tools, plant and equipment to carry out the survey and cable installation work.

The bidders are instructed to give all the details of equipment at their disposal, to carry out the work successfully and speedily.

**4.21 BENDING RADIUS:**

The minimum bending radius of XLPE insulated cables is as follows:

**Cable bending radius**

***Three Core 15 x D***

“D” means the overall diameter of the completed cable.

**4.22 JOINTING AND TERMINATION OF CABLES**

**4.23 TESTS AFTER INSTALLATION**

All tests as prescribed in Clause-6 of IEC-840 shall be performed after installation of cable. Following minimum tests shall be carried out:

a) Insulation Resistance of each cable drum length after paying but before jointing.

b) Serving insulation resistance after laying each cable length shall withstand a voltage of 5 kV DC between each reinforcement and external conducting surface for one minute. In addition, the serving insulation resistance shall be measured and checked with the values obtained in the routine factory test.

c) On completion of the cable laying and jointing work, the complete installation shall be tested with a D.C. voltage (high Voltage Test) as per IS 1255.

d) Conductor resistance of each cable of each complete circuit shall be measured and compared with the values obtained during routine factory tests.

e) Test for 5 minutes with system voltage applied between the conductor and the armour/ screen earthed.

f) Test for 24 hours with normal operating voltage of the system.

**B. FOUNDATION / RCC CONSTRUCTION**

**General**

1. Work covered under this Clause of the Specification comprises the designand construction of foundations and other RCC constructions for switchyard structures, equipment supports, trenches, control cubicles, bus supports, and systems, or for any other equipment or service and any other foundation required to complete the work. This clause is as well applicable to the other ECC constructions.

2. Concrete shall conform to the requirements mentioned in IS: 456 and all the tests shall be conducted as per relevant Indian Standard Codes as mentioned in Standard field quality plan appended with the specification. A minimum grade of M20 concrete (1:1.5:3 mix) shall be used for all structural/load bearing members as per latest IS 456.

3. If the site is sloppy, the foundation height will be adjusted to maintain the exact level of the top of structures to compensate such slopes.

4. The switchyard foundation’s plinths and building plinths shall be minimum 300 mm and 500 mm above finished ground level respectively.

5. Minimum 75 mm thick lean concrete (1:4:8) shall be provided below all underground structures, foundations, trenches, etc., to provide a base for construction.

6. Concrete made with Portland slag cement shall be carefully cured and special importance shall be given during the placing of concrete and removal of shuttering.

7. The design and detailing of foundations shall be done based on the approved soil data and sub-soil conditions as well as for all possible critical loads and the combinations thereof.

The Spread footings foundation or pile foundation as may be required based on soil/sub-soil conditions and superimposed loads shall be provided.

8. If pile foundations are adopted, the same shall be case-in-situ driven/bored or precast or under reamed type as per relevant parts of IS Code 2911.

Only RCC piles shall be provided. Suitability of the adopted pile foundations shall be justified by way of full design calculations. Detailed design calculations shall be submitted by the bidder showing complete.

Details of piles/pile groups proposed to be used. Necessary initial load test shall also be carried out by the bidder at their cost to establish the piles design capacity. Only after the design capacity of piles has been established, the Contractor shall take up the job of piling. Routine tests from the piles shall also be conducted. All the work (design & testing) shall be planned in such a way that these shall not cause any delay in project completion.

D**esign**

1. All foundation shall be of reinforced cement concrete. The design and construction of RCC structures shall be carried out as per IS: 456 and minimum grade of concrete shall be M-20. Higher grade of concrete than specified above may be used at the discretion of Contractor without any additional financial implication to the Owner.

2. Limit state method of design shall be adopted unless specified otherwise in the specification.

3. For detailing of reinforcement IS: 2502 and SP: 34 shall be followed. Cold twisted deformed bars (Fe=415 N/mm²) conforming to IS: 1786 shall be used as reinforcement. However, in specific areas, mild steel (Grade-I) conforming to IS: 432 can also be used. Two layers of reinforcement (on inner and outer face) shall be provided for wall and slab sections having thickness of 150 mm and above. Clear cover to reinforcement towards the earth face shall be minimum 40 mm.

4. The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and or equipment and or superstructure and other conditions, which produces the maximum stresses in the foundation or the foundation component and as per the relevant IS Codes of foundation design. Detailed design calculations shall be submitted by the bidder showing complete details of piles/pile groups proposed to be used.

5. Design shall consider any sub-soil water pressure that may be encountered following relevant standard strictly.

6. Necessary protection to the foundation work, if required shall be provided to take care of any special requirements for aggressive alkaline soil, black cotton soil or any other type of soil which is detrimental/harmful to the concrete foundations.

7. RCC columns shall be provided with rigid connection at the base.

8. All sub-structures shall be checked for sliding and overturning stability during both construction and operating conditions for various combinations of loads. Factors of safety for these cases shall be taken as mentioned in relevant IS Codes or as stipulated elsewhere in the Specifications. For checking against overturning, weight of soil vertically above footing shall be taken and inverted frustum of pyramid of earth on the foundation should not be considered.

9. Earth pressure for all underground structures shall be calculated using coefficient of earth pressure at rest, co-efficient of active or passive earth pressure (whichever is applicable). However, for the design of substructures of any underground enclosures, earth pressure at rest shall be considered.

10. In addition to earth pressure and ground water pressure etc., a surcharge load of 2T/m² shall also be considered for the design of all underground structures including channels, sumps, tanks, trenches, sub-structure of any underground hollow enclosure, etc., for the vehicular traffic in the vicinity of the structure.

11. Following conditions shall be considered for the design of water tank in pumps house, channels, sumps, trenches and other underground structures:

a) Full water pressure from inside and no earth pressure and ground water pressure and surcharge pressure from outside (application only to structures, which are liable to be filled up with water or any other liquid).

b) Full earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.

c) Design shall also be checked against buoyancy due to the ground water during construction and maintenance stages. Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the superimposed loadings.

12. The foundations shall be proportioned so that the estimated total and differential movements of the foundations are not greater than the movements that the structure or equipment is designed to accommodate.

13. The foundations of circuit breaker shall be of block type foundation. Minimum reinforcement shall be governed by IS: 2974 and IS: 456.

14. The tower and equipment foundations shall be checked for a factor of safety of 2.2 for normal condition and 1.65 for short circuit condition against sliding, overturning and pullout. The same factors shall be used as partial safety factor overloads in limit state design also.

**Admixtures & Additives**

1. Only approved admixtures shall be used in the concrete for the Works. When more than one admixture is to be used, each admixture shall be batched in its own batch and added to the mixing water separately before discharging into the mixer. Admixtures shall be delivered in suitably labeled containers to enable identification.

2. Admixtures in concrete shall conform to IS: 9103. The water proofing cement additives shall conform to IS: 2645. Owner shall approve concrete

3. The Contractor may propose and the Owner may approve the use of a water-reducing set-retarding admixture in some of the concrete. The use of such an admixture will not be approved to overcome problems associated with inadequate concrete plant capacity or improperly planned placing operations and shall only be approved as an aid to overcoming unusual circumstances and placing conditions.

4. The water reducing set-retarding admixture shall be an approved brand of Ligno-sulphonate type admixture.

5. The water proofing cement additives shall be used as required/advised by the owner.

**Technical specification of 11 kV/LT jointing kits**

**1.1General**: The cable jointing personnel and his crew shall have good experience in the type of joints and terminations that are used.

The jointing work shall commence as soon as two or three lengths of cables have been laid.

The cable jointing accessories shall include the end terminating kits, straight through joints, and also any special tools and tackles required for making these joints.

The contractor shall minimize the use of straight joints.

All care should be taken to protect the factory-plumbed caps/ seals on the cable ends, and the cable end shall be resealed whenever the end is exposed for tests.

Jointing of cables in carriage ways, drive ways under costly paving, under concrete or asphalt surfaces and in proximity to telephone cables and water mains should be avoided wherever possible.

Sufficient over lap of cables shall be allowed for making the joints.

The joint bay should be of sufficient dimensions to allow the jointers to work with as much freedom of movement and comfort as possible.

Sufficient space should be kept below the cable to be jointed. The joints of different phases shall be staggered.

All jointing shall be done by joint manufacturer’s jointers or under their supervision.

* 1. **TENTS / COVERS**

An enclosure or suitable protection cover shall be used in all circumstances wherever jointing work is carried out in the open irrespective of the weather conditions. The joint shall be made in dust free and clean atmosphere.

* 1. **PRECAUTIONS BEFORE MAKING A JOINT/ END TERMINATION**

The cable end seals should not be opened until all arrangement have been made for jointing and all necessary precautions have been taken to prevent circumstances arising out of rainy/ inclement weather conditions, which might become uncontrollable.

If the cable end seals or cable ends are found to have suffered damage the cables should not be jointed, without tests and rectification.

* 1. **MEASUREMENT OF INSULATION RESISTANCE**

Before and after jointing, the insulation resistance of both sections of cables shall be checked.

* 1. **IDENTIFICATION**

The identification of each phase shall be clearly and properly noted. The cables shall be jointed as per the design approved by the TGSPDCL based on the proposal submitted by the Contractor. Each cable shall have identification for phase and circuit at joint bays.

* 1. **MAKING A JOINT/ END TERMINATION**

Comprehensive jointing instructions should be obtained from the manufacture of jointing/end kits and meticulously followed.

The materials used in the joints/ end kits like Mechanical connectors, screen/armour continuity bonds, lugs etc., shall be of good quality and conform to standards.

The jointing tools shall be appropriate and as per the requirement of jointing XLPE/PVC cables.

**1.7 CABLE TERMINATIONS**

The cable terminations used are to be of outdoor type.

The preparation of the cable end for installing the terminations and the precautions to be taken before fixing the terminations shall be followed as in the case of the cable jointing procedures.

The instructions furnished by the termination manufacturer shall be strictly followed.

All terminations shall be done by joint manufacturer’s jointers or under their supervision.

At cable terminating end, the following provisions for supply and erection are to be included.

(i) A terminating structure should be provided where necessary for supporting the cable to be terminated (except at the ring main unit ends)

(ii) A sufficient length of spare cable shall be left in the ground, for future needs.

(iii) The rise of the cable immediately from the ground shall be enclosed in 225 mm dia GI pipe to protect against direct exposure to the sun.

(iv) The cable shall be properly fastened to the support using non-metallic clamps.

(v) Appropriate labels shall be fixed identifying the phase circuit, voltage and date of commissioning etc., on the cable supporting structure.

(vi) The sealing end shall be mounted on insulators to isolate them from their supporting steel work.

(vii) Protection from contact with the exposed metal work at the termination shall be provided by resin bonded glass fiber shroud.

(viii) Providing earth stations with all required materials, like leads, connectors etc for earthing of armour and screen.

**1.8 BONDING OF SCREEN / ARMOUR**

The screens and armour at both ends shall be brought out and solidly bonded to the earth station.

All accessories and consumables used in the termination should be of good quality and compatible with the cable.

**1.9 CONNECTION OF RADIAL WATER BARRIER AND CABLE SCREEN**

If the metallic radial water barrier is insulated from the metallic wire screen a connection suitable to carry the currents occurring during operation must be installed between metallic radial water barrier of the cable and metallic wire screen in joints and sealing ends.

**1.10 ERECTION OF CABLE TERMINATING STRUCTURES.**

The terminating structure should be designed as per the requirement of the cable end sealing, offered by bidder.

The mounting structure shall be of latticed Steel structure suitably grouted to the ground.

After fixing the end termination, the cable shall be fixed to the support, with non-magnetic material clamps to the required height securely.

The mounting structure includes the supports for cable end boxes, link boxes and any other structure required for the intent of the contract.

All steel sections used shall be free from all imperfections, mill scales, slag intrusions, laminations, fillings, rust etc., which may impair their strength, durability and appearance. All materials shall be of tested quality only unless otherwise permitted by the TGSPDCL. The Contractor shall fabricate, provide and install the structures.

**2.0. SERVICE CONDITIONS**

2.1. Ambient air temperature range 5°C to 50°C

2.2 Height of Installation 700 meters above sea level.

2.3 Terrain Rocky terrain and some areas are hilly

2.4 Atmospheric conditions foggy and dusty atmosphere

2.5 Maximum relative humidity 100%

2.6 Average annual rainfall 400mm approx.

**3.0 GENERAL REQUIREMENTS**

3.1 Compliance with standards

REFERENCES:

1. Standard Number ESI-09-13- Performance Specification for high voltage, heat shrinkable components for use with high voltage solid cables up to an including 33,000 volts.
2. IS: 13573-2010 Type Test and Performance Requirements for cable Terminations and Joints on XLPE Cables from 6.6 kV to 33 kV ratings.
3. IEC 61238-1: Compression and Mechanical Connectors for Power Cables with copper or Aluminum conductors - Tests Materials and Requirements.

3.2 Quality, Environmental Management**System and Laboratory Accreditation**

3.2.1 The Tenderer shall have a valid IS09001:2000 Quality Management System(QMS) certificate for the goods offered. The goods include the shrinkable and moulded components, as well as connectors.

The scope (extent) of the certification shall cover at least the design, development, production, installation and servicing of the offered goods.

In case of tenderers who act as kitters, the scope (extent) of the certification shall cover at least the production of the offered goods. This is in addition to the requirement for the design of the offered goods, which shall be under the QMS certificate of the manufacturer. The kitter shall also have a valid authorization by the manufacturer of the shrinkable components, authorizing the kitter.

In case the execution of the whole or any part of the work will be sub-contracted by the Tenderer to another company, the requirement pertaining to the Tenderer's Quality, Environmental Management System and Laboratory Accreditation will be satisfied, if the said requirement is possessed by the company which will actually undertake such execution.

3.2.2 The following requirements are additional to the requirements of the Specification

* The Tenderer shall have a valid IS014001:2000 Environmental Management System certificate. A copy of a valid IS014001:2000 Certificate should be submitted with the Tender.
* The Manufacturer Testing Laboratories shall be accredited to the ISO17025. A copy of a valid ISO 17025 Certificate should be submitted with the Tender.

In case the execution of the whole or any part of the work will be sub-contracted by the Tenderer to another company, the requirement pertaining to the Tenderer's Quality, Environmental Management System and Laboratory Accreditation will be satisfied, if the said requirement is possessed by the company which will actually undertake such execution.

3.3 Units**of measurement**

In all correspondence, in all technical schedules and drawings metric units of measurement shall be used.

3.4 General requirements**for Kits**

All materials in the Joint/termination kits offered shall be the latest designs incorporating improvements in materials and installation procedures.

The jointing/termination materials and components shall be offered in the form of kits. The kits shall be supplied complete with all necessary tubings and components. The kits shall include connectors, lugs and all other accessories to form a ready to energize joint/termination.

All components mentioned in paragraph 7.4, as well as all other premoulded or elastic components comprising a Joint/Termination kit, shall be designed and manufactured by the same manufacturer, excluding the stress control tube.

3.5 Packing and Marking

The joint/termination kit shall be properly packed with all the shrinkable tubings, moulding components and connectors, lugs, other accessories as required forming a self contained kit. The packing shall be of such design as to prevent moisture and dust ingress and shall also protect the contents against mechanical damage.External packing shall carry a label with the following information clearly marked:

* Name of Manufacturer
* Manufacturers reference
* Year of Manufacture/ Purchase order No.
* Expiry date whenever applicable

The kits shall also include the following:

1. Installation Instruction sheet manuals containing complete step by step instructions in the English language.
2. A check list stating the quantities and description of components contained in the kit shall be supplied in each kit.

Each component of the kit shall be separately packed in polyethylene and component name/part number shall be marked on the polyethylene packing.

All materials and components comprising the kit shall be clearly and permanently marked in a prominent position with the supplier/manufacturer name, product identification, batch number and year of manufacture. The batch number shall allow for full traceability of manufacture including the new materials which make up the polymeric compounds used in extrusion and moulding processes. Extruded components (tubing and wrap-around) shall additionally be marked with their expanded and fully recovered internal diameter. They may alternatively be marked with the upper and lower diameters of their range of application.

Markings on extruded components shall be repeated along the length with gaps not exceeding 200mm. Components which cannot be marked shall have the above information provided on immediate packaging.

Packed kits shall be packed in carton boxes which shall be placed in wooden pallets in order to facilitate fork-lift handling.

The carton box is to be permanently fixed to the wooden pallet and consideration to be given to the fact that the boxes shall have maximum height 140cm. Thepacking are to be wrapped with strong nylon cover for protection against ingress of moisture.

**3.6 Storage**

Components and kits shall be capable of being stored without deterioration in an ambient air temperature 5°C to 50°C when protected from direct sunlight.

**3.7** **Inspection and testing**

All materials covered by this Specification shall be subject to inspection and test by the Authority during manufacture and before final dispatch from manufacturer's works. The approval of the Authority of any such inspection or test will not, however, prejudice the right of the Authority to reject the materials or any part thereof, if it does not comply with the specification when erected or does not give complete satisfaction in service. The contractor shall make available to the Authority for the inspection and testing all required personnel and offer facilities (equipment, testing instruments etc.) at no cost to the Authority. The Authority may, however, use his own instruments and apparatus as a check.

Before any part of the jointing materials is packed or dispatched from the manufacturers works, all tests called for are to have been successfully and satisfactorily carried out in the presence of the Inspector and a certificate issued to that effect by the Inspector in writing.

Adequate notice is to be given when any part of the jointing materials is ready for inspection or test and every facility is to be provided by the Contractor and his sub­contractors to enable the Inspector to carry out the necessary inspection and witness the tests. Duplicate copies of all principal Test Records and Test Certificates are to be supplied to the Inspector for all tests carried out in accordance with the provisions of this specification.

The jointing materials and all component parts thereof are to be fully tested in accordance with the provisions of the latest relevant standards as stated in paragraph 2.0 of this Specification or as may be agreed in writing with the Inspector. Test Certificates are to be forwarded to the Purchaser together with the invoices.

**3.8 Service experience**

Tenderers shall provide evidence proving that they have satisfactory experience of at least 10 years in the design and manufacturing of jointing accessories for electric cables, 5 of which must be for the type of accessories offered.

In addition, Tenderers shall meet the requirements of the relevant clause "Documents Establishing Goods conformity to Tender Documents" of the relevant section of the Tender Documents.

**3.9Accelerated laboratory tests**

The following requirement is additional to the requirements of the Specification, and if met will benefit the tenderers for Evaluation of the Tender Documents.

Proof of accelerated laboratory test and long term field usage to confirm the retention of the properties of the materials within permissible limits under variations of temperature and thermal ageing must be submitted with Tender.

3.10 Samples

Tenderers are required to submit with their tender samples of the kits offered as to be delivered in case of order. The kits shall include the installation instructions.

Tenders without samples shall not be considered. The samples shall be returned to the tenderers, after the award, at their own expenses.

3.11 Training

Tenderers are required to provide training for TGSPDCL staff and also to the available outsourced cable jointers for at least 10 man days in phase wise over the period of the contract, at dates that will be decided at a later stage. All expenses i.e., trainers wages, living expenses, training materials i.e., cables and jointing materials shall be provided by shall be covered by the Tenderer.

4.0 TECHNICAL REQUIREMENTS

The technical requirements described below refer to heat shrinkable, elastic and moulded products (separable connectors).

4.1 Design**and** Technology

Product design shall be based on the use of heat-shrinkable or elastic tubings and moulded parts to provide for the functions of high voltage insulation, electrical stress control, electrical screening, sealing and environmental protection as necessary. The use of tapes to provide primary insulation, screening or primary stress control is not acceptable.

Tenderers shall submit evidence with their tenders that designs are based on sound engineering principles, accumulated know-how and satisfactory service experience.

Design shall aim at minimizing the number of component parts and the time and skill required for satisfactory installation.

For joints single anti tracking tube design is required, which shall provide both anti tracking and stress control grading.

Anti-track and weather-resistant tubing shall be used in outdoor terminations in all positions where the material surface is subject to electrical stress. Mastics or adhesives used as sealants for these tubings must be similarly anti-track and weather-resistant.

All necessary sealants shall be provided pre-coated on the internal surfaces of tubings and moulded parts. Sealant surfaces shall be protected by release paper as necessary.

Screening of conductor connectors shall be achieved with *single* co-extruded dual wall tubing/Tripple wall tubing comprising an inner insulating layer and an outer conducting layer. Separate or additional insulating and conducting tubings are not acceptable. The insulating layer shall provide an insulation thickness at least 30% more than the cable insulation.

4.2 Lugs**and connectors**

4.2.1. Mechanical **shear bolt type**

Mechanical shear bolt type connectors shall be used as follows:

They shall have the following characteristics/features:

1. They shall be in accordance with EN 61238-1.
2. Connectors shall be of the water block type and the shear bolt heads to be hexagonal.
3. Lugs on Aluminum cores shall be provided with oxidation inhibiting compound, or any other approved means for inhibiting oxidation.
4. Bolts of the shear bolt type shall be suitable for M12 bolt

**4.3.** Installation Instructions

Detailed installation instructions with drawings for all joints and terminations offered, including all parts, shall be provided with the tender documents in English language.

The successful tenderer shall provide installation instructions in English language.

4.4 Component types

For heat shrinkable materials:

1. The tubing components (such as internal insulating tubing, stress controltubing, anti-track tubing, external protective tubing) shall conform to therequirements given of EA TS 09

The moulded components shall conform to the requirements given in List 2 of EA TS 09-13.

1. The sealants shall conform to the requirements given in List 3 of EA TS 09-13 and EA TS 09-11.
   * 1. Specific requirements for components

Electric stress control for the cable insulation screen ends and over the connectors shall be achieved by tubings.

The stress control material shall have defined impedance characteristic, volume resistivity, and permittivity (dielectric constant). The AC impedance shall remain constant despite of thermal ageing, which will take place due to heating effect within the conductor and the temperature of the environment.

Tenderers must submit:

1. Documentary evidence including graphs showing the effects of temperature and thermal ageing on the impedance of the stress control material offered.
2. A technical explanation as to how the correct electrical properties of the material Vs volume resistivity, permittivity and AC impedance, have been derived
3. The recommended lengths of the stress control material.
4. Proof of accelerated laboratory and long term field usage to confirm the retention of the properties within permissible limits under variations of temperature and thermal ageing.

4.4.1.2 Non tracking erosion and weather resistant, insulating tubing and moulded parts

Tenderers must provide proof of weather and track resistance of the polymeric material offered, through actual field studies or through accelerated laboratory studies, to confirm a minimum of 30 years expectancy.

This should include:

1. Thermal Endurance - An Arrhenius plot to confirm the life expectancy on continuous exposure at 90° C.
2. Tracking and Erosion Resistance Test to prove the withstand ability against effects of surface electrical leakage currents.
3. Weathering Data properties.

4.4.1.3 Track Resistant Sealant is (Insulating and Weather Resistant)

Sealing of the interfaces between components subject to electrical stress shall be achieved by using a track resistant sealant or a hot melt adhesive. This sealant/adhesive shall be pre-coated inside the shrinkable components. Tenderers must provide the following information:

1. The adhesive peel strength the sealant provides between Non tracking tubing and non tracking moulded part.
2. The dielectric strength, tracking and erosion resistance of the sealant as per ASTM D2303.

4.4.1.4 Dual Wall/Tripple wall co, extruded Tubing

Tenderers must submit:

(a) Proof that the dual/Tripple wall tubings are manufactured by means of co extrusion.

* Proof of accelerated laboratory and long term field usage to confirm the retention of key properties within permissible limits due to thermal ageing. Minimum key properties before and after ageing to be stated.
* Confirmation of the minimum thickness of insulation provided over theconnector for the maximum size of conductor for which the tubing is supplied.The insulation layer shall provide an insulation thickness at least 30% morethan the cable insulation.

4.4.1, 5 Void Filling, Stress Relieving Mastic

Tenderers must submit:

(a) Data of the stress relieving mastic, which should include information on thevolume resistivity, and permittivity.

The mastic shall provide a void free interface between the stress control layer and the cable insulation as well as the connector and Proof of long term usage in the field to confirm satisfactory performance.

**4.5. SpecificRequirements for Joints.**

**4.5.1 General requirements for joints.**

4.5.1.1 External leakage insulation between the live conductor and earth potential using anti-track and weather resistant material.

4.5.1.2 Electrical stress control using electrical stress control material over the cores.

4.5.1.3 Hermetic sealing of the interfaces between the cable accessory and cable surfaces, bushings or cable lugs by use of track resistant adhesive/sealant.

4.5.1.4. Detail technical characteristics wrap around sleeve if offered must be provided.

4.5.2.4 Outdoor termination kits shall provide means for protecting the exposed insulation of the conductors from UV radiation.

5.0 TESTS

5.1 Type**Tests on Components**

The Tenderer shall submit with the tender documents test certificates to prove that shrinkable or elastic or moulded components, lugs and connectors used for cable joints and termination kits comply with the performance specification as indicated in HD629.1 S2, EA TS 09-11 and EATS 09-13. Test certificates shall be submitted with the tender documents.

**5.2 Routine Tests on Components**

Tenderers must submit with their tenders routine tests certificates as per the requirements of EA TS 09-11 and EA TS 09-13.

In addition, during the acceptance testing of the first and any other subsequent consignment, components will be randomly selected by the Inspector from jointing kits and will be subjected to the following routine and type tests, at CPRI.

The cost of testing shall be inclusive of all tests specified at CPRI in the bid cost.

Visual examination

1. Dimension
2. Flame Retardant
3. Packing and markings.

**5.3 Type Tests on 33 kV Joints and Terminations**

The Tenderers are required to submit with their Tenders the type test certificates mentioned in the following paragraphs, for each type of cable Joint or Termination. For testing, the test specimen shall be mounted on a cable similar with that intended. Parts and accessories (e.g. connectors) included in the design/supply that can affect the test result shall be installed. For tender purposes, the type tests must have been carried out by using mechanical connectors.

In addition, during the acceptance testing of the first consignment, Joint and Termination kits will be selected on a random basis by the Inspector and the following tests shall be repeated on cables provided by the Authority, at his presence, and tests certificates shall be issued by the Manufacturer. Thermal cycle and salt fog tests can be waived at the discretion of the Inspector, provided that test certificates issued by a reputable and internationally recognized Testing Body are presented.

In addition during the acceptance testing of the first and any other subsequent consignment, joint/termination kits will be selected on a random basis by the Inspector and the tests described above shall be repeated on cables provided by the Authority, at his presence, and test certificates shall be issued by the manufacturer.

The tests shall be performed using the appropriate type of lugs and connectors, as required in paragraph 7.2 above.

TYPE TEST SEQUENCE FOR JOINTS AND TERMINATIONS:

TEST SEQUENCE FOR TERMINATIONS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sr. No | Test1) | Requirements | Test Methods of IS: 13573 Part 3 |  | | | | |
|  | | | |  |  |  |  |  |
| 1 | Conductor resistance |  | Sub clause 4.1 |  |  |  |  |  |
| 2 | AC withstand or DC withstand  AC (wet) | AC for 5 min at 4.5 U0 or DC for 15 min at 4 U0  1 min at 4 U0 2) | Sub clause 4.2 or 5 |  |  |  |  |  |
| 3 | Partial discharge | 10 pC max. at 1.73 U0 | Clause 7 |  |  |  |  |  |
| 4 | Impulse at θt3) | 10 impulses of each polarity | Clause 6 |  |  |  |  |  |
| 5 | Heating cycles in air | 60 cycles4) at θt3) and 2.5 U0 | Subclauses  9.1 and 9.2 |  |  |  |  |  |
| 6 | Partial discharge at θt3),5) and ambient temperature | 10 pC max. at 1.73 U0 | Clause 7 |  |  |  |  |  |
| 7 | Thermal short circuit (screen)6) | Two short circuits at Isc of the cable screen. No visible deterioration | Clause 10 |  |  |  |  |  |
| 8 | Thermal short circuit (conductor) | Two short circuits to raise conductor to θsc of the cable. No visible deterioration | Clause 11 |  |  |  |  |  |
| 9 | Dynamic short circuit8) | One short circuit at Id. No visible deterioration | Clause 12 |  |  |  |  |  |

TEST SEQUENCE FOR TERMINATIONS (CONTINUED)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 10 | Impulse | 10 impulses of each polarity | Clause 6 |  |  |  |  |  |
| 11 | Conductor resistance |  | Subclause 4.1 |  |  |  |  |  |
| 12 | AC Voltage | 15 min at 2.5 U0 | Subclause 4.2 |  |  |  |  |  |
| 13 | Humidity 9),10) | 300 hrs at 1.25 U0 | Clause 13 |  |  |  |  |  |
| 14 | Salt Fog 2),10) | 1000 hrs at 1.25 U0 | Clause 13 |  |  |  |  |  |
| 15 | Examination | For information only11) | - |  |  |  |  |  |
| 1) Unless otherwise specified, tests shall be carried out at ambient temperature.   1. For outdoor terminations only. 2. θt is the maximum cable conductor temperature in normal operation +5 °C to + 10 °C. 3. 8 hrs total with ≥ 2 hrs steady and ≥ 3 hrs cooling. 4. Measurement is made at the end of the heating period. 5. This test is only required for terminations that are equipped with a connection to, or adaptor for, the metallic screen of the cable 6. Thermal short circuit may be combined with the dynamic short circuit. 7. Only required for single core cable accessories designed for initial peak currents ip> 80 kA and three core accessories designed for ip> 63 kA. Value of id shall be declared by the manufacturer. 8. For outdoor terminations only. Not required for compound filled terminal boxes. Shrouded terminations shall be tested in a three phase condition. 9. Not required for terminations having porcelain insulators. 10. It is advised that the accessory is examined for signs of any of the following:   - cracking in the filling media and/or tape or tube components.  And/or - a moisture path across a primary seal  And/or - corrosion and/or tracking and/or erosion which would, in time, lead  to failure of the accessory.  And/or - leakage of any insulating material. | | | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sr. No | | Test1) | Requirements | Test Methods of IS: 13573 Part 3 |  | | |
|  | | | | |  |  |  |
| 1 | Conductor resistance | |  | Subclause 4.1 |  |  |  |
| 2 | AC withstand or DC withstand | | AC for 5 min at 4.5 U0 or DC for 15 min at 4 U0 | Subclause 4.2 or 5 |  |  |  |
| 3 | Partial discharge | | 10 pC max. at 1.73 U0 | Clause 7 |  |  |  |
| 4 | Impulse at θt2) | | 10 impulses of each polarity | Clause 6 |  |  |  |
| 5 | Heating cycles in air | | 30 cycles3) at θt2) and 2.5 U0 | Clause 9 |  |  |  |
| 6 | Heating cycles under water | | 30 cycles3) at θt2) and 2.5 U0 | Clause 9 |  |  |  |
| 7 | Partial discharge at θt2),4) and ambient temperature | | 10 pC max at 1.73 U0 | Clause 7 |  |  |  |
| 8 | Thermal short circuit (screen) | | Two short circuits at Isc of the cable screen. No visible deterioration | Clause 10 |  |  |  |
| 9 | Thermal short circuit (conductor) | | Two short circuits to raise conductor to θsc of the cable. No visible deterioration | Clause 11 |  |  |  |
| 10 | Dynamic short circuit6) | | One short circuit at Id. No visible deterioration | Clause 12 |  |  |  |
| 11 | Impulse | | 10 impulses of each polarity | Clause 6 |  |  |  |

Note: The Contractor has to follow REC standard for the work where ever it is not specifically mentioned above.

**SECTION 6**

**QUALITY ASSURANCE PLAN**

**QUALITY ASSURANCE PROGRAMME**

1. To ensure that the equipments are in accordance with the specifications, the contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programme shall be out lined by the contractor and shall be finally accepted by owner/ authorized representative after discussions before the award of contract. The QA programme shall be generally in line with ISO-9000/IS-14000. A quality assurance programme of the contractor shall generally cover the following:

i) His organization structure for the management and implementation of the proposed quality assurance programme.

ii) Quality system manual.

iii) Design control system.

iv) Documentation control system

v) Qualification data for bidder’s key personnel.

vi) The procedure for purchase of material, parts, components and selection of sub vendors service including vendor analysis, source inspection, incoming raw material inspection, verification of materials purchased etc.,

vii) System for shop manufacturing control including process controls, fabrication and assembly controls.

viii) Control of non conforming items and systems for corrective actions.

ix) Inspection and test procedure as per relevant ISS.

x) Control of calibration and testing of measuring and testing equipment as per standards.

xi) System for indication and appraisal of inspection status.

xii) System for quality audit

xiii) System for authorizing release of manufactured product to owner.

xiv) System for maintenance of records

xv) System for handling storage and delivery

xvi) All the plant standard/ written down practices followed by the manufacturer/ contractor against the manufacturing activities in their works will be submitted in electronic media preferably in at least one set of compact discs.

**2. GENERAL REQUIREMENTS – QUALITY ASSURANCE PLAN**

2.1 All materials, components and equipment covered under this specification shall be procedure manufactured and tested at all the stages, as per a comprehensive quality programme. An indicative programme of inspection/ tests to be carried out by the contractor for some of the major items is given in this specification. This is however, not intended to form a comprehensive programme as it is the contractor’s responsibility to draw up and implement such programme duly approved by the Owner. The detailed quality plans for the manufacturing activities should be drawn up by the bidder, and will be submitted to Owner for approval. Schedule for finalization of such quality plans will be finalized before award.

2.2 Manufacturing quality plan shall detail out for all the components and equipments, various tests, inspection, to be carried out as per the requirements to this specification and standards mentioned therein and quality practices and procedures followed by contractor’s Quality Control Organization, the relevant reference documents and standards acceptance norms, inspection documents raised etc., during all stages of material procurement, manufacture, assembly and final testing/ performance testing.

2.3 The bidder shall also furnish copies of the reference documents/ plant standard / acceptance norms/ test and inspection procedure etc., as referred in Quality Plan alongwith Quality Plans.

2.4 The Quality Plans and reference documents/ standards etc., will be subject to Owner’s approval and will form a part of the contract. In these approved Quality Plan, Owner shall identify customer hold points (CHP) which shall be carried out in presence of the Owner’s Project Manager and beyond which work shall not proceed without, written consent of Owner’s Project Manager/ authorized representative in writing. All deviation to this specifications, approved quality plans and applicable standard must be documented and referred to Owner along with technical justification for approval and dispositioning.

2.5 No material shall be dispatched from the manufacture’s works before the same is accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/ inspections by Owner’s Project Manager/ authorized representative, and duly authorized for dispatch issuance of MDCC.

2.6 All materials used and supplied shall be accompanied by valid and approved materials certificates and tests and inspection reports. These certificates and reports shall indicate the heat numbers or other such acceptance identical numbers of the material. The material certified shall also have the identification details stamped on it.

2.7 All materials used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/ standard. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and / or agreed details.

2.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME section-IX/ BS-4870 or other international equivalent standard acceptance to the Owner.

2.9 All welding/ brazing procedure shall be submitted to the Owner or its authorized representative for approval prior to carrying out the welding/ brazing.

2.10 All brazers, welders and welding operators, employed on any part of the contract either in contract / his sub-contractors works or at site elsewhere shall be qualified as per ASME section-IX or BS-4871 or other equivalent International Standards acceptable to the Owner.

2.11 Test results of qualification tests and specimen testing shall be furnished to the Owner for approval. However where required by the Owner, tests shall be conducted in presence of Owner/ authorized representative.

2.12 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

2.13 Results of all non-destructive testing shall be recorded on certificates.

2.14 All the sub-vendors proposed by the contractor for procurement of major bought out item including castings, forgings, semi-finalized and finished components/ equipment, list of which shall be drawn up by the contractor and finalized with the Owner shall be subject to Owner’s approval. The contractor’s proposal shall include vendor’s facilities established at the respective works, the process capability, process stabilization, QC Systems followed, experience list etc. along with his own technical evaluation and shall be submitted to the Owner for approval prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

2.15 For components/ equipment procured by the contractors for the contract, after obtaining the written approval of the Owner, the contractor’s purchase specifications and enquiries shall call for quality plans to be submitted by the suppliers along with their proposals. The quality plans called for from the vendors shall set out, during the various stages of manufacture, the quality practices and procedures followed by the vendor’s quality control organization, the relevant reference documents/ standards used, acceptance level, inspection of documentation raised etc.,

2.16 Such quality plans of the successful vendors shall be finalized with the Owner and such approved quality plans shall form a part of the purchase order/ contracts between the contractor and the vendor, within three weeks of the release of the purchase order/ contract for such bought out items/ components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Owner by the contractor.

2.17 The purchase specifications for the major bought out items, list of which shall be drawn up by the contractor and finalized with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.

2.18 Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the contractor’s or their sub-vendor’s quality management and control activities. The contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

2.19 The contractor shall carry out an inspection and testing programme.

2.20 Quality audit/ surveillance/ approval of the results of the tests and inspection will not, however, prejudice the right of the Owner to reject the equipment if it does not comply with specification when installed or does not comply with the specification in service and the above shall in no way limit the liabilities and responsibilities of the contractor in ensuring complete conformance of the materials/ equipment supplied to relevant specification, standard, data sheet, drawings etc.,

2.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

2.22 Repair/ rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Owner/ authorized representative.

**3. QUALITY ASSURANCE DOCUMENTS**

3.1 The contractor shall be required to submit two sets of compact discs of the following Quality Assurance Documents within three weeks after dispatch of the equipment.

i) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

ii) Factory tests results for testing required as per applicable codes and standard referred in the specification.

iii) Inspection reports duly signed by QA personnel of the Owner and contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded.

1. When some important repair work is involved to make the job acceptable; and
2. The repair work remains part of the accepted product quality.

iv) All the accepted deviations shall be included with complete technical details.

SECTION – 7

**SCHEDULE OF QUANTITIES AND PRICES**

1. **PREAMBLE**
2. The schedule of Quantities shall be read in conjunction with the Instructions to Bidders. General and Special Conditions of Contract, Technical Specifications and Drawings and schedule-A of price bid document where quantities and their estimated values are mentioned.
3. The quantities given are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered in the schedule-A of price bid document. Where applicable and otherwise at such rates and prices the Engineer may fix within the terms of the Contract.
4. The rates and prices tendered in the schedule-A of price bid document shall, except in so far as it is otherwise provided under the Contract, include all constructional plant, labour, supervision materials, erection maintenance, insurance, profit. Taxes and duties, together with all general risks, liabilities and obligations set out or implied in the contract.
5. The whole cost of complying with provisions of the Contract shall be included in the items provided in the schedule-A of price bid document, and where no items are provided the cost shall be deemed to be distributed among the rates and prices entered for the related items of work.
6. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the schedule-A of price bid document. References to the relevant sections of the contract documentation shall be made before entering prices against each item in the price schedule of Quantities.
7. The method of measurement of completed work which means supply erection and fixing of cross arms and other necessary auxiliaries in case of PSCC poles and the payment shall be in accordance with relevant I.S.S. Codes.
8. The method of measurement of completed work of payment shall be in accordance with relevant I.S.S. Codes.
9. Rock defined as all materials which, in the opinion of the Engineer require blasting or the use of metal wedges and sledge hammers or the use of compressed air drilling for its removal and which cannot be extracted by ripping with tractor at least with 150 BHP with single rear mounted heavy duty ripper.

SECTION - 8

**SAFETY MEASURES**

The Contractor shall maintain safety tools and materials as per the work to be carried out.

TGSPDCL is not liable for any accident or untoward incident during the execution of work.

**Warnings Signs**

Different types of warning signs such as "Men working", "Line under permit to work", "Danger", etc and other indications for earthing, live parts, shock hazard possibility etc are to be displayed at strategic points by the contractor.

The contractor shall utilize the safety material as detailed during the execution of work.

**Rubber Gloves**

These are specially processed gloves, high dielectric strength, hardened as required and with flexibility for normal bend of fingers and thumbs for operating equipment handles.

**Work Gloves**

These are gloves made of silicon grain leather, flexible and with large protective cuff. These gloves are used while working on equipment for pre-commissioning tests or for repairs.

**Polyethylene helmets**

Safety hats for industrial and construction use, with tough outer shell, brims to allow water to drain and with adjustable side ventilation, in standard sizes.

**Insulated boots**

These are boots made of special leather with elastomeric canvas support, flexible with anti-slip sole.

**Safety Unit**

Safety clothing, include safety suit with no metal parts, resistant to wear and tear, flexible comfortable with Velcro straps.

**Hooded Rain Coat**

PVC rain garment with matching nylon trousers for the use of workmen during rains.

**Reinforced Safety Belt**

These are waist belts for use in the overhead line work, with polyamide or leather elements, cast steel buckles suspension rings, straps, fiber ropes etc. Anti-fall safety-snaps will also be part of the safety belt.

**Portable lamps’**

In the safety tools of workmen, head lamps, pocket torch, hand lamps etc are also included.

**Life saving Kits**

These shall contain, voltage detectors, cable cutter with insulated handles and insulated platform on ladder and rescue sticks.

**Fire Extinguisher -**

Normally CO2cylinder 4.5'\*g, 6.5 kg, 9 kg, 22 kg are used in sub-stations and generating stations. 22 kgcylinders are generally trolley mounted type.

The work area shall be separated from all possible sources of supply of power, by ensuring relevant circuit breakers, isolating switches etc.

The equipment like breakers and isolators shall be locked in the open condition.

1. Warning boards shall be exhibited even during the simple temporarymaintenance operation,
2. The area of work shall be properly demarcated with identifying ribbons or ropes.
3. Each conductor or apparatus shall be checked to ensure absence of voltage.
4. Proper short circuit and earthing shall be made before commencing any work on the line or equipment.

All safety rules given above and other associated guide lines are for enhancing safety when a person is in contact with or in close proximity to an electrical network. Using proper ladders, safety belts, helmets, insulating gloves etc form part of the safety rules, as observation of the same are essential for preventing accidents other than the electrical shock hazard.

**Safety Checks**

The safety checks include the following

1. Whether the worker is properly trained for the work and aware of safety rules?

ii) Whether appropriate tools, and gadget available for the work? ***AN%***

iii) Whether the' person is properly insulated by using insulated platform, gloves, mats etc.?

iv) Whether the active or live conductors are away at a safe distance?

v) Whether safety equipment like helmets, safety belts, fire fighting equipment, earth rods etc. available?

vi) Whether all accidental reconnection of supply or induced voltage possibilities are guarded against?

vii) Whether life saving kits and first aid equipment available?

**Safety Measures during erection of lines and installation of Equipment 3.5.1 Excavation for Foundations.**

• The excavation for pad or pile type foundations in excess of 1.5 meters depth located on unstable earth shall be either sloped to the angle of repose or shored if entry is required., Ladders shall be used for access to pad or pile type footing excavations in excess of 1.2 meters.

Workmen shall not enter excavated pit in un-stable earth unless shoring is used to protect them.

* Workmen shall not remain in the excavated pit where concreting is done using machinery.
* Mobile machines for concreting shall be located only on leveled earth to ensure stability.

**SECTION - 9**

**FORM OF BID, QUALIFICATION INFORMATION, PERFORMANCE BANK GUARANTEE AND LETTER OF ACCEPTANCE**

**TABLE OF FORMS:**

* **CONTRACTOR’S BID**
* **QUALIFICATION INFORMATION**
* **LETTER OF ACCEPTANCE**
* **NOTICE TO PROCEED WITH THE WORK**
* **BID SECURITY BANK GUARANTEE**
* **PERFORMANCE SECURITY BANK GUARANTEE**
* **AGREEMENT FORM**
* **DECLARATION FORM**

**CONTRACTOR’S BID**

Description of the Works \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**BID**

To : Chief Engineer /Medchal Zone, TGSPDCL, Mint Compound, Hyderabad-500063.

(The Employer)

**Gentlemen,**

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying this Bid for the Contract Price of \_\_\_\_\_\_\_\_\_\_\_\_ (in figures) (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) in letters.

Whether advance is available or not the advance payments required is: Rupees\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

This Bid and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Bid you receive.

Commission or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution if we are awarded the contract, are listed below:

Name and address of agent Amount Purpose of Commission on gratuity/

………………………………. ………….. ………………………………………..

………………………………. ………….. ………………………………………..

………………………………. …………..

(If none, state “none”)

We hereby confirm that this Bid complies with the Bid Validity and Bid Security required by the Bidding documents.

We attach herewith our current income-tax clearance certificate.

Yours faithfully,

Authorized Signature:

Name & Title of Signatory: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name of Bidder: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Address: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. To be filled by Bidder, together with his particulars and date of submission at the bottom of the form of Bid.

**QUALIFICATION INFORMATION**

The information to be filled in by the Bidder in the following pages will be used for purposes of post – qualification as provided for in Clause 4 of the instructions to Bidders. This information will not be incorporated in the Contract.

1. For Individual Bidders
   1. Constitution or legal status of Bidder

(Attach Copy)

Place of Registration:

Principal place of business:

Power of Attorney of Signatory of Bid

(Attach)

* 1. Total value of Electrical Engineering Construction
  2. Work performed in the last Seven years.

(in Rs. Crores)

* + 1. Work performed as prime contractor (in the same name) on works of a similar nature over the last seven years **duly furnishing the date of work commencement, completion along with Agreement No. should be invariably furnished in the performance certificates issued by the concerned Engineer**.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Project Name | Name of Employer | Description of work | Contract No. | Value of contract (Rs. Cores) | Date of issue of work order | Stipulated  period of completion | **Actual date of commencement and completion** | Remarks  Explaining reasons for delay and work completed |

**Note:** The certificates shall be attested by not less than the Divisional Engineer, Construction in Charge of the work.

* + 1. Quantities of work executed as prime contractor (in the same name and style) in the last seven years.

**Year Name of the work Qty Amount in Rs. Lakhs**

1.Erection of 33/11kV substations **Indoor or outdoor**

2. Erection of length of new Line/UG Cable**(route length)**

(33kV & 11kV)

* Enclose certificate(s) from the Engineer(s) in-charge.

@ The item of work for which data is requested should tally with that specified in ITB clause 4.3.

\*\* Immediately preceding the financial year in which bids are received.

* 1. Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.

1. Existing commitments and on-going works in **Medchal zone** and other works.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Description of work | Place  &  State | Contract No. & Date | Name and Address of employer | Value of Contract (Rs. Crores) | Stipulated period of completion | Value of works remaining to be completed Rs. Crores | Anticipated date of completion |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |

1. Works for which bids already submitted:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Description  Of  Work | Place  &  State | Estimated value of works  (Rs. Lakhs) | Stipulated period of completion | Date when decision is expected | Remarks if any |
| (1) | (2) | (3) | (4) | (5) | (6) |
|  |  |  |  |  |  |

* Enclose certificate (s) from the Engineer (s)-in-Charge.
  1. The following items of Contractor’s Equipment are essential for carrying out the Works.

The Bidder should list all the information requested below. Refer also to Sub Clause 4.3 of the Instructions of Bidders.Declaration for rollers and cable laying works should invariably be included along with all the other relevant equipments.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Item of equipment | Requirement No. Capacity | Availability proposals Owned/leased/  to be procured | Nos./  capacity | Age/  condition | Remarks  (from whom to be purchased) |
|  |  |  |  |  |  |

* 1. Qualifications and experience of key personnel proposed for administration and execution of the Contract, Attach biographical data. Refer also to Sub Clause 4.3of instructions to Bidders and Sub Clause 9.1 of the Conditions of Contract. **Educational certificates must be submitted.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Position  Project Manager  Etc. | Name | Qualification | Years of experience (general) | Years of experience in  the proposed position |

* 1. Financial reports for the last seven financial years: Turnover balance sheets, profit and loss statements, Income tax return statements, auditors reports (in case of companies/corporation) etc. List them below and attach copies.
  2. Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copies of support documents.

1.9 Name, address and telephone, telex, and fax numbers of the Bidders’ bankers who may provide references if contacted by the Employer.

* 1. Performance certificate for the works executed is to be furnished
  2. Statement of compliance under the requirements of Sub Clause 3.2 of the instructions to Bidders.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

1.12 Proposed work method and schedule. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents. (Refer ITB Clause 4.1 and 4.3.

1. Additional Requirements

Bidders should provide any additional information required to fulfill the requirements of Clause 4 of the instructions to the Bidders, if applicable.

ANNEXURE – I

Undertaking to be given by the Company/ Partnership Firm/ Contractor along with the Bidat the time of entering into agreement with TRANSCO/ DISCOMs.

I, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ representing the Company / Partnership Firm/ Contractor responding to the bid invitation by the TRANSCO/ APEPDCL/ APSPDCL/ TSNPDCL/ TGSPDCL vide Specification No. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ hereby sincerely and solemnly affirm and state as follows:

(Strike out that which is not applicable)

a) That myself or any of the representatives of my company/ firm do not have any relatives as defined in the appended Annexure-III in the TRANSCO/ DISCOM.

(Or)

b) That the following officers/ employees of the TRANSCO/ DISCOM are related to me and to the representatives of my company / firm and their status in the TRANSCO/ DISCOMs is as under.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S.No. | Name of the officer/ employee | Designation and place of working | TRANSCO/ DISCOM | Relationship |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |
| 6 |  |  |  |  |

It is certified that the information furnished above is true to the best of my knowledge and belief. It is hereby undertaken that in the event of the above information found to be false or incorrect at a later date, the TRANSCO/ DISCOM is entitled to terminate the contract/ agreement entered into besides recovering damages as may be found necessary, with due notice.

Signature of the authorized representative

ANNEXURE – II

Declaration to be given by the Company/ Partnership Firm/ Contractor at the time of entering into agreement with TRANSCO/ DISCOMs.

(Strike out that which is not applicable)

a) I declare that myself or any of the representatives of my company/ firm do not have any relatives as defined in the appended Annexure-III in the TRANSCO/ DISCOM.

(or)

b) That the following officers/ employees of the TRANSCO/ DISCOM are related to me and to the representatives of my company / firm as mentioned here under.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S.No. | Name of the officer/ employee | Designation and place of working | TRANSCO/ DISCOM | Relationship |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |
| 6 |  |  |  |  |

It is certified that the information furnished above is true to the best of my knowledge and belief. It is hereby undertaken that in the event of the above information found to be false at a later date, the TRANSCO/ DISCOM is entitled to terminate the contract/ agreement entered into besides recovering damages as may be found necessary, with due notice.

Signature of the authorized representative

ANNEXURE – III

List of Relatives:

1) Father 14) Daughter’s Husband

2) Mother (including Step Mother) 15) Daughter’s Son

3) Son (including Step Son) 16) Daughter’s Son’s Wife

4) Son’s wife 17) Daughter’s Daughter

5) Daughter (including Step Daughter) 18) Daughter’s, Daughter’s Husband

6) Father’s Mother 19) Brother (including Step Brother)

7) Father’s Father 20) Brother’s Wife

8) Mother’s Father 21) Sister (including Step Sister)

9) Mother’s Mother 22) Sister’s Husband

10) Son’s Son 23) Son’s Wife’s Father and

their

11) Son’s, Son’s Wife 24) Son’s Wife’s Mother siblings

12) Son’s Daughter 25) Daughter’s Husband’s Father

and their siblings

13) Son’s Daughter’s Husband 26) Daughter’s Husband’s Mother

**LETTER OF INTENT**

(Letterhead paper of the Employer)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (date)

To:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Name and address of the Contractor)

Dear Sirs,

This is to notify you that your Bid dated\_\_\_\_\_\_\_\_\_for execution of the\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (name of the contract and identification number, as given in the instructions to Bidders)1 for the Contract Price of Rupees\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_(\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) (Amount in words and

Figures), as corrected and modified in accordance with the instructions to Bidders’ is hereby accepted by our Agency.

You are hereby requested to furnish Performance Security, plus additional security for unbalanced bids in terms of ITB clause 27.4 in the form detailed in Para 31.1 or ITB for an amount of Rs.\_\_\_\_\_\_\_\_\_\_\_\_ within 21 days of the receipt of this letter of acceptance valid up-to 28 days from the date of expiry of Defects Liability Period i.e. up-to ……………… and sign the contract, failing which action as stated in Para 31.3 of ITB will be taken.

Yours faithfully,

Authorized Signature

Name and Title of Signatory

Name of Agency

Chief Engineer/ Medchal Zone

Southern Power Distribution Company of Telangana Limited,

Mint Compound,

Hyderabad -500004

1. Delete “correct and” or “and modified” if only one of these actions applies. Delete “as corrected and modified in accordance with the Instructions to Bidders” if corrections or modifications have been effected.

2 To be used only if the Contractor disagrees in his Bid with the Technical Expert proposed by the Employer in the “Instructions to Bidders”.

**ISSUE OF NOTICE TO PROCEED WITH THE WORK**

(Letterhead of the Employer)

\_\_\_\_\_\_\_\_\_\_\_\_ (date)

To

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Name and Address of the Contractor)

Dear Sirs,

Pursuant to your furnishing the requisite security as stipulated in ITB clause 31.1 and signing of the contract for the construction of -------------------------@ a Bid price of Rs. ------------------------, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

Chief Engineer/ Medchal Zone

Southern Power Distribution Company of Telangana Limited

(Signature, name and title of signatory

Authorized to sign on behalf of Employer)

BANK GUARANTEE FOR 2% BID SECURITY

To

The Chief Engineer/Medchal Zone

TGSPDCL, Mint Compound, Hyderabad.

Whereas.............. (hereinafter called "the Bidder") has submitted its Bid dated (date of submission of bid) for the work ....................(name and /or description of the work) (hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that WE. ............. (name of bank) having our registered office at. ...........(address of bank)(hereinafter called "the Bank"), are bound unto you, in the sum of Rs. ……….. for which payment well and truly to be made to you, the Bank binds itself, its successors, and assigns by these presents. Sealed with the Common Seal of the said Bank this day of 2019.

THE CONDITIONS of this obligation are:

1. If the Bidder

a) withdraws its Bid during the period of bid validity specified by the Bidder on the Bid Form; or

b) does not accept the correction of errors in accordance with the Bid Specification, or

2. If the Bidder, having been notified of the acceptance of its bid by you, during the period of bid validity;

(a) fails or refuses to furnish the performance security, in accordance with the Bid Specification.

(b)fails or refuses to execute the Contract Form if required; or

We undertake to pay you up to the above amount upon receipt of its first written demand, without having to substantiate its demand, provided that in its demand you will note that the amount claimed is due to it, owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to **135 days from the date of bid opening ………………**

……………. (Specification Date) and any demand in respect thereof should reach the Bank not later than the above date.

. ....................

(Signature of the Bank)

NOTE: This will be executed on a Rs.100/- non-judicial stamp paper issued by any **Nationalized/Scheduled Bank**.

PERFORMANCE BANK GUARANTEE

To

The Chief Engineer/Medchal Zone

TGSPDCL, Mint Compound, Hyderabad.

Whereas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ [name and address of Contractor]

(hereinafter called “the Contractor”) has undertaken, in pursuance of Contract No. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_dated \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to execute \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ [name of Contract and brief description of Works] (hereinafter called “the Contract”).

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract “

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ [amount of guarantee]\* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ [in words], such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and;without cavel or argument, any sum or;sums within the limits of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ [amount of guarantee]\* as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of the Contract documents which may be made between you and the Contract shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until 28 days from the date of expiry of defects liability periodof the said contract.

Signature and seal of the Guarantor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name of Bank \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Address \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\*An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract including additional security for unbalanced Bids, if any and denominated in Indian Rupees

**AGREEMENT FORM**

This agreement, made the -------------------------day of --------------- Year --------between

--------------------------------------------------(Name and Address of Employer).

(Hereinafter called “the Employer)” and------------------------------------------------------------

-----------------------------------------------[Name and Address of Contractor] (hereinafter called “the Contractor” of the other part).

Whereas the Employer is desirous that the Contractor execute----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------)

Name and identification number of Contract] (hereinafter called “the Works’) and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein, at a cost of Rs………………….

NOW THIS AGREEMENT WITNESS as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.

2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy and defects therein conformity in all aspects with the provisions of the Contracts.

3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract price or such other sums as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:

Letter of Acceptance;

Notice to proceed with the works;

Contractor’s Bid;

Contract Data;

Conditions of Contract;

Specifications;

Drawings;

Quality assurance plan; and

Any other document listed in the Contract Data as forming part of the Contract.

In witness where of the parties there to have caused this Agreement to be executed the day and years first before written.

The Common Seal of --------------------------------------------------------

Was hereunto affixed in the presence of:

Signed, Sealed and delivered by the said---------------------------------------------------------

In the presence of:

Binding Signature of Employer ---------------------------------------------------------------

Binding Signature of Contractor ---------------------------------------------------------------