# Government of West Bengal
# Panchayats & Rural Development Department
**JOINT ADMINISTRATIVE BUILDING (6th FLOOR)**
**BLOCK-HC/7, SECTOR-III, SALT LAKE CITY, KOLKATA-700 106**

## NOTICE INVITING PRE-QUALIFICATION - CUM - TENDER (TWO COVER SYSTEM)
## Construction of proposed Electric Crematorium (for its Civil, Electrical, Sanitary & Plumbing as well as other allied works) at Tarapith Mahasmashan in the District of Birbhum
**(E-Procurement)**

**No. PNRD/N-1/C/2015-16** **Dated: 20/11/2015**

For and on behalf of the P&RD Deptt., Govt. of West Bengal, the Chief Engineer, invites sealed percentage rate tenders for the following work by two cover system upto **18:00 hours on 14/12/2015.** Pre-qualification Bids are to be uploaded in a separate sealed cover comprising of technical document along with scanned copy of Challan for cost of bid document and that of Earnest Money in a separate file. The financial bid document with Bill of Quantity in another sealed cover are to be uploaded by the qualified bidders /contactors viz. Contractors registered in appropriate class with PWD / CPWD/KMC / MES / Railways and bonafide outsiders who satisfy the terms and conditions set out in pre-qualification document. The tenders shall be available for viewing in our website (http://pmgsytenderswb.gov.in) and (http://wbprd.gov.in) on &from **18:00 hours on 20/11/2015 to 15:00 hours on 14/12/2015**.

| SL No | District | Name of Works | Estimated Cost of Construction (In Rs.) | Cost of Bidding Document (in Rs.) | Earnest Money (In Rs.) |
|---|---|---|---|---|---|
| 1 | **Birbhum** | Construction of proposed Electric Crematorium (for its Civil, Electrical, Sanitary & Plumbing as well as other allied works) at Tarapith Mahasmashan in the District of Birbhum | **60621620.00** | **5,000.00** | **606216.00** |

Intending bidders may download tender documents from e-procurement portal of our website http://pmgsytenderswb.gov.in from **18.00 hours on 20/11/2015 to 15:00 hours on 14/12/2015**. The pre-qualification and bid documents duly filled and digitally signed in all respect may be submitted on-line through our e-portal upto **18:00 hours** (as per server clock) on **14/12/2015.** WBSRDA, P&RD Deptt., Govt. of West Bengal does not take any responsibility for the delay caused due to non-availability of Internet connection or traffic jam etc. for on-line bidding. Cost of Pre-qualification and bid document is Rs.5,000.00 for on-line bids. The amount should be deposited in State Bank of India in the Account No 34412804355 in favour of "WBSRDA A/c PMGSY Administrative Expenses Fund" IFSC No SBIN0007816 through RTGS/NEFT/CBS System

only. The NIT/Tender No should be clearly mentioned in the deposit challan. Payment made otherwise will be rejected.

Cost of Earnest Money should be deposited in Union Bank of India Account No. 301802010012175 In favour of:" WBSRDA A/c Earnest Money", IFSC No UBIN0546097 through RTGS/NEFT/CBS System only. The NIT/Tender No should be clearly mentioned on the deposit Challan. Payment made otherwise will be rejected.

The pre-qualification documents alone will be opened **at 10:30 hours on 16/12/2015** by the Chief Engineer, P&RD Department, Govt. of West Bengal in presence of the willing bidders.

**Names of the technically qualified bidders** on the basis of information furnished in the check list and in "My Document" uploaded by concerned bidders after verification of the same with original will be displayed **in the portal and this office notice board at 18:00 hours on 18/12/2015, subject to completion of verification and technical evaluation.**

**The Financial Bid documents of the technically qualified bidders will be opened at 10:30 hours on 21/12/2015 for scrutiny subjected to completion of technical evaluation and verification of original document.** List of **Financial comparison chart** of bidders will be published same way **at 16:00 hours on 21/12/2015.** No separate intimation will be given for this, unless the above date is changed .In case of change of date, due intimation will be given on line. No individual intimation will be given, and the same shall place before tender committee for their recommendation accordingly.

The Chief Engineer, P&RD Department., Govt. of West Bengal reserves the right to reject or cancel any or all pre-qualification documents and bid document without assigning any reason's whatsoever.

The eligibility criteria as stated in the Bidding Document are given below:- 2

Achieved in any one year during last five years in the same name and style (excluding current year) a minimum financial turnover as certified by chartered accountant and at least 50% of which is together from civil & Electrical engineering works) equivalent to amount given below: -

- 75% of amount put to bid (Cost of construction only), for which bid has been invited. The turnover will be indexed at the rate of 8% for a completed year.
- The applicant in the same name and style as prime contractor must have successfully completed at least one similar work equal in value to one-third value of the estimated cost of work within last five years.
- Otherwise, the main bidders shall make consortium with the manufacture of crematorium furnace. In that case the following credential to be submitted.
    - Agreement between the main bidder and the manufacturer of Electric Crematorium
    - Credential of execution of minimum 2 nos Electric Cremation furnace in last five years.
    - Credential of execution of 11 Kv Sub Station min 2 nos in past five years.

- The sub-contractor should have sufficient technical manpower, tools and plants to complete the work in proportion to the quantum of work sub contracted. All documents in this regards should be uploaded in "My Documents".
- A copy of the agreement between the prime & sub-contractor to be submitted duly recommended by Executive Engineer should be uploaded in "My Documents".
- Circumstances which work at such sub-contracting.
- The contractor should have necessary bid capacity to execute the work (Documentary evidence in proof of the above 4 items should be enclosed.
- Trial Balance or Accounting sheet on the Turn over, debit, credit positions at least for the past three years (Audited).
- Income Tax return should be submitted for last 5 years.
- VAT Registration and clearance Challan& Professional Tax clearance certificate & Pan Card (Xerox copy) should be furnished.
- To qualify for a Package of contracts made up of this and other contracts for which bids are invited in the NIT, the bidder must demonstrate having experience and resources sufficient to meet the aggregates of the qualifying criteria for individual contracts. For other terms and condition for qualification the standard bidding documents may please be referred.

All duties, taxes, royalties, cess, including 1% Cess under W.B. Building and other Construction Workers (Regulation of Employments & Condition of Service) Act, 1996], toll, taxes and other levies payable by the Contractor under the Contract to the State / Central Government for any other cause, shall be included in the rates, prices and total Bid price submitted by the bidder. **1% Cess under W.B. Building and other Construction Workers (Regulation of Employments & Condition of Service) Welfare Cess Act, 1996 will be deducted from the running bills.**

To keep the **Electric Crematorium** in good condition during the next 5 years after the completion of the construction if any work is required, the same will be treated as defect liability and the Contractor has to do the maintenance work at his own cost.
Time allowed for completion of Work is 18 (Eighteen) months from the date of issue of the Work Order.

The intending bidders are requested to inspect the proposed work site before quoting their rates. The Architectural & structural drawings may be seen at the office of the Chief Engineer, P & RD Department. **Consequently, all the bidders must upload their Contact No. & e-mail id on the specific column of the Check List**.

Chief Engineer, P&RD Deptt.,
Govt. of West Bengal

1. Additional Chief Executive officer. (A.C.E.O)
2. OSD & E.O. Special Secretary, P&RD Deptt
3. T. Adviser, WBSRDA
(4) to (7) Superintending Engineer, W.B.S.R.D.A.
8. Deputy Secretary, STARPARD
9. Public Infrastructure Manager, STARPARD
10. Office notice board.

# Bidding Document
# TECHNICAL BID

***Panchayats& Rural Development Department***
***Government of West Bengal***

# SECTION 1

# LIST OF IMPORTANT DATES

# NOTICE INVITING TENDERS

## SECTION 1

List of Important Dates of Bids for Construction of proposed Electric Crematorium (for its Civil, Electrical, Sanitary & Plumbing as well as other allied works) at Tarapith Mahasmashan in the District of Birbhum

Name of Work: Construction of proposed Electric Crematorium (for its Civil, Electrical, Sanitary & Plumbing as well as other allied works) at Tarapith Mahasmashan in the District of Birbhum

| | | |
|---|---|---|
| 2.1. | Completion Period for construction: | 18 (Eighteen) Months |
| 2.2. | Maintenance Period | 5 (Five) years after the date of completion ofconstruction |
| 3. | Date of Issue of Notice Inviting Bid | 20/11/2015 |
| 4. | Period of downloading of Bidding Documents From e-procurement portal | From18:00hours on 20/11/2015 to 15:00 hours on 14/12/2015 |
| 5. | Deadline for Receiving Bids online | Upto18.00 hours on 14/12/2015 |
| 6. | Time and Date and place for opening on line Technical Bids | At 10:30 hours on 16/12/2015 At: JOINT ADMINISTRATIVE BUILDING (6TH FLOOR), BLOCK-HC-7, SECTOR-III, SALT LAKE CITY, KOLKATA-700106 |
| 7. | Time and Date and place of opening online Financial Bids | At 10:30 hours on 21/12/2015 JOINT ADMINISTRATIVE BUILDING (6TH FLOOR), BLOCK-HC/7, SECTOR–III, SALT LAKE CITY, KOLKATA–700 106 |
| 8. | Place of opening of Financial bids | Office of Chief Engineer, P&RD Deptt. JOINT ADMINISTRATIVE BUILDING (6th Floor) BLOCK-HC/7, SECTOR–III, SALT LAKE CITY, KOLKATA-700 106 |
| 9. | Bid Validity | 180 days from the date of opening of Financial Bid |
| 10. | Officer inviting Bids/Tender Inviting Authority | Designation: -Chief Engineer, P&RD Deptt.,Govt. of West Bengal, JOINT ADMINISTRATIVE BUILDING (6th Floor) BLOCK-HC/7, SECTOR–III, SALT LAKE CITY, KOLKATA–700 106 |

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# Instructions to Bidders (ITB)

## *A. General*

### 1. Scope of Bid

**1.1** The Employer as defined in the Appendix to ITB invites bids for the Construction of (Civil, Electrical, Sanitary & Plumbing & other allied works) proposed Electric Crematorium at Tarapith Mahasmashanand their maintenance for five years, as described in these documents and referred to as "the works". The name and identification number of the works is provided in the Appendix to ITB. The bidders may submit bids for any or all of the works detailed in the table given in the Notice Inviting Tender. Bid for each work should be submitted separately.

**1.2** The successful Bidder will be expected to complete the Works by the Intended Completion Date specified in the Part I General Conditions of Contract and do the routine maintenance of roads for five years from the date of completion.

**1.3** Throughout these documents, the terms "bid" and "tender" and their derivatives (bidder / tenderer, bid / tender, bidding / tendering etc.) are synonymous.

### 2. Source of Funds

**2.1** The Government of the State as defined in the Appendix to ITB has decided to undertake the Construction of (Civil, Electrical, Sanitary & Plumbing & other allied works) proposed Electric Crematorium at Tarapith Mahasmashan.

**2.2 The State Government has decided to provide funds.**

### 3. Eligible Bidders

**3.1** This Invitation for Bids is open to all bidders as defined in the Appendix to ITB.

**3.2** Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices by the Central Government, the State Government or any public undertaking, autonomous body, authority by whatever name called under the Central or the State Government.

### 4. Qualification of the Bidder

**4.1** All bidders shall provide in Section 3, Forms of Bid and Qualification information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary.

**4.2** All bidders shall include the following information and documents with their bids in Section 3, Qualification Information unless otherwise stated in the Appendix to ITB:

(a) 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;

(b) Total monetary value of civil construction works performed for each of the last five years, with detail break up of works done **with corresponding payment certificate** from the concern Engineer-in-Charge

(c) Experience in works of a similar nature and size for each of the last five years, and details of works in progress or contractually committed with **certificates from the concerned officer of the rank of Executive Engineer or equivalent;**

(d) Evidence of ownership of major items of construction equipment named in Clause 4.4 B (b) (i) of ITB or evidence of arrangement of possessing them on hire / lease / buying as defined therein.

(e) Details of the technical personnel proposed to be employed for the Contract having the qualifications defined in Clause 4.4 B (b) (ii) of ITB for the construction.

(f) Reports on the financial standing of the Bidder, such as profit and loss statements and auditor's reports for the past three years;

(g) An affidavit that the bidder will be able to invest a minimum of cash up to the percentage (defined in the Appendix to ITB) of the contract price of works, during the implementation of the works;

(h) Evidence of access to line(s) of credit and availability of other financial resources / facilities [Ten percent (10%) of the estimate cost of construction value] certified by banker (the certificate being not more than 3 months old.)
(i) Authority to seek references from the Bidder's bankers;

(j) Information regarding any litigation or arbitration during the last five years in which the Bidder is involved, the parties concerned, the disputed amount, and the matter;

(k) Proposals for subcontracting the components of the Works for **construction**, aggregating to not more than **Twenty fivepercent(25%)** of the Contract Price; and

(l)The proposed methodology and programme of construction, backed with equipment and material planning and deployment, duly supported with broad calculations and Quality Management Plan proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications and within the stipulated period of completion.

(m)The contractor would furnish an affidavit in the following manner in non-judicial stamp paper: -

i)If the contract is awarded to me, I will deploy at site all necessary T&P and equipments as listed in the ITB of the bidding document immediately on receipt of the work order. I would commence the work only on deployment of machineries at site to the full satisfaction of the Engineer-in Charge. I would be duty bound to use those equipment's at site to achieve the best result as per requirement of the contract. I would upkeep and maintain those equipment's in running condition till completion of the Project. Any breakdown of any equipment will be replaced immediately. No part of equipment will be shifted to another site without the written permission of the E.I.C.

ii)I would establish a siteLaboratory with minimum testing equipment's / apparatus as listed in the ITB to conduct the various tests on soil, aggregates, cement, and concrete to maintain the quality at site. I will upkeep the Laboratory set-up in good condition of the Project.

iii)I would deploy at site all necessary technical Personnel as listed in ITB for efficient contract management and supervision of works with a view to achieving best quality of works at site.

iv)I would carry out all necessary tests of all major items at frequency spelled out in the contract document to achieve the best quality work at site. I will be contract bound to bring to the notice of the EIC any non-compliance of test results along with the action taken report.

v)Any departure whatsoever in any form will be considered as breach of contract. In such situation the Department at his liberty may with hold my payment till I rectify the defects or fulfil my contractual obligation. In this connection, Departmental decision will be final and binding.

**4.3** Bids from joint venture are not allowed.

**4.4 A** To qualify for award of the Contract, each bidder should have in the last five years:
Achieved in any one year during last five years in the same name and style (excluding current year) a minimum financial turnover as certified by chartered accountant and at least 50% of which is from civil engineering construction works) equivalent to amount given below.

i) 75% of amount put to bid, for which bid has been invited. The turnover will be indexed at the rate of 8% for a year.

a)Satisfactorily completed, **as prime Contractor**, at least one similar work equal in value to one-third of the estimated cost of work for which the bid is invited.

b)Otherwise, the main bidders shall make consortium with the manufacture of crematorium furnace. In that case the following credential to be submitted.

- Agreement between the main bidder and the manufacturer of Electric Crematorium
- Credential of execution of minimum 2 nos Electric Cremation furnace in last five years.
- Credential of execution of 11 Kv Sub Station min 2 nos in past five years.

**4.4 B** **(a)** Each bidder must produce:

(i) The current income tax return and Pan Card.

(ii) An affidavit that the information furnished with the bid documents is correct in all respects; and

(iii) Such other certificates as defined in the Appendix to ITB. Failure to produce the certificates shall make the bid non-responsive.

**(b)** Each bidder must demonstrate:

(i)Availability for construction work, either owned, or on lease or on hire, of the key equipment stated in the Appendix to ITB including equipment's required for establishing field laboratory to perform mandatory tests, and those stated in the Appendix to ITB;

(ii)Availability for construction work for this work of technical personnel as stated in the Appendix to ITB.

(iii)Liquid assets and / or credit facilities, net of other contractual commitments and exclusive of any advance payments which may be made under the Contract, of not less than the amount specified in the Appendix to ITB;

**(c)** The bidder must not have in his employment:

(i) The near relations (defined as first blood relations, and their spouses, of the bidder or the bidder's spouse) of persons listed in the Appendix to ITB.

(ii) Without Government permission, any person who retired as gazetted officer within the last two years of the rank and from the departments listed in the Appendix to ITB.

**4.4.C** To qualify for a package of contracts made up of this and other contracts for which bids are invited in the Notice Inviting Tender, the bidder must demonstrate having experience and resources sufficient to meet the aggregate of the qualifying criteria for the individual contracts.

**4.5** If the bidder is a prime contract or Sub-Contractors' experience and resources shall not be taken into account in determining the bidder's compliance with the qualifying criteria except to the extent stated in 4.4 A above.

**4.6**Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity for construction work is equal to or more than the total bid value. The available bid capacity will be calculated as under:

Assessed Available Bid capacity = (A*N*M - B)

Where

A = Maximum value of civil engineering works executed in any one year during the last five years (updated to the price level of the last year at the rate of **8 percent simple interest a year**) taking into account the completed as well as works in progress.

N = 1

M = 3.0

B = Value, at the current price level, of existing commitments and on-going works to be completed during the period of completion of the works for which bids are invited.

**Note:** The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed

should be countersigned by the Engineer in charge, not below the rank of an Executive Engineer or equivalent.

**4.7** Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have:

(i) Made misleading or false representations in the forms, statements, affidavits and attachments submitted in proof of the qualification requirements; and / or record of submission of any false / fake document(s).

(ii) Record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.

(iii) Participated in the previous bidding for the same work and had quoted unreasonably high or low bid prices and could not furnish rational justification for it to the Employer.

### 5. One Bid per Bidder

**5.1** Each Bidder shall submit only one Bid for one work. **A Bidder who submits more than one Bid will cause the proposals with the Bidder's participation to be disqualified**.

### 6. Cost of Bidding

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

### 7. Site Visit

**7.1** The Bidder, at his own cost, responsibility and risk, is encouraged to visit, examine and familiarise himself with the Site of Works and its surroundings including source of earth, water, road aggregates etc. 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. He may contact the person whose contact details are given in the Appendix to ITB.

## *B. Bidding Documents*

### 8. Content of Bidding Documents

**8.1** The set of bidding documents comprises the documents listed below and addenda issued in accordance with Clause 10 of ITB.

1. Notice Inviting Tender
2. Instructions to Bidders
3. Qualification Information
4. Conditions of Contract

(Part I General Conditions of Contract, and Contract Data; Part II Special Conditions of Contract)

5. Specifications (to be drawn)
6. Drawings
7. Bill of Quantities (to be prepared)
8. Form of Bid
9. Form of Unconditional Bank Guarantee.

**8.2** One set of the bidding documents will be issued to the bidder against the payment.

**8.3** The bidder is expected to examine carefully all instructions, conditions of contract, contract data, forms, terms and specifications, bill of quantities, forms and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be liable to rejection of Bid Documents.

## 9. Clarification of Bidding Documents and Pre-bid Meeting

**9.1** A prospective Bidder requiring any clarification of the bidding documents may notify the Employer in writing or by cable ("cable" includes fax, e-mail and facsimile) at the Employer's address indicated in the Notice Inviting Tenders. The Employer will respond to any request for clarification received earlier than 10 days prior to the deadline for submission of bids. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including a description of the inquiry, but without identifying its source.

**9.2.1** If a pre-bid meeting is to be held, the bidder or his authorised representative is invited to attend it. Its date, time and address are given in the Appendix to ITB.

**9.2.2** The purpose of the meeting will be to clarify issues if any and to answer questions on any matter that may be raised at that stage.

**9.2.3** The bidder is requested to submit any questions in writing or by cable so as to reach the Employer not later than one week before the meeting.

**9.2.4** Minutes of the meeting, including the text of the questions raised (without identifying the source of the enquiry) and the responses given will be transmitted without delay to all purchasers of the bidding documents. Any modifications of the bidding documents listed in Clause 8.1 of ITB, which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 10 of ITB and not through the minutes of the pre-bid meeting.

**9.2.5** Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

## 10. Amendment of Bidding Documents

**10.1** Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda.

**10.2** Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing by registered post or by cable to all purchasers of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum by fax, e-mail and facsimile to the Employer.

**10.3** To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer shall extend, as necessary, the deadline for submission of bids, in accordance with Clause 20.2 of ITB.

## *C. Preparation of Bids*

### 11. Language of Bid

**11.1** All documents relating to the Bid shall be in the language specified in the Appendix to ITB.

### 12. Documents Comprising the Bid

**12.1** The Bid submitted by the Bidder shall be in two separate parts:

**Part I** This shall be named Technical Bid and shall comprise of:

I. For bidding documents downloaded from the website, the Xerox copy of the bank's receipt for the cost of the bidding documents placed in a separate file, marked "bidder file1" downloaded from the internet".

II. Xerox copy of the bank's receipt for Earnest Money in the above mentioned file

III. Authorised address and contact details of the bidder having the following information:- Address of communication:-
Telephone No(s) Office:- Mobile No:-

IV. Facsimile (FAX) No:-

V. Electronic Mail Identification (E-mail ID):-

VI. Qualification information, supporting documents, affidavit and undertaking as specified in Clause 4 of ITB.

VII. Undertaking that the bid shall remain valid for the period specified in clause 15.1 OF ITB.

VIII. Any other information / documents required to be completed and submitted by bidders, as specified in the Appendix to ITB, and

IX. An affidavit affirming that information he has furnished in the bidding document is correct to the best of his knowledge and belief.

X. An index furnishing the page nos. of all documents submitted

XI. Check List, duly filled up

XII. Schedule of Quantities

**Part II.** Itshall be named Financial Bid and shall comprise of:

(i)Form of Bid as specified in Section 6;

**12. 2** Each part shall be separately sealed and marked in accordance with Sealing and Marking instructions in clause 19 of ITB.

## 13. Bid Prices

**13.1** The Contract shall be for the whole Works, as described in Clause 1. 1 of ITB, based on the priced Bill of Quantities submitted by the Bidder.

**13.2** The Bidder shall adopt the Percentage Rate Method as specified in the Appendix to ITB; only the same option is allowed to all the Bidders.

Percentage Rate Method requires the bidder to quote a percentage above / below / at par of the schedule of rates specified in the Appendix to ITB.

**13.3** All duties, taxes, royalties and other levies payable by the Contractor under the Contract to the State / Central Government / Local bodies for any other cause, shall be included in the rates, prices, and total Bid price submitted by the Bidder. **1% Cess under W.B. Building and other Construction Workers (Regulation of Employments & Condition of Service) Welfare Cess Act, 1996 will be deducted from the running bills.**

**13.4** The rates and prices quoted by the Bidder shall be fixed for the duration of the Contract and shall not be subject to adjustment.

## 14. Currencies of Bid

**14.1** The unit rates and the prices shall be quoted by the bidder entirely in Indian Rupees.

## 15. Bid Validity

**15.1** Bids shall remain valid for a period of one hundred eighty days after the deadline for financial bid date for bid submission specified in Clause 20 of ITB. A bid valid for a shorter period **shall be rejected by the Employer as non-responsive.**

**15.2** In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidders may extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by cable. A bidder will not be required or permitted to modify his bid, but will be required to extend the validity of his earnest money for a period of the extension, and in compliance with Clause 16 of ITB in all respects.

## 16. Earnest Money

**16.1** The Bidder shall furnish, as part of the Bid, Earnest Money, in the amount specified in the
Appendix to ITB / N.I.T

**16.2** The Earnest Money should deposited in Union Bank of India Account No. 301802010012175
In favour of:" WBSRDA A/c Earnest Money", IFSC No UBIN0546097 through RTGS/NEFT/CBS System only.

**16.3** Any bid not accompanied by an acceptable Earnest Money in the Technical Bid shall be rejected by the Employer as non-responsive.

**16.4** The Earnest Money of unsuccessful bidders will be returned after 28 days from the date of issue of work-order.

**16.5** The Earnest Money of the successful Bidder will be discharged when the Bidder has signed
the Agreement and furnished the required Performance Security.

**16.6** The Earnest Money may be forfeited:

a) If the Bidder withdraws the Bid after bid opening (technical bid) during the period of Bid validity;

b) In the case of a successful Bidder, if the Bidder fails within the specified time limit to

i. Sign the Agreement; and / or
ii. Furnish the required Performance Security.

## 17. Alternative Proposals by Bidders

**17.1** Bidders shall submit offers that comply with the requirements of the bidding documents, including the Bill of Quantities and the basic technical design as indicated in the drawings and specifications. Alternative proposals will be rejected as non-responsive.

## 18. Format and Signing of Bid

**18.1** The Bidder shall submit one set of the bid comprising of the documents as described in Clause 12 of ITB.

**18.2** The Bid shall be typed ,uploaded and shall be digitally signed by a person duly authorised to sign on behalf of the Bidder through e-token, pursuant to Clause 4.3 (a) of ITB. All pages of the Bid shall be signed by the person signing the Bid.

**18.3** The Bid shall contain no overwriting, 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 made by scoring out the cancelled

portion, writing the correction and initialling and dating it by the person or persons signing the Bid.

*D. Submission of Bids*

**19. Sealing and Marking of Bids**

**19.1** The Bidder shall place the two separate folder marked "Technical Bid" and "Financial Bid" in other folder. The inner envelopes will have markings as follows:

Technical Bid: To be opened on 04.11.2015

Financial Bid: Not to be opened except with the approval of the Employer.

The contents of the Technical and Financial Bids shall be as specified in clause 12.1of ITB.

**19.2** The inner and outer envelopes containing the Technical and Financial Bids shall
a)be addressed to the Employer at the address provided in the Appendix to ITB;
b)bear the name and identification number of the Contract as defined in clause 1.1 of ITB; and
c)Provide a warning not to open before the specified time and date for Bid opening as defined in clause 22.1 of ITB.

**19.3** In addition to the identification required in Clause 19.2, each of the envelopes shall indicate the name and address of the Bidder to enable the Bid to be returned unopened in case it is declared late, pursuant to Clause 21 of ITB, or is declared non-responsive pursuant to Clause 2~~3~~2 of ITB.

**20. Deadline for Submission of Bids**

**20.1** Complete Bids (including Technical and Financial) must be received by the Employer at the address specified in the Appendix to ITB not later than the date and time indicated in the Appendix to ITB. In the event of the specified date for the submission of bids being declared a holiday for the Employer, the Bids will be received up to the specified time on the next working day.

**20.2** The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 10.3 of ITB, 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.

**21. Late Bids**

**21.1** Any Bid received by the Employer after the deadline prescribed in Clause 20 of ITB will be returned unopened to the Bidder.

## *E. Bid Opening and Evaluation*

### 22. Bid Opening

**22.1** The Employer will open the bids received (except those received late) in the presence of the bidders / bidders' representatives who choose to attend at the time, date and place specified in the Appendix to ITB. In the event of the specified date for the submission of bids 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** The folder containing the technical bid shall be opened. The inner envelope marked "cost of bidding document downloaded from the Internet" will be opened first and if the cost of the bidding documents is not there, or incomplete, the remaining bid documents will not be opened, and bid will be rejected.

**22.3** In all other cases, the amount of Earnest Money, forms and validity shall be announced. Thereafter, the bidders' names and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening.

**22.4** The Employer will prepare entire bid details in the tender register after opening of the bid.

**22.5** Evaluation of the technical bids with respect to bid security, qualification information and other information furnished in Part I of the bid in pursuant to Clause 12.1 of ITB, shall be taken up and completed preferably within fifteen working days of the date of bid opening, and a list will be drawn up of the responsive bids whose financial bids are eligible for consideration.

**22.6.**The Employer shall publish a list of the bidders, whose technical bids are found responsive and will be displayed in the Office Notice Board one day before the schedule date of opening of financial bid. In case the specified date is deferred, a corrigenda notice will be published stating the revised schedule of bid opening (Financial) and will be displayed in the Office Notice Board at least one day before the Specific date as mentioned in Section 1 (List of Important dates). No separate communication will be made to the prospective bidder from the end of the Employer.

**22.7**At the time of the opening of the 'Financial Bid', the names of the bidders whose technical bids were found responsive in accordance with clause 22.5 of ITB will be announced. The financial bids of only these bidders will be opened. The remaining bids will be returned unopened to the bidders. The responsive bidders' names, the Bid prices, the total amount of each bid, 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, which is not read out and recorded, will not be taken into account in Bid Evaluation.

**22.8** The Employer shall enter the bid details in a register to be opened for this purpose.

## 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 attempt 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 and Contacting the Employer

**24.1** No Bidder shall contact the Employer on any matter relating to its bid from the time of the bid opening to the time the contract is awarded.

**24.2** Any attempt by the bidder to influence the Employer's bid evaluation, bid comparison or contract award decision may result in the rejection of his bid.

## 25. Examination of Bids and Determination of Responsiveness

**25.1** During the detailed evaluation of "Technical Bids", the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clauses 3 and 4; (b) has been properly signed; (c) is accompanied by the required securities; and (d) is substantially responsive to the requirements of the bidding documents. During the detailed evaluation of the "Financial Bids", the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications and drawings.

**25.2** A substantially responsive "Financial 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 affect unfairly the competitive position of other bidders presenting substantially responsive bids. No conditional bid will be accepted in any form.

**25.3**If a "Financial 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 nonconforming 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:

a) where there is a discrepancy between the rates in figures and in words, the rate in words will govern; and

b)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.

**26.2** The amount stated in the Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount, the Bid will be rejected, and the Earnest money shall be forfeited in accordance with Clause 16.6(b) of ITB.

### 27. Evaluation and Comparison of Bids

**27.1** The Employer will evaluate and compare only the bids determined to be substantially responsive in accordance with Clause 25 of ITB.

**27.2** In evaluating the bids, the Employer will determine for each Bid the evaluated Bid price by adjusting the Bid price by making correction, if any, for errors pursuant to Clause 26 of ITB.

**27.3** If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer's estimate 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 32 of ITB be 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. The amount of the increased performance security shall be decided at the sole discretion of the Employer, which shall be final, binding and conclusive on the bidder.

### 28. Price Preference

**28.1** There will be no price preference to any bidder.

## *F. Award of Contract*

### 29. Award Criteria

**29.1** Subject to Clause 31 of ITB, the Employer will award the Contract to the Bidder whose Bid has been determined:

i. 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 of ITB, and (b) qualified in accordance with the provisions of Clause 4 of ITB; and

ii. to be within the available bid capacity adjusted to account for his bid price which is evaluated the lowest in any of the packages opened earlier than the one under consideration.

## 30. Employer's Right to accept any Bid and to reject any or all Bids

**30.1** Notwithstanding Clause 29 above, 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.

## 31. Notification of Award and Signing of Agreement.

**31.1**The bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by cable, fax, letter, e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Part I *General Conditions of Contract* called the "Letter of Acceptance") will state the sum that the Employer will pay to the Contractor in consideration of the execution, completionby the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

**31.2.** 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 32.

**31.3.** The Agreement will incorporate all agreements between the Employer and the successful Bidder. It will be signed by the Employer and the successful Bidder after the performance security is furnished.

**31.4** 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.

## 32. Performance Security

**32.1**The successful bidder/contractor shall provide to the employer a total Performance Security of five percent of the Contract Price, for a period of 5 years and the time of completion of construction work plus additional security for unbalanced bids in accordance with clause 27.3 and 27.4 of ITB and Clause 46 Part I General Conditions of Contract.

Within 10 days after receipt of Letter of Acceptance but before signing the contract, a Performance Security of two and a half percent of Contract Price plus additional security for unbalanced bids in accordance with clause 27.3 and 27.4 of ITB and Clause 46 Part I General Conditions of Contract shall be delivered by the successful bidder to the employer.

The employer shall retain remaining two and a half percent Performance Security from each payment due to the contractor until completion of the whole of the construction works (except advance payment as per Clause 45 of General conditions of Contract).

**32.2** Performance Security of two and a half percent to be delivered by the successful bidder after the receipt of letter of acceptance shall be either in form of a Bank Guarantee of Fixed Deposit receipts in the name of employer, from a scheduled commercial bank.

If the Performance Security is in the form of a Bank Guarantee, the period of validity of Bank Guarantee of two and a half percent of contract price could be one year initially, however, the bidder/contractor shall get this Bank Guarantee extended in such a way that an amount equal to the requisite performance security is always available with employer until 45 days after the laps of Defect Liability Period. If the bidder/contractor fails to maintain above Performance Security, the Employer would recover the same from any dues payable to the contractor.

**32.3** Failure of successful Bidder to comply with the requirement of delivery of Performance Security of two and a half percent of contract price plus additional security for unbalanced bids as per provisions of Clause 32.1 shall constitute sufficient ground for cancellation of award and forfeiture of the Earnest Money. Such successful bidder who fails to comply with the above requirements is liable to be debarred from participating in bids under PMGSY for a period of one year.

## 33.Advances

**33.1**No Mobilization Advance and Advance against purchase of equipments will be paid for the work

**33.2**No Secured Advance will be paid for the work under any circumstances

## 34.Corrupt or Fraudulent Practices

The Employer requires the bidders / Contractors to strictly observe the laws against fraud and corruption in force in India, namely, Prevention of Corruption Act, 1988.

## 35.Escalation in Price

The Employer should fill out this Appendix to ITB before issuing the bidding documents The insertions should correspond to the information provided in the Invitation for Bids.

| Instructions to Bidders Clause Reference | |
|---|---|
| (1.1) | The Employer is Principal Secretary, P & RD Deptt., Joint Administrative Building (6th floor), Block – HC/7, Sector–III, Salt Lake City, Kolkata – 700 106 for the purpose of invitation and evaluation of tender only. For the purpose of agreement and execution of work The Employer is WBSRDA district unit |

(1.1) The Works is _____

(1.1) Identification No. of the works is:

(2.1) The State is West Bengal.

(3.1) Eligible Bidders are: Regd. With PWD, MES, NHAI, Railways and Bonafide Outsiders.

*The information required from bidders in Clause 4.2 is modified as follows:*
Nil

4.2 (g) The percentage is Thirty (30) percent

(4.4 **A**) (b) One-third

(4.4 **B**) (a) (iii) Other certificates required with the bid are: NIL

(4.4 **B**) (b)(iii) The minimum amount of liquid assets and / or credit facilities net of other contractual commitments of the successful Bidder shall be 10% (ten) percent

(4.4 **B**) (c) (i) The bidder must produce an affidavit stating that the near relations of the following departmental officers are not in his employment:

SE / DE / EE / AE / SAE

(4.4 **B**) (c) (ii) The bidder must produce an affidavit stating the names of retired gazetted officer (if any) in his employment who retired within the last two years with the following ranks from the departments listed below:

In case there is no such person in his employment, his affidavit should clearly state this fact.

(4.6) M = 3.0 (Three Point Zero)

(7.1) The contact person is:

Chief Engineer, P & RD Deptt.
Address: Joint Administrative Building (6th Floor), Block–HC/7, Sector–III, Salt Lake City, Kolkata–700 106

(11.1) Language of the bid is: English

Under no circumstances Escalation in prices in materials, labour charges, cost of P.O.L. will be entertained.

| | |
|---|---|
| (12.1) Part I (vi) | The other documents required are: NIL<br>_____<br>_____ |
| (13.2.) | Bids may be submitted only in one of the following:<br>**Percentage Rate Method** |
| (13.2) | **Schedule of Rate applicable for Percentage Rate Method is:**<br>**PWD, Govt. of West Bengal Schedule of Rates** |
| (16.1) | The amount of Earnest Money shall be (As mentioned in NIT) |
| (16.2) | Amount should be deposited in Union Bank of India **Account No. 301802010012175**<br>In favour of:" **WBSRDA A/c Earnest Money"**,<br>IFSC Code No **UBIN0546097** throughRTGS or CBS System. |
| (16.2) | Other acceptable forms of Earnest is Nil |
| (16.3) | Exemption from Earnest Money is granted to: NO |
| (20.1) | The Employer's address for the purpose of Bid submission is P&RD Deptt., Govt. of West Bengal, Joint Administrative Building (6th Floor), Block–HC/7, Sector–III, Salt Lake City,Kolkata–700 106. |
| (20.1) | The deadline for submission of bids shall be:<br>Time: **As Per NIT**<br>Date: **As Per NIT** |
| (22.1) & (22.6) | The date, time and place for opening of the Technical Bids are:<br>(A) Technical Bid<br><br>Time: **As Per NIT**<br>Date: **As Per NIT** Place: Joint Administrative Building (6th Floor), Block–HC/7, Sector–III, Salt Lake City, Kolkata–700 106<br><br>(B) Financial Bid (For qualified bidder)<br><br>Time: **As Per NIT**<br>Date: **As Per NIT**<br>Place: Joint Administrative Building (6th Floor), Block–HC/7, Sector–III, Salt Lake City, Kolkata–700 106 |
| (32.1) | The amount and validity period of the performance guarantee is:<br><br>Amount: percent of the contract price 2.5 (Two point Five) percent |

Validity Period: 1yrs. (To be renewed each year for next 5 years).

(i) Performance security shall be valid until a date 45 days after the expiry of Defect Liability Period of 5 years after intended completion date.

(ii) Additional Performance Security for unbalanced Bid shall be valid for 45 days after the intended completion date.

**Signature of Employer / Authorised Signatory**

## Section 3 Qualification Information

**Notes on Form of Qualification Information**
The information to be filled in by bidders 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. Attach additional pages as necessary. All the necessary documents along with the certificates should be uploaded in the "My Document" of the bidder and which should be hyperlinked/tagged with the bid during submission.

### 1. Individual Bidders

| | | |
|---|---|---|
| 1.1 | Constitution or legal status of Bidder<br><br>Place of registration:<br><br>Principal place of business:<br><br>Power of attorney of signatory of Bid | *[Attach copy]*<br><br>_____<br><br>_____<br><br>*[Attach]* |
| 1.2 | Total annual volume of civil engineering construction work executed and payments received in the last five years preceding the year in which bids are invited. (Attach | **(Rs. In lakhs)**<br><br>2010-2011<br>2011-2012<br>2012-2013<br>2013-2014 |

| | | |
|---|---|---|
| | certificate from Chartered Accountant) | 2014-2015 |

| | |
|---|---|
| 1.3 1 | Work performed as prime Contractor (in the same name and style) on construction works of a similar nature and volume over the last five years. **Attach certificate from the Engineer-in-charge. The certificate must be uploaded in My Document of the bidder and tagged during tender submission.** |

| Project Name | Name of Employer | Description of work | Value of contract | Contract No. | Date of Issue of Work Order | Stipulated Date of Completion | Actual Date of Completion | Remarks explaining reasons for Delay, if any |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

1.3.2 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.

**(A) <u>Existing commitments and on-going works</u>:**

| Description of Work | Place & State | Contract No & Date | Name & Address of Employer | Value of Contract (Rs. In Lakhs) | Stipulated period of completion | Value of works remaining to be completed (Rs. Lakhs) * | Anticipated Date of completion |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | | | | | | | |

**<u>N.B. Suppression of any fact regarding work-in-hand will be liable for non-responsive of bid</u>**

**** Enclose certificate(s) from Engineer(s)-in-charge for value of work remaining to be completed.***

**(B) Works for which bids already submitted: (Work-order not issued)**

| Description of Work | Place & State | Name & Address of Employer | Estimated Value of Works (Rs. Lakhs) | Stipulated period of completion | Date when decision is expected | Remarks, if any |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | | | | |

**1.6** Proposed sub-contractors and firms involved **for construction**. Refer to Clause 7 of Part I General Conditions of Contract.

| Sections of the Works | Value of subcontract | Sub-contractor (name and address) | Experience in similar work |
|---|---|---|---|
| | | | |

Note: The capability of the sub-Contractor will also be assessed (on the same lines as for the main Contractor) before according approval to him.

**1.7** Financial reports for the last five years: balance sheets, profit and loss statements, auditors' reports, etc. List below and attach copies.

_____

_____

_____

_____

**1.8** Evidence of access to financial resources to meet the qualification requirements: cash in hand (Five percent), lines of credit, etc. List below and attach copies of support documents. (Sample format attached).

_____

_____

_____

_____

**1.9** Name, address, and telephone, telex, and facsimile numbers of banks that may provide references if contacted by the Employer.

_____

_____

_____

_____

**1.10**Information on current litigation in which the Bidder is involved.

| Name of Other party(s) | Cause of dispute | Litigation where (Court / arbitration) | Amount involved |
|---|---|---|---|
| | | | |

**1.11**Proposed Programme (work method and schedule). Descriptions, drawings, and charts as necessary, to comply with the requirements of the bidding documents.

**1.12**Contact Address,Telephone No,Mobile No,Telex,E-mail Id of Contractor

Address:

Mobile No.: Telephone No.:
Telex No.:

E-mail ID:

## SAMPLE FORMAT FOR AFFIDAVIT

I, Sri……,S/o Sri……..,aged…Years, Residing at……, Proprietor/Partner/Director of……., do hereby solemnly affirm and declare in connection with **Construction of (Civil, Electrical, Sanitary & Plumbing & other allied works) proposed Electric Crematorium at Tarapith MahasmashanPackage No PN01** is follows:

1.That I, the undersigned, do certify that all the information furnished & statements made in the bid documents are true and correct to the best of my knowledge and belief.
2. That the undersigned also hereby certifies that neither any near relations of DE/SE/AE/SAE of the Department nor any retired gazetted officers are in our employment
3. The undersigned would authorise and request any bank, person, firm or corporation to furnish pertinent information as deemed necessary and or as requested by the Department to verify this statement.
4. The undersigned understands and agrees that the bid shall remain open for Acceptance 180 days from the date of opening of financial bid.
5. The undersigned agrees to invest 30% of the contract price of works by cash during the implementation of the works.
6. The undersigned agrees to authorise the authority to seek references from the Bankers of the undersigned.

7. If the contract is awarded to us, we will deploy at site all necessary T&P and equipments immediately on receipt of the work order. We would commence the work only on deployment of machineries at site to the full satisfaction of the Engineer-in Charge. We would be duty bound to use those equipments at site to achieve the best result as per requirement of the contract. We would upkeep and maintain those equipments in running condition till completion of the Project. Any breakdown of any equipment will be replaced immediately. No part of equipment will be shifted to another site without the written permission of the E.I.C.

8. We would establish a siteLaboratory with minimum testing equipments / apparatus to conduct the various tests on soil, aggregates, and cement, concrete to maintain the quality at site. We will upkeep the Laboratory set-up in good condition of the Project.

9. We would deploy at site all necessary technical Personnel for efficient contract management and supervision of works with a view to achieving best quality of works at site.

10. We would carry out all necessary tests of all major items at frequency spelled out in the contract documentto achieve the best quality work at site. We will be contract bound to bring to the notice of the EIC any non-compliance of test results along with the action taken report.

11. Any departure whatsoever in any form will be considered as breach of contract. In such situation the Department at his liberty may with hold our payment till we rectify the defects or fulfil our contractual obligation. In this connection, Departmental decision will be final and binding.
12. The undersigned also certifies that neither we have abandoned any work awarded to us, nor any penal action was taken against us by any department. The undersigned also declares that we do not have any running litigation with any department

## Table of Clauses

## Section 4

## Part I General Conditions of Contract

### A. General

### 1.Definitions

**1.1** Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Capital initials are used to identify defined terms.

**Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid.

**Compensation Events** are those defined in Clause 40 hereunder.

**The Completion Date** is the date of completion of the Works as certified by the Engineer, in accordance with Clause 48.1.

**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.

**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 Workshas been accepted by the Employer.

**The Contractor's Bid** is the completed bidding document 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 Certificate** is the certificate issued by Engineer, after the Defect Liability Period has ended and upon correction of Defects by the Contractor.

**The Defects Liability Period** is five years calculated from the Completion Date.

**Drawings** include calculations and other information provided or approved by the Engineer for the execution of the Contract.

**The Employer** is the party as defined in the Contract Data, who employs the Contractor to carry out the Works. The Employer may delegate any or all functions to a person or body nominated by him for specified functions.

**The Engineer** is the person named in the Contract Data (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Engineer) who is responsible for supervising the execution of the Works and administering the Contract.

**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.

**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 that shall have a mechanical, electrical, electronic, chemical, or biological function.

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

**Site Investigation Reports** are those that were included in the bidding documents and are reports about the surface and subsurface conditions at the Site.

**Specification** means 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.

A **Sub-Contractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the construction work in the Contract, which includes work on the Site.

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

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

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

## 2. Interpretation

**2.1** 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 these Conditions of Contract.

**2.2** 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).

**2.3** The documents forming the Contract shall be interpreted in the following order of priority:

(1). Agreement,
(2). Notice to Proceed with the Work,
(3). Letter of Acceptance,
(4). Contractor's Bid,
(5). Contract Data,
(6). Special Conditions of Contract Part II,
(7). General Conditions of Contract Part I,
(8). Specifications,
(9). Drawings,
(10). Bill of Quantities, and
(11). Any other document listed in the Contract Data.

## 3. Language and Law

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

## 4.Engineer's 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. However, if the Engineer is required under the rules and regulations and orders of the Employer to obtain approval of some other authorities for specific actions, he will so obtain the approval.

**4.2** Except as expressly stated in the Contract, the Engineer shall not have any authority to relieve the Contractor of any of his obligations under the contract.

## 5. Delegation

**5.1** The Engineer, with the approval of the Employer, may delegate any of his duties and responsibilities to other people, after notifying the Contractor, and may cancel any delegation after notifying the Contractor.

## 6. Communications

**6.1** All certificates, notices or instructions to be given to the Contractor by Employer / Engineer shall be sent on the address or contact details given by the Contractor in Section-6 Form of Bid. The address and contact details given in Contract Data to GCC. Communications between parties that are referred to in the conditions shall be in writing. The Notice sent by facsimile (FAX) or other electronic means shall be effective on confirmation of the transmission. The Notice sent by Registered post or Speed post shall be effective on delivery or at the expiry of the normal delivery period as undertaken by the postal service.

## 7. Subcontracting

**7.1** The Contractor may subcontract part of the construction work with the approval of the Employer in writing, up to 25 percent of the contract price but will not assign the Contract. It I expressly agreed that the Contractor shall at all times, be responsible and liable for all his obligations under this Agreement notwithstanding anything contained in the agreements with his Sub-contractor or any other agreement that may be entered into by the Contractor and no default under any such agreement shall exempt the Contractor from his obligations or liability hereunder.

**7.2** The Contractor shall not be required to obtain any consent from the Employer for:

a.the sub-contracting of any part of the Works for which the Sub-Contractor is named in the Contract;

b.The provision for labour, or labour component.

c.The purchase of Materials which are in accordance with the standards specified in the Contract.

**7.3** Beyond what has been stated in clauses 7.1 and 7.2, if the Contractor proposes sub-contracting any part of the work during execution of the Works, the Employer will consider the following before according approval:

a)The Contractor shall not sub-contract the whole of the Works.
b)The Contractor shall not sub-contract any part of the Work without prior consent of the Employer. Any such consent shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any his sub-Contractor, his agents or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents and workmen.

**7.4** The Engineer should satisfy himself before recommending to the Employer whether the Sub-Contractor so proposed for the work possess the experience qualifications and equipment necessary for the job proposed to entrusted to him in proportion to the quantum of Works to be sub-contractor

7.5 While sub-contracting part of construction work as per provisions of Clause 7.1 and 7.3 above the contractor shall enter into formal sub-contract with the sub-contractor making provisions for such requirements as may be specified by the Engineer including a condition that to the extent of inconsistency, provision of the contract shall prevail over the provisions of the sub-contractor. A copy of document of formal sub-contract shall be furnished to the employer within a period of 30 Days from the date of such sub-contract. In all such cases, on completion of the contract the Engineer-in-Charge, unless for reasons recorded in writing decides otherwise shall issue a Certificate of Experience to the contractor and in such certificate the experience of the sub-contractor shall also be mentioned. The copy of such certificate would also be endorsed to the sub-contractor.

## 8. Other Contractors

**8.1** 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, as referred to in the Contract Data. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.

**8.2** The Contractor should take up the works in convenient reaches as decided by the Engineer to ensure there is least hindrance to the smooth flow of traffic including movement of vehicles and equipment of other Contractors till the completion of the Works.

## 9. Personnel

**9.1** The Contractor shall employ for the construction work the technical personnel named in the Contract Data or other technical persons approved by the Engineer. The

Engineer will approve any proposed replacement of technical personnel only if their relevant qualifications and abilities are substantially equal to or better than those of the personnel stated in the Contract Data.

**9.2** If the Engineer asks the Contractor to remove a person who is a member of the Contractor's staff or 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 Works in the Contract.

**9.3** The Contractor shall not employ any retired Gazetted officer who has worked in the Engineering Department of the State Government and has either not completed two years after the date of retirement or has not obtained State Government's permission to employment with the Contractor.

## 10. Employer's and Contractor's Risks

**10.1** 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.

## 11. Employer's Risks

**11.1** The Employer is responsible for the excepted 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, 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), 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.

## 12. Contractor's Risks

**12.1** 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 other than the excepted risks, referred to in clause 11.1, are the responsibility of the Contractor.

a)loss of or damage to the Plant and Machineries including laboratory equipments;
b)loss of or damage to works executed and materials procured for the work;
c)loss of or damage to contractors own property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and
d)Personal injury or death.
e)Third party liability.

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## 13 Site Investigation Reports

**13.1** The Contractor, in preparing the Bid, may rely on any Site Investigation Reports referred to in the Contract Data, supplemented by any other information available to him, before submitting the bid.

## 14. Queries about the Contract Data

**14.1** The Engineer will clarify queries on the Contract Data.

## 15. Contractor to Construct the Works

**15.1**The Contractor shall construct, and install and maintain the Works in accordance with the Specifications and Drawings.

**16.1**The contractor shall construct the works with intermediate technology i.e. by manual means with medium input of machinery required to ensure the quality of works as per specifications. The contractor shall deploy the equipment and machinery as given in Contract Data.

## 17. The Works to Be Completed by the Intended Completion Date

**17.1** The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Programme submitted by the Contractor, as updated with the approval of the Engineer, and complete them by the Intended Completion Date.

## 18. Approval by the Engineer

**18.1** The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Engineer, who is to approve them.

**18.2** The Contractor shall be responsible for design of Temporary Works.

**18.3** The Engineer's approval shall not alter the Contractor's responsibility for design of the Temporary Works.

**18.4** The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.

**18.5** All Drawings prepared by the Contractor for the execution of the temporary Works, are subject to prior approval by the Engineer before their use.

## 19. Safety

**19.1** The Contractor shall be responsible for the safety of all activities on the Site.

## 20. Discoveries

**20.1** Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Employer. The Contractor shall notify the Engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

## 21. Possession of the Site

**21.1** The Employer shall hand over complete or part possession of the site to the Contractor 7 days in advance of construction programme. At the start of the work, the employer shall hand over the possession of at least 75% of the site.

## 22. Access to the Site

**22.1** The Contractor shall allow access to the Site and to any place where work in connection with the Contract is being carried out, or is intended to be carried out to the engineer and any person / persons / agency authorised by:

a.The Engineer
b.The Employer
c.The Ministry of Rural Development, Government of India.
d.National Rural Roads Development Agency, New Delhi

## 23. Instructions

**23.1** The Contractor shall carry out all instructions of the Engineer, which comply with the applicable laws where the Site is located.

## 24. Dispute Redressal System

**24.1** If any dispute or difference of any kind what-so-ever shall arises in connection with or arising out of this Contract or the execution of Works or maintenance of the Works there under, whether before its commencement or during the progress of Works or after the termination, abandonment or breach of the Contract, it shall, in the first instance, be referred for settlement to the competent authority, described along with their powers in the Contract Data, above the rank of the Engineer. The competent authority shall, so earmark or Superintending Engineer, within a period of forty-five days after being requested in writing by the Contractor to do so, convey his decision to the Contractor. Such decision in respect of every matter so referred shall, subject to review as hereinafter provided, be final and binding upon the Contractor. In case the Works is already in progress, the Contractor shall proceed with the execution of the Works, including maintenance thereof, pending receipt of the decision of the competent authority as aforesaid, with all due diligence.

**24.2** Either party will have the right of appeal, against the decision of the competent authority, to the Standing Empowered Committee if the amount appealed against exceeds rupees one lakh.

**24.3**The composition of the Empowered Standing Committee will be:

I.One official member, Chairman of the Standing Empowered Committee, not below the rank of Joint Secretary to the State Government;
II.One official member not below the rank of chief engineer; and

III. One non-official member who will be technical expert of Chief Engineer's level selected by the Contractor from a panel of three persons given to him by the Employer.

**24.4** The Contractor and the Employer will be entitled to present their case in writing duly supported by documents. If so requested, the Standing Empowered Committee may allow one opportunity to the Contractor and the Employer for oral arguments for a specified period. The Empowered Committee shall give its decision within a period of ninety days from the date of appeal, failing which the contractor can approach the appropriate court for the resolution of the dispute.

**24.5** The decision of the Standing Empowered Committee will be binding on the Employer for payment of claims up to five percent of the Initial Contract Price. The Contractor can accept and receive payment after signing as "in full and final settlement of all claims". If he does not accept the decision, he is not barred from approaching the courts. Similarly, if the Employer does not accept the decision of the Standing Empowered Committee above the limit of five percent of the Initial Contract Price, he will be free to approach the courts applicable under the law.

### 25. Arbitration

**25.1** In view of the provision of the clause 24 on Dispute Redressal System, it is the condition of the Contract that there will be no arbitration for the settlement of any dispute between the parties.

## *B. Time Control*

### 26. Programme

**26.1** Within the time stated in the Contract Data, the Contractor shall submit to the Engineer for approval a Programme showing the general methods, arrangements, order, and timing for all the activities in the Works, along with monthly cash flow forecasts for the construction of works.

**26.2** The Contractor shall submit the list of equipment and machinery being brought to site, the list of key personnel being deployed, the list of machinery / equipment's being placed in field laboratory and the location of field laboratory along with the Programme. The Engineer shall cause these details to be verified at each appropriate stage of the programme.

**26.3** An update of the Programme shall be a programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining Works, including any changes to the sequence of the activities.

**26.4** The Contractor shall submit to the Engineer for approval an updated Programme at intervals no longer than the period stated in the Contract Data. If the Contractor does not submit an updated Programme 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 Programme has been submitted.

**26.5** The Engineer's approval of the Programme shall not alter the Contractor's obligations. The Contractor may revise the Programme and submit it to the Engineer again at any time. A revised Programme shall show the effect of Variations and Compensation Events.

## 27. Extension of the Intended Completion Date

**27.1** 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 Works, which would cause the Contractor to incur additional cost.

**27.2** The Engineer shall decide whether and by how much time 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 cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

## 28. Delays Ordered by the Engineer

**28.1** The Engineer may instruct the Contractor to delay the start or progress of any activity within the Works. Delay/delays totalling more than 30 days will require prior written approval of the Employer.

## 29. Management Meetings

**29.1** The Engineer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the plans for the Works including physical and financial progress.

**29.2** The Engineer shall record the business of management meetings and provide copies of the record to those attending the meeting. The responsibility of the parties for actions to be taken shall be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all those who attended the meeting.

## 30. Uncorrected Defects

**30.1** If the Contractor has not corrected a Defect pertaining to the Defect Liability Period for 5 years, to the satisfaction of the Engineer, within the time specified in the Engineer's notice, the Engineer will assess the cost of having the Defect corrected, and the Contractor will pay this amount, on correction of the Defect.

## *D. Cost Control*

### *31. Variations*

**31.1** The Engineer shall, having regard to the scope of the Works and the sanctioned estimated cost, have power to order, in writing, Variations within the scope of the Works. He considers necessary or advisable during the progress of the Works. Such Variations shall form part of the Contract and the Contractor shall carry them out and include them in updated Programmes produced by the Contractor. Oral orders of the Engineer for Variations, unless followed by written confirmation, shall not be taken into account.

### 32. Payments for Variations

**32.1** If rates for Variation items are specified in the Bill of Quantities PW (Roads) / PWD, the Contractor shall carry out such work at the same rate. This shall apply for Variations only up to the limit prescribed in the Contract Data. If the Variation exceeds this limit, the rate shall be derived under the provisions of clause 36.3 for quantities (higher or lower) exceeding the deviation limit.

**32.2** If the rates for Variation are not specified in the Bill of Quantities, the Engineer shall derive the rate from similar items in the Bill of Quantities.

**32.3** If the rate for Variation item cannot be determined in the manner specified in Clause 36.1 or 36.2, the Contractor shall, within 14 days of the issue of order of Variation work, inform the Engineer the rate which he proposes to claim, supported by analysis of the rates. The Engineer shall assess the quotation and determine the rate based on prevailing market rates + 10% Over Head & Profit within one month of the submission of the claim by the Contractor. As far as possible, the rate analysis shall be based on the standard data book and the current schedule of rates of the district public works division. The decision of the Engineer on the rate so determined shall be final and binding on the Contractor.

### 33. Payments

**33.1** Payments shall be adjusted for deductions for advance payments, security deposit, other recoveries in terms of the Contract and taxes at source, as applicable under the law. The Engineer shall pay the Contractor the amounts he had certified within 15 days of the date of each certificate.

**33.2** The Employer may appoint another authority, as specified in the Contract Data (or any other competent person appointed by the Employer and notified to the contractor) to make payment certified by the Engineer.

**33.3** Items of the Works for which no rate or price has been entered in the Bill of Quantities, will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

## 34. Compensation Events

**34.1** The following shall be Compensation Events unless they are caused by the Contractor:

a)The Engineer orders a delay or delays exceeding a total of 30 days.
b)The effects on the Contractor of any of the Employer's Risks.

**34.2** If a Compensation Event would prevent the Works being completed before the Intended Completion Date, the Intended Completion Date shall be extended. The Engineer shall decide whether and by how much the Intended Completion Date shall be extended.

## 35. Tax

**35.1** The rates quoted by the Contractor shall be deemed to be inclusive of the sales and other levies, duties, royalties, cess, toll, taxes of Central and State Governments, local bodies and authorities that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

## 36. Currencies

All payments will be made in Indian Rupees.

## 37. Security Deposit

**37.1** The Employer shall retain security deposit of five percent and performance security of two and half percent of the amount from each payment due to the Contractor until ~~C~~completion of the whole of the construction Work..

**37.2** On completion of the whole of the construction Work half the total amount retained as Security Deposit from the running bills is repaid to the contractor, 25% after completion of 2nd year and balance 25% after completion of 3rd year and the Engineer has certified that all Defects notified by the Engineer to the Contractor before the end of this period have been corrected.

**37.3** The additional performance security for unbalanced bids as detailed in Clause 51 of Conditions of Contract is repaid to the contractor when the construction work is complete

38.The performance security equal to the five percent of the contract price and additional performance security as detailed in Clause 51 of Conditions of Contract is repaid to the contractor when the period of five years is over and the Engineer has certified that the contractor has satisfactorily carried out the Routine Maintenance of the works. If the Maintenance part of the contract is not carried out by the Contractor as per contract, the employer will be free to carry out Maintenance work and the amount required for this work will be recovered from the amount of Performance Security available with the employer and/or from any amounts of the Contractor whatever is due.

39.If the contractor so desires then the Security Deposit can be converted into any interest bearing security of schedule commercial bank in the name of the Employer or National Savings Certificates duly pledged in favour of the Employer for Defect Liability Period.

## 40. Liquidated Damages

**40.1** The Contractor shall pay liquidated damages to the Employer at the rate per week or part thereof stated in the Contract Data for the period that the Completion Date is later than the Intended Completion Date. Liquidated damages at the same rate shall be withheld if the Contractor fails to achieve the milestones prescribed in the Contract Data. However, in case the Contractor achieves the next milestone the amount of the liquidated damages already withheld shall be restored to the Contractor by adjustment in the next payment certificate. 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 shall not affect the Contractor's other liabilities.

**40.2** 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.

## 41. Securities

**41.1** The Performance Security equal to five percent of the contract price and additional security for unbalanced bids shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in the form given in the Contract Data and by a scheduled commercial bank. The Performance Security and additional performance security for routine maintenance shall be valid, by renewing each year, until a date 45 days from the date of expiry of Defect Liability Period and the additional security for unbalanced bids shall be valid until a date 45 days from the date of issue of the certificate of completion.

## 42. Cost of Repairs

42.1The Performance Security equal to five percent of the Contract Price and additional security for unbalanced bids shall be provided to the employer. Out of total Performance Security equal to five percent of contract price, half shall be delivered to the employer no later than the dates specified in the letter of acceptance and shall be issued in the form given in contract Data, however, balance half Performance Security shall be retained at the rate of two and a half percent of each payment due to the contractor until completion of whole of the construction work.

42.2 The Performance Security and additional Performance Security for maintenance shall be valid until a date 45 days from the date of issue of certificate of completion of construction work and maintenance work subject to the condition that if the Performance Security is in the form of Bank Guarantee, the period of validity of Bank Guarantee could be one year initially, however, the contractor would get this Bank Guarantee extended in such a way that an amount equal to five percent of the contract price is always available with employer until 45 days after the lapse of Defect liability Period. If the contractor fails to maintain above Performance Security, the Employer would recover the same from any dues payable to the contractor.

## *E. Finishing the Contract*

### 43. Completion

**43.1** 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 Works is completed.

### 44. Completion of Construction and Maintenance

**44.1**The Contractor shall request the Engineer to issue a certificate of completion of the construction of the works, and the Engineer will do so upon deciding that the works is completed.

**44.2** The contractor shall request the Engineer to issue the certificate of completion of the Maintenance and the Engineer will do so upon deciding that the Routine Maintenance is completed.

### 45. Taking Over

45.1The Employer shall take over the works within seven days of the Engineer issuing a certificate of completion of works. The Contractor shall continue to remain responsible for its routine maintenance during the maintenance period.

45.2The employer shall take over the maintained road within 7 days of the Engineer issuing a certificate of completion of the Routine Maintenance.

## 46. Final Account

46.1 The Contractor shall supply the Engineer with a detailed account of the total amount that the Contractor considers payable under the Contract within 21 days of issue of certificate of completion of construction of works. The Engineer shall issue a defect liability certificate and certify any payment that is due to the Contractors for works within 42 days of receiving the Contractor's account if it is correct and complete. If the account is not correct or complete, The Engineer shall issue within 42 days a schedule that states the scope of corrections or additions that are necessary. If the 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 14 days thereafter.

46.2 In case the account is not received within 21 days of issue of Certificate of Completion as provided in clause 50.1 above, the Engineer shall proceed to finalise the account and issue a payment certificate within 28 days. The payment of final bill for construction of works will be made within 14 days thereafter.

46.3 The Contractor shall supply the Engineer with a detailed account of the total amount that the Contractor considers payable under the contract 21 days before the end of the end of the Routine Maintenance Period. The Engineer shall issue a Routine Maintenance Certificate and certify any final payment that is due to the Contractor within 42 days of receiving the Contractor's account if it is correct and complete. If it is not THE engineer shall issue within 42 days a schedule that states the scope of the correction 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 28 days of receiving the Contractor's revised account. The payment of final bills for routine maintenance will be made within 14 days thereafter.

46.4 In case the account is not received within 21 days of issue of Certificate of Completion as provided in clause 50.3 above, the Engineer shall proceed to finalise the account and issue a payment certificate within 28 days. The payment of routine maintenance will be made within 14 days thereafter.

## 47. Operating and Maintenance Manuals

**47.1** 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.

**47.2** 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 payments due to the Contractor.

## 48. Termination

**48.1** The Employer may terminate the Contract if the Contractor causes a fundamental breach of the Contract.

**48.2** Fundamental breaches of Contract shall include, but shall not be limited to, the following:

a)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;
b)the Contractor is declared as bankrupt or goes into liquidation other than for approved reconstruction or amalgamation;
c)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;
d)the Contractor does not maintain a Security, which is required;
e)the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as defined in clause 44.1;
f)The Contractor fails to provide insurance cover as required under clause 13; due to personal injury or death.
g)If the Contractor, in the judgement of the Employer, has engaged in the corrupt or fraudulent practice in competing for or in executing the Contract. For the purpose of this clause, "corrupt practise" 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 Employer and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid process at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition.
h)if the Contractor has not completed atleast thirty percent of the value of construction Work required to be completed after half of the completion period has elapsed;
i)if the Contractor fails to set up a field laboratory with the prescribed equipment, within the period specified in the Contract Data; and work order.
j)any other fundamental breaches as specified in the Contract Data.
k)If the Contractor fails to deploy machinery and equipment or personnel as specified in the Contract Data at the appropriate time.
l)A show cause notice shall be served to the contractor before termination for not obeying the contract.

**48.3** Notwithstanding the above, the Employer may terminate the Contract for convenience.

**48.4** 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.

## 49. Payment upon Termination

**49.1** 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 and Materials ordered less advance (Running A/c bill) payments received up to the date of

the issue of the certificate and 10 (Ten) percent less the percentage to apply to the value of 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 difference shall be recovered from the security deposit, and performance security. If any amount is still left un-recovered it will be a debt payable to the Employer.

**49.2** If the Contract is terminated at the Employer's convenience, 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 (Running A/c bill) 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.

## 50. Property

**50.1** All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer for use for completing balance construction work if the Contract is terminated because of the Contractor's default, till the Works is completed after which it will be transferred to the Contractor and credit, if any, given for its use.

## 51. Release from Performance

**51.1** If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of 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 a commitment was made.

*F. Other Conditions of Contract*

## 52. Labour

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

**52.2** 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 other information as the Engineer may require.

## 53. COMPLIANCE WITH LABOUR REGULATIONS

**53.1** During continuance of the Contract, the Contractor and his sub Contractors shall abide at all times by all existing labour enactments 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 in Appendix to Part I General Condition of Contract. 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 and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

## 54. Drawings and Photographs of the Works

**54.1** The contractor shall do photography / video photography of the site firstly before the start of the work, secondly mid-way in the execution of different stages of work and lastly after the completion of the work. No separate payment will be made to the contractor for this.

**54.2** The Contractor shall not disclose details of Drawings furnished to him and works on which he is engaged without the prior approval of the Engineer in writing. No photograph of the works or any part thereof or plant employed thereon, expect those permitted under clause 58.1, shall be taken or permitted by the Contractor to be taken

by any of his employees or any employees of his sub-Contractors without the prior approval of the Engineer in writing. No photographs/ Video photography shall be published or otherwise circulated without the approval of the Engineer in writing.

## 55. The Apprentices Act 1961

**55.1** The Contractor shall duly comply with the provisions of the Apprentices Act 1961 (III of 1961), the rules made there under and the orders that may be issued from time to time under the said Act and the said Rules and on his failure or neglect to do so he shall be subject to all liabilities and penalties provided by the said Act and said Rules.

55.2 Notwithstanding the provisions made in the related BOQ any item of the work which can legitimately be considered as not stipulated in the Specific Schedule of probable items of work but has become necessarily as a reasonable contingent item during actual execution of the work will have to be done by the contractor if so directed by the engineer-in-Charge in writing obtaining prior approval of the tender accepting authority and the rates will be fixed in the manner as stated below.

a)The rate of Supplementary item shall be analised to the maximum extent possible from rates of allied item of works appearing in the "Specific Priced Schedule of Probable Items".

b)To complete the analysis, if necessary, the rates appearing in the Schedule of Rates of WBSRDA in force for the working area at the date of acceptance of the tender.

c)In case of the Supplementary Items, which do not appear in the above Schedule of Rates of WBSRDA, such items shall be paid at the rates entered in the P.W. (roads) Department's schedule of Rates applicable at the date of acceptance of the tender.

d)If the rates of the Supplementary Items cannot be arrived at even after application of the Clause 61(a), 61(b), 61(c) above, the same shall be determined by analysis on the basis of "Standard Data Book for Analysis of Rates for Rural Roads, MORD" and on the basis of prevailing market rates of the materials. Contractor's profit and overhead charges (both together) at 12.5% (twelve point five per cent) will be allowed (instead of 20% as stated in the Standard Data Book). The contractual percentage will not be applicable in this case. Black market rate of the materials involved shall never be allowed.

e)Contractual percentage shall only be applicable with regard to the portions of the analysis based on Clause 61 (a), 61 (b) and 91 (c) above only.

## 56. Supplementary Items:-

Value of the supplementary tender / substitute Supplementary tender shall not be more than 10% (ten per cent) of the tender amount / contract value accepted provided that total work value together with the Supplementary tender / substitute Supplementary tender (along with excess work if any) shall not be exceed by the Sanctioned Value of the Package or Estimated Amount put to the tender +5% whichever is less.

# TECHNICAL SPECIFICATIONS

## 1.0 EXCAVATION AND EARTHWORK:

### 1.1 General

The excavation will generally refer to open excavation of foundation wet or dry and in all sorts of soils.

### 1.2 Examine the site

The Contractor shall visit and ascertain the nature of the ground to be excavated and the work to be done and shall accept all responsibility for the cost of the work involved.

### 1.3 Setting out

The contractor shall set out the building or other involved works after clearing the site and get the same approved by the Employer/Consultants. It shall be the responsibility of the Contractor to install substantial reference marks, bench marks etc. and maintain them as long as required by the Employer/Consultants. The contractor shall assume full responsibility for proper setting out, alignment, elevation and dimension of each and all parts of the work.

### 1.4 Ground level and site level:

Before commencement of excavation spot levels on an approved grid covering the entire plot shall be taken by the Contractor in consultation with the Employer/Consultants and proper record of these levels shall be kept jointly signed by the Contractor and the Employer/Consultants. A block level plan showing all ground levels of the plot shall be prepared by contractor and shall also be jointly signed by the Contractor and the Employer/Consultants.

### 1.5 Excavation and preparation of foundation for concrete

Excavation shall include removal of all materials of whatever nature at all depths and whether wet or dry necessary for the construction of foundation substructure (including mass excavation for basement underground reservoir where applicable) exactly in accordance with lines, levels, grades and curves shown in the drawings or as directed by the Employer/Consultants. The bottoms of excavation shall be levelled both longitudinal and transversely or sloped as directed by the Employer/Consultants.

Should the contractor excavate to a greater depth or width than show on the drawings or as directed by the Employer/Consultants, he shall at his own expense fill the extra depth or width in cement concrete in proportion as to be directed by the Employer/Consultants but in no case with concrete of mix leaner than 1:4:8 cement concrete.

The contractor shall report to the Employer/Consultants when the excavations are ready to receive concrete. No concrete shall be placed in foundations until the contractor has obtained Employer/Consultants' approval. In case, the excavation is done through different types of soil and if different rates are applicable as per provision of the Schedule of Quantities, the contractor must get the dimensions of the strata agreed by the Employer/Consultants for payment. If no specific provisions are made in the schedule of quantities it will be presumed that excavation shall be in all types of soil and the contractor's rate shall cover for the same.

After the excavation is passed by the Employer/Consultants and before laying the concrete, the contractor shall get the depth and dimensions of excavation and levels (and nature of strata as applicable as per Schedule of Quantities like hard rock, soft rock) and measurements recorded by the Employer/Consultants.

1.6 Shoring

The sides of the excavation should be timbered and supported in such a way as is necessary to secure these from falling in, and the shoring shall be maintained in position as long as necessary. The contractor shall be responsible for the proper design of the shoring to be approved Employer/Consultants to hold the sides of the excavation in position and ensure safety of persons and properties etc. The shoring shall be removed as directed after the items for which it is required are completed. Unless otherwise mentioned in the Schedule of Quantities no extra payment will be made for shoring.

1.7 Protection

If instructed by the Employer/Consultants all foundation pits, and similar excavations shall be strongly fenced and marked with red lights at night to avoid accidents. Adequate protective measure shall be taken to make sure that the excavation does not affect or damage adjoining structures. All measures required for the safety of excavations, the people working in and around the foundation trenches, property and the people in the vicinity shall be taken by the contractor at his own cost. He shall be entirely responsible for any injury and damage to property caused by his negligence or accident due to his constructional operations, storage of materials etc.

1.8 Stacking of excavated materials:

All materials excavated will remain the property of the Employer and rate for excavation shall include sorting out of useful materials and stacking them on site as directed. Materials suitable and useful for back filling, plinth filling or levelling of the plot or other use shall be stacked in convenient places but not in such a way as to obstruct free movement of men, animals and vehicles or encroach on the area required for constructional purposes.

1.9 Backfilling

All shoring and form work shall be removed after their necessity ceases and trash of any sorts shall be cleaned out from the excavation. All space between foundation masonry or concrete and sides of excavation shall be refilled to the original surface with approved excavated materials in layers 15 cm. in thickness watered and rammed. The filling shall be done after concrete or masonry is fully set and done in such a way as not to cause undue thrust on any part of the structure. Where suitable excavated materials are to be used for refilling it shall be brought from the place where it is temporarily stacked and used in refilling.

No excavation of foundations shall be filled in or covered up until all measurements of excavations, masonry concrete and other works below ground level are jointly recorded. Black cotton soil shall not be used for back filling or in plinth filling.

1.10 Dewatering

Rates for excavation shall include bailing or pumping out water which may accumulate in the excavation during the progress of work either from seepage, springs, rain or any other cause and diverting surface flow if any by bunds of other means. Pumping out of water shall be done in such approved manner as to preclude the possibility of any damage to the foundation trench concrete or masonry or any adjacent structure. When water is met in foundation trenches or in tank excavations, pumping out water shall be carried out from auxiliary pit of adequate size dug slightly outside the building excavations. The depth of auxiliary pit shall be more than the working foundation trench levels. The auxiliary pit shall be refilled with approved excavated materials after the dewatering is over.

The excavation shall be kept free from water :-

a) During inspection and measurement;

b) When concrete and/or masonry works are in progress and till they come above the natural water level and

c) till the Employer/Consultants consider that the concrete/mortar is sufficiently set.

1.11 Surplus excavated materials:

All excavated materials certified as surplus and not useful shall be removed by the Contractor from the site in an approved manner with the approval of the Local Authority as required to his own dump and shall be paid as a separate item as in the Schedule of Quantities. No extra claim on any account will be paid. The items of removal of surplus excavated materials shall only be undertaken by the Contractor when specific instruction in this regard has been obtained from the Employer/Consultants. The contractor must also secure the approval of the Employer/Consultants regarding the quantity of surplus materials to be removed prior to commencement of this item of work.

1.12 Rates to include for excavation item:

Apart from other factors mentioned elsewhere in this contract, rates for the item of excavation shall also include for the following:-

i) Clearing site.

ii) Setting out works as required.

iii) Providing shoring and shuttering to avoid sliding of soil and to protect adjacent structures and subsequently by removing the same, if not started separately in the schedule of quantities.

iv) Bailing and pumping out water as required and directed.

v) Excavation at all depth (unless otherwise specified in the Schedule of Quantities) and removal of all materials of whatever nature wet or dry and necessary for the construction of foundation underground reservoir etc. and preparing bed for laying concrete.

vi) Sorting out useful excavated materials and conveying beyond the structure and stacking them neatly on the site for back filling or re-use as directed.

vii) Necessary protection works involving, labour, materials, and equipment to ensure safety and protection against risk or accident.

viii) Drilling of small holes as directed to explore the nature of substrata if necessary.

1.13 Measurement for excavation:

Excavation for foundation of column, beams, walls and the like shall be measured and paid net as per drawing, dimensions of concrete (bed concrete where so specified) and the lowest level in regard to length and breadth and depth shall be computed from the excavation levels and ground levels taken before excavation for that area. Any additional excavation required for working space, form work, planking, shuttering for concrete work, de-watering and strutting etc. shall not be measured and shall not be paid for

separately but rates quoted for excavation shall include for all these factors. No increase in bulk after excavation shall be allowed.

1.14 Rates to include for backfilling item:

Apart from other factors mentioned elsewhere in this contract, rates for the item of backfilling item of work shall also include for the following:-

i) Backfilling the trenches alongside masonry or concrete with approved excavated materials upto the natural ground level in layers as specified including watering and ramming.

ii) Earth filling in Plinth

If there is approved surplus earth after backfilling the sides of excavations, the same will be used for plinth filling if required. Any additional quantities of good quality earth, if required for plinth filling, shall be brought to the site, by the contractor from outside. No borrow pits shall be opened on the site. Filling in plinth shall be done in layers of 15 cm. thick each layer being consolidated by ramming and watering.

The payment of back filling item shall be made on measurement of finished consolidated quantity, arrived by difference levels taken before and after the back filling.

iii) No payment shall be made for backfilling to the trenches excavated by the contractor for working space, form work, planking, shuttering for concrete work, de-watering and strutting etc. with approved excavated materials upto the natural ground level in layers as specified including watering and ramming.

2.0 PRE CONSTRUCTION ANTI-TERMITE TREATMENT

Soil treatment shall conform to the following:-

2.1 Chemicals:

The treatment of the area shall be carried out by applying of chloropyrefos chemical 20% EC and not less than the designated concentration.

2.2 Records:

A daily record shall be maintained by the contractor indicating the amount of work done and quantity of chemical consumed for the work. This record book shall be property of the Employer.

2.3 Tests:

The contractor should perform test at his own cost of the chemical to be used in the work and the result of the test should be submitted to the Employer through Consultants.

2.4 Method of application:

The following paragraphs specify the manner and sequence of operations, which must be followed. The rates of applications of chemical as indicated in the following paras for various operations should be followed. This specification represent the minimum rates of application of each operation and the contractor shall actually apply chemical at rates higher than those specified to the extent he may consider then necessary for effectiveness during the 5 YEARS guarantee period. In their words onus of responsibility of applying adequate amounts of chemicals as required to sustain the 5 YEARS guarantee shall be that of the contractor, but in no case shall actual rates of application be less than those specified in the Technical Specifications.

2.4.1 Backfill in immediate contact with RCC Basement Wall:

The treatment will start at a depth of 500 mm. below the ground level except when such ground level in raised or lowered by filling or cutting. After the basement wall have been cast and soil in immediate contact with vertical surface of basement wall a trench should be made and chemical emulsion to be injected with high pressure pump along the wall at the rates of 7.5 litres per square metre of vertical surfaces and the excavated soil shall be treated before refilling. Should the earth outside the building be carried out on completion of such grading.

2.4.2 Treatment soil under apron along External Perimeter of Building:

Top surface of the consolidated earth over which the apron is to be laid shall be treated with chemical emulsion at the rate of 5 litres per square metre of the vertical surface before the apron is laid. If consolidated earth does not allow emulsion to sleep through, holes upto 50 to 75 mm. deep at 150 mm. centres both ways shall be made with 12 mm. diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion.

2.4.3 Treatment of Soil Surrounding Pipes, Wastes and Conduits:

When pipes, wastes and conduits enter the soil inside the area of the foundations, soils surrounding the point of entry shall be loosened around each of such pipe, waste or conduit for a distance of 150 mm. and to a depth of 75 mm. before treatment is commenced. When they enter the soil external to the foundations, they shall be similar treated for a distance of over 300 mm. unless they stand clear of the walls of the building by about 75 mm.

2.4.4 Treatment of Expansion Joints:

The soil beneath the expansion joints at ground floor should receive special attention when the treatments as specified above are carried out. This treatment should be supplemented by treating through the expansion joint after the sub-grade is laid at the rate of 2 litres per linear metre.

2.4.5 Door, window frames and shutters:

All wooden doors and frames of the building which comes in contract with brick/concrete wall are to be treated before and after fixing. All external wall upto window level (in ground floor only) are also to be treated. All electrical conduits and switch boxes in all floors are to be treated.

2.4.6 Treatment of soil along External Perimeter of Building:

After the building is completed the earth along the external perimeter of the building should be rodded at intervals of 150 mm. and to a depth of 300 mm. The rod should be moved backward and forward parallel to the wall to back up the earth and chemical emulsion poured along the wall at the rate of 7.5 litres per square metre of vertical surfaces. After the treatment, the earth should be tampted back into place. Should the earth outside the building be graded on completion of the grading.

In the event of filling being more than 300 mm. the external perimeter treatment shall be extended to the full depth of filling upto the ground level so as to ensure continuity of the chemical barrier.

2.5 Treatment shall not be made the soil or fill is excessively wet or immediately after heavy rain to avoid surface flow of toxicant from application site. Unless the treated areas are to be immediately covered, precautions shall be taken to prevent disturbance of the treatment by human or animal contact with treated soil.

2.6 Guarantee:

10 (Ten) years guarantee should be submitted on non-judicial stamp paper as per the Proforma attached. The guarantee shall be signed by the main contractor and the specialized who have executed the work. In the unlikely even of any treatment becoming necessary subsequently during the guarantee period, required inspection and treatment shall be carried out free of cost.

2.7 Instructions to contractor for quoting rates:

Tenderer should include in his rates given in Schedule of Quantities in Sqm. area all the stages of treatment as mentioned above. Where the rates of application of the chemical, has not been specified clearly the rates should be governed to that

during the guarantee period no trouble may arise. Payment will be made on the plinth area measurement and the rate for the same should include all the stages of work as mentioned above and no extra on this account will be entertained.

The work should be executed in stages according to the progress of work and in co-ordination with the general building and other contractors. Idle labour, if any, for the same shall not be entertained.

The work should be executed through a specialized firm approved by the Employer/Consultants. Approval of such firm shall be obtained from the Employer/Consultants before commencement of work.

## 3.0 CONCRETE

### 3.A GENERAL

#### A.1 Supervision:

A competent person approved by the Employer/Consultants shall be employed by the contractor whose first duty will be to supervise all stages in the preparation and placing of the concrete. All cubes should be made and necessary site tests carried out under his direct supervision in the presence of Employer/Consultants.

#### A.2 Approval of concreting arrangement etc.

Before commencement of construction the contractor shall submit detailed arrangements for concreting, system of form work and all other devices which he proposes to use for the construction of structural frame work for approval of Employer/Consultants.

#### A.3 Sample and Tests

Every facility shall be provided by contractor at site to enable the Employer/ Consultants to select samples, get contractor to collect samples and carry out tests on the materials and construction. At least 10% of the cube tests should be carried out in Laboratory/Institution approved by the Employer/Consultants. If those tests shows that strength of cubes do not comply with the acceptance criteria of specifications, the contractor will be responsible for replacement of the defective construction. The necessary cost of all such sampling and testing has to be borne by the contractor.

#### A.4 Rejected materials:

All materials which have been damaged, contaminated or have deteriorated or do no comply in any way with the requirements of this specification, shall be

rejected and shall be removed immediately from the site at the Contractor's own expense.

A.5 Loading of floor slabs:

No materials shall be stored or stacked on suspended floors and roofs without the Employer's/Consultants' prior approval.

A.6 Co-ordination:

The Contractor shall be responsible for the co-ordination with sub-contractors or other contractors for incorporating any inserts, electrical conduit pipes, fixing blocks, chases, holes etc. in concrete members brick works as required. The contractor shall ensure that these requirements have been approved by the Employer/Consultants before the operations are put in hand. All bricks, chases, inserts, holders etc. to be left in the concrete shall be of the sizes specified and be accurately set and out and placed before pouring concrete.

The Contractor's rates quoted for concrete items shall include all these factors. No holes and chases shall be cut in concrete without prior approval of the Employer/Consultants.

A.7 Inserts to concrete:

The contractor should note that he shall provide necessary wooden plugs, m.s. inserts, sleeves etc. required for the works for which no extra payment will be made. He will have to provide if so directed, any inserts, wooden plugs sleeves for other contractors, such as Electrical Contractor, Fire Fighting Contractor, Contractor for Lifts etc. for which he will be entitled for payment but in case the other contractors provide such inserts, then he will have to take proper measures (at his expense) and care not to disturb their work while laying concrete.

A.8 Equipment:

The contractor shall keep at work site testing equipment for aggregate and concrete, viz. Test sleeves, balance, slump cones concrete cube testing machine etc. all items required conforming to relevant I.S. specification. Dial gauge of cube testing machine should have been calibrated recently from a Govt. approved laboratory.

3.B Materials:

All materials shall be of approved quality as per relevant I.S. specifications/or as specified in the contract.

B.1 Cement:

a) Ordinary Portland cement and Portland Slag Cement shall conform to the I.S. specification I.S. 269 and IS 455 of latest edition.

b) Cement at site shall be stored in dry weatherproof godowns (or shed) built at the cost of the contractor. Cement must not be stacked in more than 10 bags height. Sufficient space shall be provided for circulation and rotation of bags in order to minimize the length of storage of any of the bags. The floor of the godown shall consists of wooden planks resting on base prepared of dry bricks laid on edge.

c) The contractor shall be fully responsible for the quality of cement brought by him at the work site. The contractor shall ensure that the cement brought to the work site conforms to the requirements of IS 269 or IS 455 and shall procure manufacturer's certificate to this effect, in hisown interest. In case the contractor has any doubt regarding the quality of cement brought on work site by him, it is upto him to have it tested at his own expenses and make sure that cement is of right quality.

d) Employer/Consultants can order on the contractor to have the cement tested or they can take samples in the presence of contractor from cement bags stored at work site and forward them to a approved laboratory for testing and the contractor shall be responsible for the cost of testing including transporting of samples to the laboratory. Daily record of cement received and consumed shall be maintained by the Contractor in cement register at site and submitted to Consultants if called for. Theoretical consumption vis-à-vis materials brought at site by the Contractor shall also be submitted with proper documents with every bill for verification. A chart showing the consumption of cement for different items of work is annexed. Consumption of cement in the corresponding items of work under the contract shall be computed on the basis of the quantities shown in the table subject to a variation of plus/minus three percent (the weight of 1 cum of cement shall be taken as 1,440 kg). For the items not available in the enclosed cement consumption chart, C.P.W.D. schedule shall be followed.

e) Cement of doubtful quality shall not be used until satisfactory result is obtained after testing. All cement not conforming to specifications and cement that has deteriorated, damaged or set shall not be allowed to be used. All such cement shall be immediately removed from work site by the contractor. The cost of all such cement shall be borne by the contractor.

B.2 Aggregate:

Aggregate shall conform to IS 383 of latest edition.

B.3 Fine Aggregate : Sand

a) The fine aggregate – sand shall be hard, strong, dense, durable clean with uncoated grains. The maximum size of the particles shall be 4.75 mm. (3/16 in) and shall be graded down. The sand shall not contain any harmful materials such as iron, Pyrites, coal, mica, silt, clay, alkali, sea shells organic impurities, loam etc. or in case of reinforced concrete work, any materials which might attack the reinforcement or detrimental to concrete. Aggregate, which are chemically reactive with the alkalies of the cement, shall not be used. The maximum quantity of deleterious materials shall not exceed the limit specified in the relevant I.S. Specifications. The silt content shall be with 8%.

b) Grading:

The natural sand used for work shall have a grading conforming to grading zones of I and II of I.S. 383 of latest edition.

B.4 Coarse Aggregate:

a) Coarse aggregate shall consist of hard, dense, durable uncoated crushed rock. Gravel aggregate shall be allowed to be used only if specially specified in the bill of quantities. Otherwise it shall be taken that only crushed rock shall be permitted as coarse aggregate.

b) The aggregate shall be free from soft, friable thin or long laminated pieces. Aggregate shall be free from injurious amounts of alkali, organic matter and other deleterious materials. Flaky or weathered stones shall not be used. The maximum percentage of deleterious materials shall not exceed those specified in the relevant I.S. specification.

c) The contractor shall arrange to supply coarse aggregate of nominal size conform to the grading in the limits specified in I.S. 383 of latest edition.

d) Size of Aggregate:

i) Generally for reinforced concrete work, nominal maximum size of aggregate is 20 mm. graded suitably.

e) In selecting the aggregate, the contractor shall satisfy himself that the source is suitable for regular supply and a watch shall be maintained that

the particles shape and grading remain reasonably uniform throughout the progress of work.

f) Where so directed by the Employer/Consultants aggregate shall be washed by approved methods at contractor's expenses.

B.5 Water

Water to be used in construction to be tested before commencement of work and hence source to be finalised.

Water used for both mixing and curing shall be clean and free from injurious amounts of deleterious materials which are likely to affect the strength or durability of concrete. Water containing any sugar shall not be allowed for use. Water is to be tested in accordance with I.S. 456 of latest edition. The PH values of water shall generally be not less than 6.

3.C Mixing and placing of concrete:

C.1 Cement:

Cement shall be matched by volume. Where the weight of the cement is determined by accepting the maker's weight per bag, a certain number of bags as directed by the Employer/Consultants shall be weighed separately to check the nett weight. Where the cement is weighed on the site and not in bags, it should be weighed separately from Aggregate.

C.2 Aggregate

The aggregate shall be matched by volume; the form as used shall be of the correct sizes to be certified by the Employer/Consultants before use. Heaping of aggregate on the form is prohibited and aggregates shall be filled level in form and struck off with a horizontal timber or steel rule. Where sand is measured by volume, bulkage allowance as determined by the Employer/Consultants shall be accounted for while measuring sand.

C.3 Water:

Water shall be measured either by volume in celebrated tanks/vessels having conical shape narrower at top of water shall be weighed. Water shall not be measured using ordinary buckets which are wider at top and narrower at the base. The measurement of water to control and maintain a constant water cement ratio is of utmost importance and adequate attention to this end by the contractor to the satisfaction of the Employer/Consultants shall be made so as to produce concrete of adequate workability as required.

C.4 Mixing of concrete:

a) Machine mixing:

Concrete shall be mixed in Mechanical Mixer. Mixing shall be continued until there is uniform distribution of materials and the mass is uniform in colour and consistency. The mixing time from the time of adding water shall be in accordance with I.S. 1791 of latest edition but in no case mixing shall be done for less than two minutes.

b) Hand mixing

Hand mixing shall not be permitted except for unimportant structural members and purely at the discretion of the Employer/Consultants. When hand mixing is permitted it shall be taken to ensure that the mixing is continued until the mass is uniform in colour and consistency. If hand mixing is permitted by the Employer/Consultants, the contractor shall use 10% extra cement for hand mixing for which no extra payment will be made.

C.5 Transporting, Placing, Compaction and curing of concrete:

C.6 Transporting

Concrete shall be handled from the place of mixing to the place of final desposit as rapidly as practicable, by method which will prevent the segregation or loss of any of the ingredients. If segregation occurs during transport, the concrete shall be remixed before use. The concrete shall be placed in position and compacted before the initial set of cement has commenced and shall not be subsequently disturbed. During hot or cold weather concrete shall be transported in deep container to reduce loss of water by evaporation during hot weather and loss of heat during cold weather. Deep containers are specified on account of their lower ratio of surface area to mass.

C.7 Dropping of Concrete

Concrete shall not be dropped into position from a height greater than 1.0 metre unless directed otherwise by Employer / Consultant.

C.8 Debris etc. removed

All debris, saw dust etc. shall be removed from the shuttering before any concrete is placed. Care shall be taken to see that the shuttering is water-tight and has been properly treated with approved composition to prevent absorption of water.

C.9 Protection and placing in layers

Concrete shall be placed into the forms in layers not exceeding 300 mm. (approx.) in thickness. Concrete after placing and finishing shall be protected by use of covering as approved by the Employer / Consultants during first stage for hardening against high winds, heat, rain, surface water etc. No shock or vibration shall be allowed to be imparted to forms supporting fresh finished concrete.

C.10 Compaction:

Concrete shall be thoroughly compacted during operation of placing by the use of Mechanical Vibrators. Sufficient number of vibrators (including stand by) of adequate capacities shall be used for compaction of concrete. Vibration shall be carried out by trained men and in the presence of a qualified supervisor trained in the use of vibrators and vibrated concrete. In certain portions where vibration is not effective, careful rodding and taping shall be carried out and sufficient men employed to ensure that thorough consolidation takes place. Where manual compaction becomes necessary, the work ability of the mix should be controlled to strength requirement.

C.11 Continuous concreting:

Concreting shall be carried out continuously upto predetermined positions of construction joints. The position and arrangement, for construction joints shall be approved by the Employer/Consultants. Rest pauses for meals etc. shall be subject to the Employer's/Consultants' approval.

C.12 Packing round reinforcement:

In the case of reinforced concrete work, the concrete shall be carefully consolidated and packed round the reinforcement and care shall be taken to ensure that reinforcement is not displaced during the placing and compaction of concrete. I reinforcement moves out of its place, it must brought back in position immediately.

C.13 Curing:

All concrete work shall be water cured for a minimum period of 7 days after concreting or as directed by the Employer/Consultants. Horizontal surfaces shall be kept covered with water ponded by means of bunds and vertical surfaces like those of column, fins etc. by barlaps kept constantly wet with water sprays. Mere sprinkling of water on vertical surface without sacks will not be allowed. In respect of concrete made out of pozzalana cement, curing shall be continued for another 8 days.

C.14 Trained Supervisor

It is essential that the contractor's supervisor who is in charge of the construction of all concrete work whether reinforced or not, shall be skilled in this class of

work and shall superintend personally the whole construction and pay special attention to:-

a) The quality, testing, proportioning and mixing of the materials and particularly control of water cement ratio.

b) Laying of materials in place and thorough consolidation of the concrete to ensure solidity and freedom from voids.

c) Position of reinforcements.

3.D Construction Joints

D.1 General

a) Location

The position of all construction joints shall be as approved by the Employer / Consultants. The contractor shall submit details of the location where he proposes to provide construction joints for the approval of the Employer / Consultants.

b) Stop Boards

All vertical construction joints shall be formed with proper wooden stop board at the joints. Where directed, the joint shall be rebated or joggled and of approved shape.

c) Water Bar & Water Sealer

Wherever shown in the drawing or whenever instructed by the Employer / Consultants water bar or water sealer of approved quality shall be used in construction joints for R.C. works. It is necessary to ensure that water bars form continuous diaphragms. The water bars shall be made out of special chemically treated rubber materials for retaining the flexibility indefinitely. Unless otherwise instructed by the Employer / Consultants the water bars shall be "Centre Bulb type" corrugated and with end grip of approved quality. These shall be of any width as mentioned in the Schedule of Quantities and 10 mm. thickness or other sizes thickness approved by the Employer / Consultants. The rate for supplying and fixing water bar in construction joints shall also include all appliances necessary inter-section pieces.

D.2 Construction joints in Superstructure

a) Columns

Joints shall be formed horizontally above top of foundation and 75 mm. below the lowest soffit of the beams meeting at the head of the column. Concrete in the head of a column where one or more beams meet shall be placed at the same time that in the beam or beams without any joint.

b) Beams

Concrete in the beams shall be placed throughout without a joint but if the provision of joint is unavoidable the joint shall be vertical and at positions approved by the Employer / Consultants.

c) Slab

Where the joint is unavoidable it shall be vertical and parallel to the principal reinforcement. However, if joints is required to be provided at right angles to the principal reinforcements it shall be vertical and at 1/3rd to 1/4th position of span / at positions approved by the Employer / Consultants.

d) Treatment of construction joint

i) When work is resumed on the surface which has hardened such surface shall be roughened. It shall be thoroughly cleaned and wetted and covered with a 12 mm. layer of mortar composed of cement and sand in the same ratio as cement and sand in the concrete mix. This 12 mm. layer of mortar shall be freshly mixed and placed immediately before the placing of the concrete.

ii) Where the surface has not fully hardened the latiance shall be removed by scrubbing the wet surface with wire bristle brush, care being taken to avoid dislodgment of aggregates. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement grout.

iii) Care shall be taken to obtain good bond between the hardened and freshly placed concrete. Ramming and moulding of concrete around water bar shall be carefully carried out. Labour and materials for treatment of concrete joints are to be included in the rate of respective items.

3.E Expansion joints

a) Expansion joints shall be provided as shown in the drawings.

b) Expansion joints are meant to provide discontinuity in the structure. Care shall be taken to ensure this discontinuity by having clear joints throughout the length and height of the expansion joints. There shall be no connection between two sides of an expansion joint except with the materials used to

form the expansion joints like fillers, water bar and other materials indicated in the drawings.

c) Unless otherwise specified, the filler materials for expansion joints shall be shalitex joint filler as manufactured by M/s. Shalimar of appropriate thickness. The filler materials shall extend to the entire depth of the joint except for a distance of 25 mm. from the exposed faces as shown in the drawing.

d) Expansion joints shall be leakproof and the Contractor shall be responsible for any leakage and resulting damages.

3.F Tests for Concrete:

Tests shall be conducted in accordance with I.S.: 516 of latest edition.

Test cubes:

a) Works tests cubes shall represent quality of concrete incorporated in the work and taken out in sets of cubes. The concrete for preparation of one set of 6 cubes shall be taken from one batch of mixed concrete discharged from mixer. The cubes shall be mouled in accordance with Indian Standard Code of Practice.

b) A minimum of one set of 6 cubes shall be taken for every 20 cum. Or part thereof in case of beam, slabs and connected columns; one set for 5 cum. or part thereof of concrete poured for columns and they shall be considered as representative for said quantity. This is an average figure, and may be increased to cater for special conditions at the discretion of the Employer/Consultants.

c) The cubes shall be cured as per IS Code of Practice. The entire operation of casting, arranging and despatch of cubes to Laboratory will be carried out by the Contractor under the supervision of the Bank's Site Engineer/Consultant. Out of 6 cubes, 3 cubes shall be tested at an age of 7 days and balance at an age of 28 days in an approved Laboratory.

d) The cubes shall be initialed, numbered, dated jointly by the contractor's representatives and the Site Engineer of Employer/Consultants representative with a piece of wire or nail so that an indentation of the initials is left on the cubes.

e) The contractor shall arrange to transport the cubes to the approved laboratory and arrange to have the test results forwarded (in duplicate) directly from the laboratory to the Employer/Consultants. The contractor shall bear all expenses in connection with the preparation of test cubes, i.e. provision of moulds, cost of concrete, labour and transportation charges to

the approved laboratory, laboratory testing charges etc. and his rates for concrete items should be quoted accordingly.

f) A Register shall be maintained at site by the Contractor with following details entered and initialed by the Contractor and the Site Engineer/Architect.

i) Reference to specific structural members receiving the batch of concrete from which the cubes were cast.

ii) Mark on cubes.

iii) The mix of concrete.

iv) Date and time of casting.

v) Slump

vi) Crushing strengths as obtained at the end of 7 days for 3 cubes out of a set of a 6 and at the end of 28 days from the other 3 cubes.

vii) Laboratory in which tested and reference to test certificate.

viii) Any other information directed by the Employer/Consultants.

g) A record of the quality of concrete incorporated in the work that is represented by the quality of concrete of the set of cubes along with the description of the structural members where concrete has been deposited shall be mentioned.

3.G Vibration of concrete:

a) Water cement ratio:

The water cement ratio (by weight) for all vibrated concrete (except controlled concrete) shall generally conform to relevant I.S. provision and it shall not be varied unless otherwise directed. In respect of "Design Mix" the water cement ratio shall be as determined in the laboratory mix design suitable for vibrated concrete.

b) Placing:

Concrete shall be placed in layers not over 45 to 60 cm. (10 to 24 inches) deep and each layer shall be vibrated into places by methods which will not permit the ingredients to separate. Surfaces shall be smooth and free

from voids caused by stone pickets, where necessary vibration shall be supplemented by hand spading to secure these results.

c) Number and size of vibrators:

Vibrators shall be of sturdy construction, adequately powered. The vibration shall be sufficiently tense to cause the concrete to flow or settle readily into place and visibly affect the concrete over a radius of at least 450 mm. (18") when used in concrete having slump of one inch. A sufficient number of vibrators (at least one vibrator for a rate of concreting of 1.5 cum. (50 cft.) per hour shall be employed so that at the required rate of placement, vibration throughout the entire volume of each layer of concrete and complete compaction are secured.

d) Manipulation of vibrators:

Internal vibrators shall be kept constantly moving in the concrete and shall be applied at points uniformly placed not further apart than the radius over which the vibrator is visibly effective. The vibrator shall not be held in one location long enough to draw a pool of grout from surrounding concrete. The vibration shall be such that the concrete become uniformly plastic and there shall be at least 200 seconds of vibration per square metre (20 second of vibration per Sq.ft.) of surface of each layers of concrete, computed on the basis of visibly affected radius and taking overlap into consideration.

3.H a) Grade of concrete:

The concrete shall be of grades designated as M-15, M-20, M-25, M-30 of cube crushing strengths as specified in I.S. Code 456 of latest edition.

Note : The designation of concrete mix: Letter M refers to the mix and the number to the characteristic compressive strength of 15 cm. cube of 28 days, expressed in N/sq.mm.

b) i) Ordinary concrete:

Concrete made without preliminary tests but by adopting volumetric concrete mix, shall be called "ORDINARY CONCRETE" unless otherwise mentioned in the bill of quantities all R.C. concrete shall be ordinary concrete as per Table 3 I.S. 456 of latest edition.

ii) Nominal volumetric mixes:

If in the bill of quantities concrete is specified in volumetric proportions such as 1:4:8, 1:3:6, 1:2:4, 1:1-1/2:3, 1:1:2 etc. it shall be taken to mean that the proportions by volume of cement; sand and coarse aggregate shall be in the order in which the mix is specified.

Minimum cement content for different volumetric mix of concrete are as under:

Cement: Fine Aggregate: Course Stone Aggregate

| | | Minimum cement content Kg./Cum. |
|---|---|---|
| 1:1-1/2:3 | - | 412 |
| 1:2:4 | - | 317 |
| 1:3:6 | - | 235 |
| 1:4:8 | - | 180 |

c) Strength requirements of concrete:

Where ordinary Portland cement is used, the compressive strength requirements for various grades of concrete shall be as given in Table 2 of I.S. 456 of latest edition. It shall be the contractor's responsibility to obtain specified strengths for the various grades of concrete. Where rapid hardening Portland cement is used, 28 days compressive strength requirements specified shall be met at 7 days.

d) Design Mix Concrete

Concrete made with preliminary tests by designing concrete mix in a laboratory shall be called "DESIGN MIX CONCRETE" and shall be designated as M-20, M-25, M-30 and M-35.

i) Concrete mix for various grades of Design Mix Concrete

Concrete mixes shall be designed for various grades of concrete (M-20, M-25, M-30 and M-35) by the contractor to achieve the respective strength, durability and workability necessary for the job by the most economical use of various ingredients. The design should be made conforming to the relevant IS specifications (IS-456, 516 of latest edition) in respect of proportioning of fine aggregate to coarse aggregate, maximum quantity of dry aggregates and water cement raio, the minimum cement content as mentioned in the Schedule of Quantities. The contractor will arrange for the testing of various trial mixes of sufficient number (as per direction of the Employer / Consultants) at his own cost in laboratory approved by the Employer / Consultants for the preliminary test for different grades of concrete. The Employer / Consultants will adopt the concrete mixes for the respective concrete grades from the test results of the said trial mixes, conducted and certified by the approved laboratory and the

contractor will accordingly proceed with the concreting at work site. Constant check on grading and mix proportion shall be done by the contractor who will always be responsible to produce quality concrete of required grades as per the acceptance criteria of IS 456 of latest edition. If there is any change in the quality of aggregates (both coarse and fine), necessary alteration to the mix proportion should further be approved by the Employer / Consultants before the same are used at work site.

The Consultants 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 of aggregate or other reason.

3.I Classification of concrete of lower or higher strength than specified:

Where the strength of concrete mix (for ordinary concrete or design mix concrete) as indicated by tests, lies in between the strengths of any of two grades, such concrete shall be classified as a grade belonging to the lower of
the two grades between which its strength lies. In case the cube tests strength show higher strengths than those specified for the particular grade, the concrete shall not be placed in any higher grade nor shall contractor as entitled for any extra payment on such account.

3.J Watertight Concrete

Concrete in all underground works such as water tanks and the like where concrete of mix 1:1-1/2:3 grades or richer is specified, will be considered as water-tight concrete even if not specifically mentioned in the Schedule of Quantities. In respect of such concrete it shall be contractor's responsibility to ensure that the resulting construction is watertight, failing which, the contractor shall carry out at his own cost, all necessary remedial measures as per direction of Employer / Consultants.

J.1 Sample size and acceptance criteria

All tests shall be carried out in accordance with I.S. 516 of latest edition. The criteria for acceptance of a concrete of a specific grade shall be in accordance with recommendation of IS-456 of latest edition.

J.2 Waterproof of concrete

Excepting internal R.C. columns and R.C. walls all structural concrete of retaining walls, Ramp wall and slab, water tanks and underground tanks shall be cast with admixture of waterproofing compound as advised by the specialist waterproof agency. The waterproofing compound for the purpose shall be of approved manufacturers and shall be mixed as per manufacturer's specification. The resulting concrete shall be perfectly waterproof. The work of waterproofing concrete by the admixture of waterproofing compound shall be done under direct supervision of a senior representative of the approved manufacturers. The contractor shall give a guarantee for

5 YEARS non judicial stamp paper of appropriate value as per the proforma enclosed against water leakage through the resulting concrete work and shall rectify all defects during the guarantee period without any extra charges. The waterproofing compound for this purpose shall be paid in a separate item if not otherwise mentioned in the Schedule of Quantities. Full payment against this item of work shall be made after testing and satisfactory result and submission of guarantee at an approved Proforma.

3.K Form Work:

K.1 Materials and Design:

a) The form work shall be of approved dressed timber of not less than 3.5 cms. Thick except where otherwise stated. As an alternative sufficiently rigid steel/ply board shuttering of approved design may be used. Joints of the shuttering must not allow loss of liquid from concrete. In timber shuttering the joints shall therefore be either tongued or grooved or the joints must be perfectly closed and lined with craft paper or other types sof approved materials. In case of steel shuttering also the joints are to be similarly lined. If any particular material or materials be specified in the Schedule of Quantities for formwork such particularly specified material or materials shall be used in work. The formwork shall be constructed as to remain sufficiently rigid during placing of the concrete. All shuttering and framing must be adequately stayed and braced to the satisfaction of the Employer/Consultants for properly supporting the concrete during the period of hardening. The forms shall be sufficient strength and rigidity to hold concrete and withstand the pressure of ramming and vibration without deflection from the prescribed lines and levels. The surface of all forms in contact with concrete shall be clean, rigid, watertight and smooth. Suitable devices hall be used to hold corners, adjacent ends and edges of panels of other forms together in accurate alignment.

b) The form work shall conform to the shape, lines and dimensions to suit the R.C.C. members as shown on drawing. Form work shall be adequately designed to support the full weight of workers, fresh placed concrete without yielding to settlement or deflection and to ensure good and true aligned concrete finish in accordance with the construction drawings. A camber in all direction of 6 mm. for every 5 metre span in all slab and beam centering shall be given to allow for unavoidable sagging due to compression or other causes.

c) The for work shall be so designed that the sides of the beams shall be first struck leaving the soffit of beams and supporting props in position. Props shall be designed to allow accurate adjustment and to permit of their being struck without jarring the concrete.

d) Temporary openings shall be provided at the base of columns forms and at other points where necessary for facilities of cleaning and observations immediately before concrete is deposited.

e) Vertical shuttering:

The vertical shuttering shall be carried down to such solid surface as is sufficiently strong to afford adequate support and shall remain in position until the newly constructed work is able to support itself. Props shall be securely braced against lateral deflection. Steel props of approved quality shall be used. In case timber props and bullies are allowed to use these shall be of minimum 10 cm. diameter and shall be straight and adequately strong. Bamboo props shall not be used. The spacing of such struts shall be designed to carry loads imposed on it without undue deflection of the members supported by the props and shall be approved by the Employer/Consultants.

Any alterations suggested by them shall be carried out at contractor's expenses. Bracing shall be provided as directed without extra cost. The contractor shall allow in his rates for providing props and struts for any height shown in the working drawings issued to the contractor from time to time.

K.2 Water tightness:

The contractor shall ensure that the forms are checked for water tightness just before concreting operation starts and shall make good any deficiencies. If instructed by the Employer/Consultants building paper or any other approved materials will have to be used without any extra charge for the same.

K.3 Cleaning and treatment of forms:

All rubbish, particularly wood chippings, shavings and saw dust, shall be removed from the interior of the forms before the concrete is placed and the form work in contact with the concrete shall be cleaned and thoroughly wetted or treated with an approved composition. Care shall be taken that such approved composition is kept out of contact with the reinforcements. Interior of all moulds and boxes must be thoroughly washed out with hose pipe or otherwise so as to be perfectly cleaned and free from all extraneous matter before deposition of concrete. Prior approval of the form work should be taken from Consultants before placing reinforcement on the form work.

K.4 Stripping:

Form shall be left in place until their removal is authorised by the Employer/Consultants and shall then be removed with care so as to avoid injury to concrete. Under no circumstances shall form be struck until the concrete reaches strength of at least twice the stress to which the concrete may be subjected at the time of striking. The strength referred to shall be that of concrete using the same cement and aggregate with the same proportion, and cured under

conditions of temperature and moisture similar to these existing on the work. Where possible, the form work should be left longer as it would assist the curing.

K.5 Stripping time:

In normal circumstances (generally where temperatures are above 20 degree C and where ordinary cement is used) forms shall be struck after expiry of the following periods unless otherwise directed at site by the Employer/Consultants.

| LOCATION | Striking time in days Ordinary Portland Cement | Pozzalane Cement. |
|---|---|---|
| a) Vertical sides of walls slabs, beams and columns. | 2 | 4 |
| b) Bottom of slabs upto 4.5 M. span. | 7 | 14 |
| c) Bottom of slabs above 4.5 M. span Bottoms of beams upto 6.0 M. span. | 14 | 21 |
| d) Bottoms of beams over 6 M. span & arch rib bottoms above 6 M. span. | 21 | 30 |
| For rapid hardening cement, 3/7 of the above periods will be sufficient in all cases except vertical sides of walls, slabs, beams and columns which should be retained for a minimum period of 24 hours. | | |

K.6 Formwork in Lifts for continuous surface:

Where forms for continuous surface are placed in successive units, (as for example in columns or walls) the forms shall fit tightly over the completed surface so as to prevent leakage of mortar from the concrete and to maintain accurate alignment of the surface.

K.7 Procedure while removing the formwork:

All formwork shall be removed without such shock or vibration as would damage the reinforced concrete. Before the soffit and struts are removed the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened. Proper precautions shall be taken to allow for the decrease in the rate of hardening that occurs with all cement in the cold weather.

K.8 Tolerance:

The following shall be the maximum permissible tolerance.

a) In general, setting out dimension upto 4 M. in length a tolerance upto 3 mm. will be allowed.

b) On lengths of more than 4 M. tolerance of not more than 5 5 mm. will be allowed.

c) On the cross sectional dimensions of columns, beams, slabs, facias, chajja, mullions, fins, louvers, and such other members, tolerance of more than 3 mm. will not be allowed.

d) The top surface of concrete floor slab will be within 6 mm. of the level and line shown on the drawings.

e) Columns and walls and other vertical members shall not be more than 3 mm. out of plumb in their storey height and not more than 6 mm. out of plumb in their full height.

f) If work is not carried out within the tolerance set out above in (a) to (e), the cost of all rectification measures of dismantling and reconstructing as decided by the Employer/Consultants shall be borne by the contractor. In case of work dismantled the same not to be measured and paid for.

3.L Defective or poor concrete – Procedure for dealing with

L.1 General:

If in the Employer/Consultants opinion there is doubt as to the strength of the structure due to the works test cube failing to attain specified strength due to poor workmanship like honeycombing etc. or any reason attributable to negligence on the part of the contractor then the Employer's/Consultant's decision regarding dismantling, of such concrete or rectification if concrete is allowed to be retained in its place shall be final and binding on the contractor.

L.2 Where concrete in structure is allowed to be retained:

In the case of concrete showing the result of the tests strength less than those specified, the quantities in cubic metre certified by the Employer/Consultants as so deficit may be allowed to remain in such a case subject to deduction for such

sums as are or may become due under the contract not exceeding Rs. 50.00 per cum of the quantity so certified in case where deficiency does not exceed five percent and Rs.100.00 per cum of the said quantity where the deficiency exceeds five percent. The Employer/Consultants shall have full power in their absolute discretion to fix the actual rate of deduction subject only to that the rate so fixed shall not exceed the maximum as provided above.

L.3 Concrete ordered to be dismantled:

If the deficiency exceeds standard Deviations arrived as per IS 456 of latest edition, the Employer/Consultants may at their discretion direct the portion of concrete certified by them so as deficient in strength to be dismantled from the structure and replaced by concrete of specified strength and the contractor shall in that case have to carry out that direction at his own cost irrespective of the amount of loss, inconvenience and difficulties involved. Concrete thus dismantled will not be measured and paid for.

L.4 Concrete retained with rectification:

Where the Employer/Consultants consider that defective concrete be strengthened, the contractor shall carry out all rectification work as per direction of Employer/Consultants at contractor's expense. The concrete of lower strength thus accepted shall, however, be paid for concrete as mentioned above after necessary strengthening.

L.5 Quality of defective concrete represented by cubes:

In all cases of defective concrete as revealed by work test cubes strength falling below the specified strength, the quantity of concrete thus affected and represented by the cubes will be decided by the Employer/Consultants whose decision shall be final and binding on the contractor.

L.6 Honeycombing:

a) Where honeycombed surface are noticed in the concrete, the contractor shall not patch up the same until examined by the Employer/Consultants and decision given regarding the acceptance with rectification or rejection of the same. If the contractor patches up such defects without the knowledge of the Employer/Consultants, the Employer/Consultants will be at liberty to order demolition of the concerned concrete members to the extent they consider necessary. In such case, the contractor at his expense, shall demolish and reconstruct defective work. The demolished work shall not be measured and paid for.

b) If in the opinion of the Employer/Consultants the honeycombing if harmful to the structure and where so directed by the Employer/Consultants the full structural members affected by honeycombing as decided by the Employer/Consultants shall be

dismantled and reconstructed to Employer's/Consultants' approval at the contractor's expense. The demolished will not be measured and paid for.

c) Where in the opinion of the Employer/Consultants the Structural members containing honeycombing can be allowed to be retained with rectification, the rectification shall be carried out as directed by the Employer/Consultants by gunitting (with cement mortar 1:3 proportion) the areas concerned at the contractor's expense.

d) If such honeycombed areas are not severe in the opinion of the Employer/Consultants and where so directed shall be patched up with cement mortar consisting of 1 part of cement and 3 parts of sand after removing defective concrete up to sound concrete surface to the satisfaction of Employer/Consultants all at the expense of the contractor.

L.7 Load Testing

The Employer / Consultants reserve the right to reject proposal of any load testing on structure and proceed to deal with defective concrete as stated in the paragraph. However, purely at their discretion, they may instruct the contractor to make a loading test on the work part thereof. The nature of the test and the loading shall be left to the discretion of the Employer / Consultants. The contractor shall bear the cost of the test and the cost of dismantling and reconstruction or concreting the defects by rectification in accordance with their instructions. Where such structure is allowed to remain in the work the concrete shall be accepted as belonging to the next lower grade and payment shall be made accordingly to the contractor.

L.8 Other defects:

Any other defects in concrete shall be made good as directed by the Employer/Consultants at the contractor's expenses.

3.M Contractor's Rates to include

The rates of the contractor for the providing and laying cement concrete in various grade or proportion in the Schedule of Quantities shall, apart from any other factors specified elsewhere in the tender documents, include for the following:

a) For all factors and method of work described in this specification and relevant Indian Standards.

b) For all materials, labours, tools and plants, scaffolding, staging etc. mixing conveying and placing concrete in position, ramming, vibrating, trowelling, curing and removing the scaffolding after the work is complete.

c) Unless otherwise specified in the Schedule of Quantities the cost for concrete items shall include for providing, stays, struts, bolts, nuts and every item necessary to keep the forms rigid, smoothing the surface to receive concrete as per detailed drawing, striking and stripping form work after the concrete is cured or as specified, hacking the concrete surfaces required to receive plaster etc. Where shuttering is described as a separate item in the schedule of quantities, rate for shuttering shall be inclusive of all the works mentioned in this para apart from other factors mentioned in specification for form work and also elsewhere in this contract. Shuttering to curve structure will be measured and paid as detailed in Schedule of Quantities.

d) The reinforcement in case of reinforced concrete work will be paid for separately unless otherwise stated in the particular items, but rate shall include for pouring concrete and packing around reinforcement.

e) The measurement of concrete will be as per detailed drawing, shapes and size based on net structural sizes as per drawing i.e. exclusive of plaster.

f) Rate for concrete items shall cover for any shape of structural members like columns, beams, facia, fins, louvers etc. and for cantilever beams, slabs, etc. including curve structures.

g) Formation and treatment of construction joints, and expansion joints where water bars of approved materials or joint fillers like "Shalitex" are specified such materials shall be paid as per separate rates.

h) Design of mixes, if required by specification, testing in an approved laboratory, tests of materials and work required in the opinion of the Consultant and described in these specification.

i) Fixing all inserts like pipe, plugs, forming holes etc. as described.

j) Weigh-batching using a Mechanical Weigh Batcher of a batching plant or where so specified for volumetric batching.

k) For taking out dowel bars, fan hooks, etc. through shuttering.

l) For forming drip moulds in chajja, sills etc. as shown in the drawing or as described.

m) For work at all levels.

n) In cases where at the junctions of beams, column and slab the composition of concrete mix of specified strength be different for columns, beams and slab then in such cases only the richer concrete among those specified for in all these members shall be used at the junctions and rate quoted for columns, beams and

slabs or wny members entering such junctions shall allow for the same. Rate shall also cover for spill over of rich concrete in beams to natural angle of repose of wet concrete required from practical consideration while concreting the junctions.

3.N Steel Reinforcement:

N.1 Mild Steel Bars:

Mild steel reinforcement bars shall conform in I.S. 226 of latest addition "Standard Quantity" or I.S. 432 of latest edition "Grade I". Other qualities of steel shall not be acceptance.

N.2 High strength deformed bars

Where high strength deformed steel bars and wires are specified, the material shall be as manufactured by M/s. SAIL, M/s. Tata Steel, M/s. Vizac Steel (VSP) conforming to IS 1786 of latest edition accompanied by a certificate from manufacturer.

Test: Necessary tests on steel reinforcements bars and wires shall be carried out by the contractor as per instruction of Employer/Consultants at an interval mentioned in this contract at no extra cost.

N.3 Cleaning of Reinforcement:

Before steel reinforcement is placed in position, the surface of the reinforcement shall be cleaned of rust, dust, grease and any other objectionable substances.

N.4 Bar Bending Schedule of Reinforcement:

On receipt of structural drawing, contractor shall prepare bar bending schedule of reinforcement and shall obtain approval of the Employer/Consultants.

N.5 Cutting of Reinforcement:

Before steel reinforcement bars are cut, the contractor shall study the lengths of bars required as per drawing and shall carry out cutting only to suit the sizes required as per drawing.

N.6 Placing and Security:

Reinforcement bars shall be accurately placed and secured in position and firmly supported or wedged by precast concrete blocks of suitable thickness at sufficiently close intervals so that they will not sag between the supports or get displaced during the placing of concrete or any other operation of the work. Contractor shall maintain reinforcement in its correct position without displacement and correct specified cover. The contractor shall be responsible for

all costs for rectification required in case the bars are displaced out of their correct position.

N.7 Binding Wire:

The reinforcement shall be securely bound wherever bars cross or whenever required for with 20 gauge soft black annealed steel wire.

N.8 Welding

Welding of bars shall not be carried out unless specifically authorised in writing by Employer/Consultants as per I.S. Code of Practice in place of splicing. However, no extra payment shall be allowed for the same.

N.9 Bends etc.

Bends, cranks, etc. in steel reinforcement shall be carefully formed, care being taken to keep bends out of winding. Otherwise all rods shall be truly straight. If any bend shows signs of cracking the rod shall be removed immediately from the site. Minimum radius of 9 times diameter of the bar shall be used unless otherwise specified in the drawings. However, in respect of standard hools the radius of bend shall be 2 times the diameter of bar. Heating of reinforcement of bars to facilitate bending will not be permitted. The bars shall always be bent cold. In case of mild steel reinforcement bars of larger sizes where cold bending is not possible they may be bend by heating with written permission of the Employer/Consultants. Bars when bent shall not be heated beyond cherry red colour and after bending shall be allowed to cool slowly without quenching. The bars damaged or weakened in any way in bending shall not be used on the work. High strength deformed bars shall in no case be heated to facilitate bending or cranking.

N.10 Inspection of Reinforcement:

No concreting shall commence until the Employer/Consultants have inspected the reinforcement in position and until their approval have been obtained. A notice of at least 72 hours shall be given to the Employer/Consultants by the contractor for inspection of reinforcement. If in the opinion of the Employer/Consultants any materials are not in accordance with the specification or the reinforcement is incorrectly spaced, bent or otherwise defective, the contractor shall immediately remove such materials from the site and replace with new and rectify any other defects in accordance with the instruction of the Employer/Consultants and to their entire satisfaction.

N.11 Nett Measurement:

Reinforcement shall be placed as shown on the structural drawings and payment will be made on the nett measurements from drawings. Only such laps, dowels, chairs and pins in reinforcement as approved by the Employer/Archites or shown

on drawings shall be paid for. The contractor shall allow in his quoted rates for all wastage which will not be paid separately.

N.12 Stock piling of Steel

Steel required shall be stock piled well in advance of need in the work. Contractor shall stock pile 1/3 requirement within 15 days, 2/3rd required at ¼ contract time and full requirement at ½ contract time or to suit the accepted work programme.

N.13 Cover for Reinforcement:

Cover shall be measured from the outer surface of main reinforcement. Cover shall be as follows if not specified/shown in construction drawings.

a) At each end of a reinforcing bar, 25 mm. or twice the diameter of such rod or bar, whichever is greater.

b) For longitudinal reinforcing bar in beams 25 mm. or the diameter of such rod or bar, whichever is greater.

c) For tensile, compressive shear or other reinforcement in a slab 15 mm. or the diameter of such reinforcement whichever is greater.

d) For reinforcement in any other member such as a lintel, chajja, canopy or pardi, 15 mm. or the diameters of such reinforcements, whichever is greater.

e) For main reinforcement in isolated footings (side and bottom) clear cover shall be 50 mm.

f) For column bars clear cover shall be 40 mm. unless otherwise specified as in drawing. In case of columns of minimum dimensions of 200 mm. or under, whose reinforcing bars do not exceed 12 mm. minimum cover of 25 mm. should be provided.

g) For bars in slabs of strip footings and mat foundations the clear cover shall be 50 mm. Beam bars shall be placed over slab bars in respect of beam and slab type foundations.

N.14 Rates quoted for reinforcement in addition to any factors mentioned elsewhere shall also include for

a) All cutting to length, labour in bending and cranking, forming hooked ends, handling, hoisting and everything necessary to fix reinforcement in work as per drawing.

b) Decoiling, straightening (coiled bars, bent bars to facilitate transporting).

c) Cost of binding work required as described.

d) Cost of precast concrete cover blocks to maintain cover and holding reinforcement in position.

e) For fabricating and fitting reinforcement in any structural member irrespective of its location, dimensions and level.

f) Removal of rust and every other undesirable substances, using wire brush etc. as described.

g) Work at all levels.

h) Rolling tolerance and wastage.

i) Stock piling of reinforcements as described.

3.O Damp proof course:

Damp proof course shall be 40 mm./25 mm. thick (as specified in the Schedule of Quantities) artificial stone 1:1-1/2:3 (1 part cement 1-1/2 parts sand and 3 parts stone chips of 6 mm graded down). Approved waterproofing compound of proportion as specified by manufacturer should be mixed with the concrete during mixing, as per manufacturer's specification. Before laying the concrete on the wall, the top surface shall be thoroughly cleaned of dirt, loose particles cake mortar dropping and latiance, if any kind by scrubbing with coir or steel wire brush or by hacking if necessary. The surface shall be moistened before laying the concrete. The concrete should be laid in every case over the full width of the superstructure walls or as shown in the drawing. The top surface shall be finished with double chequered marks for adhesion of mortar for brick work. Proper curing should be done before starting the brick work over the damp proof course.

If any particular materials or any other treatments be specified in the schedule of quantities for damp proof course such particular materials or specifications shall be followed.

4.0 Precast concrete works and precast R.C.C. Jalli

4.A Precast Concrete Work

4.1 The design/details of the precast units as shown in the drawings will be normally adhered to. However, for changes in respect of size of units, method of jointing decided during the progress of work by the Employer/Consultants, the contract

will not be entitled to any extra over the rate quoted for such items of work. The contract should quote rate to include this into account while submitting tender.

4.2 The rates to be affixed to the items of manufacturing and supplying precast concrete works shall include all labours and materials (reinforcements measured separately, unless otherwise mentioned in Schedule of Quantities) including the entire cost of supplying, fixing and removing moulds and/or form work, approved finish to ace, drawing and direction of the Employer / Consultants.

4.3 Samples of precast unit should be submitted for inspection and approval of the Employer / Consultants as regard texture, colour and quality.

4.4 Unless otherwise mentioned in Schedule of Quantities the proportion for precast concrete works shall be 1:2:4 (1 cement, 2 coarse sand, 4 aggregate).

4.5 Water cement ratio for this class of concrete work should not exceed 0.5.

4.6 Form shall be composed of high quality timber of approved variety consisting mainly of two basic units-mould and perimeter frame as per drawing. Mould units are to be assembled with nail.

4.7 Where required, joints of precast units are to be grouted with sand cement (2:1) mortar with admixture of approved waterproofing compound as per manufacturer's specification.

4.8 Curing of concrete units should be as prolonged as possible (not less than 21 days) but they should be allowed to dry before fixing for as long a period as possible and should never be fixed in a green or wet condition.

4.9 During installation of the precast unit in position special care should be taken to avoid the possible damge to the units and danger to workmen. Any loss, damage or injury caused to the units or workmen due to carelessness will be the contractor's responsibility and if ordered by the Employer / Consultants the damaged units are to be replaced by new units which are absolutely at the risk and cost of the contractor.

4.10 The rates of the contractor for the same unless otherwise mentioned in Schedule of Quantities shall be inclusive of supplying and casting of the concrete blocks of specified thickness, necessary form work as specified in drawings, installation of the units in position with light crane, fixing the units to adjacent units (precast or cast in situ) and supporting frame work as shown in drawing, finally to have the cement rendering or 6 mm. thick cement plastering with all other ancillary and contingent works which may arise to have the work finished as per drawing and to the satisfaction of the Employer / Consultants.

4.B <u>Precast R.C.C. Jalli</u>

Specification same as 'Precast Concrete Work'.

5.0 Brick works:

5.1 Bricks:

a) The bricks shall be locally available kiln burnt bricks of generally regular and uniform size, shape and colour, uniformly well burn but not over burnt. The bricks shall be free from cracks, chips, flaws, stones or lumps of any kind and the rating of efflorescence shall not be more than "moderate", when treated as per I.S. 3495 of latest edition. They shall not have any part unburnt. They shall not break even after being dropped on the ground on their flat face in a standard condition from a height of 60 cms.

b) The size of brick shall normally 250 mm. x 125 m. x 75 mm. or 230 mm. x 115 mm. x 65 mm. Bricks of one standard size shall be used on one work unless specially permitted by the Employer/Consultants.

c) After immersion in water, absorption by weight shall not be exceed 20% of dry weight of the brick when tested according to I.S. 1077 of latest edition. Unless otherwise specified the load to crush the brick when stested according to IS 1077 of latest edition shall not be less than 75 Kg./Sq.cm.

d) Prior approval of Employer/Consultants shall be obtained for the brands of bricks to be used in the work after compliance with the above specifications/tests.

5.2 Mortar

Unless otherwise specified, mortar for brick work shall be composed of 1 part of cement to 6 parts of approved sand for walls of one brick thick (25 cm.) and over and one part of cement to 4 parts of approved sand for half brick thick and brick on edge walls.

5.3 Construction details:

a) Soaking:

All brick shall be immersed in water for 24 hours before being put into work so that they will be saturated and will not absorb water from the mortar.

b) Bats:

No bats or cut bricks shall be used in the work unless absolutely necessary around irregular openings or for adjusting the dimensions of different

course and for closures, in which case, full bricks shall be laid at corners, the bats being placed on the middle of the courses.

c) Laying:

The bricks shall be laid in mortar to line, level and shapes shown on the plan, slightly pressed and thoroughly bedded in mortar and all joints shall be properly flushed and packed with mortar so that they will be completely filled with mortar and no hollows left anywhere. Bricks shall be handled carefully so as not to damage their edges. They should not also be thrown from any height to the ground but should be put down gently. All courses shall be laid truly horizontal and all vertical joints made truly vertical. Vertical joints on one course and the next below should not come over one another and shall not normally be nearer than quarter of a brick length. For battered faces beading shall be at right angles to the face. Fixtures, plugs, frames etc. if any, shall be built in at place shown in the plans while laying the courses only and not later by removal of bricks already laid. The top layer of bricks of one or more thick wall coming in contact with R.C.C. beam, slab and at window sill level etc. shall be laid on edge as per direction.

Care shall be taken during construction to see that edges of bricks at quoins, sills, head etc. are not damaged.

The verticality of the walls and horizontally of the courses shall be checked very often with plumb bot and spirit level respectively.

All external wall should have fair face on exterior surface.

d) Bond:

Unless otherwise specified, brick work shall be done in English Bond. All walls, coming in contact with reinforced concrete columns, beams etc. should be properly bonded by inserting reinforcements. Extra labour shall be included in the rates (reinforcements will be measured and paid separately) against reinforcement item provided in the Schedule of Quantities.

e) Joints:

Joints shall not exceed 10 mm. (about 3/8") in thickness and this thickness shall be uniform throughout. The joints shall be raked out not less than 10 mm. (about 3/18") deep when the mortar is green where pointing is to be done. When the brick surface are to be plastered, the joints shall be raked to a depth of 5 mm. when the mortar is green, so as to provide good key to plaster.

f) Uniform Raising:

Brick work shall be carried up regularly in all cases where the nature of work will admit, not leaving any part 60 mm. lower than another. But where building at different levels is necessary, the bricks shall be stepped so as to give later at uniform level and effective bond. Horizontal courses should be to line and level, and face plumb or to later as shown on the plan. The rate of laying masonry may be upto a height of 80 cm. (about 32") per day if cement mortar is used, and 45 cm. (about 8") if lime mortar is used.

5.4 Scaffolding:

The scaffolding must be of approved type strong and rigid stiffened with necessary cross bearers and safe to prevent injury to persons or materials. The contractor shall have to allow other trades to make reasonable use of his scaffolding as directed by the Employer/Consultants. If for the interest of work the contractor have to erect scaffolding in the other properties including local bodies or Corporation, the arrangement for the same including the cost of licensing fees etc. shall have to be borne by the contractor and the Employer should be kept free from any liability on this account.

Put log holes shall be made good by bricks to match the face work when put logs are removed after ensuring that the holes behind are solidly filled in with 1:4:8 cement concrete.

5.5 Curing:

All brick works shall be kept well watered for 14 days after laying. While pozzalana cement is used for mortar the curing shall be extended by one week at contractor's expense.

5.6 Exposed brick work

Where exposed brick work is specified the usual specification for 'Brick Work' as mentioned above will be applicable for 'Exposed Brick Work', but in addition specially selected brick shall be used for facing, ensuring regular and clean faces of uniform colour. No bricks which are broken chipped, wrinkled or which have irregular edges or corners shall be used. Depending on the quality of bricks and if instructed by the Employer / Consultants the exposed faces of every bricks shall be rubbed before laying without extra charge. Wooden fillets 10 mm. thick and 10 mm. wide shall be placed at the edge of joints so that the mortar comes on the surface of the bricks and a regular thickness of joints is maintained. The surface shall be rubbed down with brush on bricks if necessary, and thoroughly washed. No mortar shall be allowed to stick to the surface, which shall be left clean to the

Employer's / Consultant's satisfactions will all joints even and true to straight line. Double scaffolding shall be used for exposed brick work, if necessary.

5.7 Half brick/brick on edge work:

Half brick thick and brick on edge walls, shall be provided H.B. wire netting of approved quality of reinforcements. For half brick thick wall and brick on edge wall H.B. netting reinforcements of approved quality shall be provided at every third course and in alternate course respectively according to standard practice.

5.8 Rates to include:

Apart from other factors mentioned elsewhere in this contract, the rates for items of brick work shall include for the following:

a) All labour, materials, use of tools, equipment and other items incidental to the satisfactory completion of brick masonry of all heights and levels.

b) Erecting and removing of all scaffolding, ladders and plant required for the execution of the work to the height and depth and shapes as shown on the plan or as ordered by the Employer/Consultants including extra labour and materials for using cut bricks in the construction of wall of varying thickness other than one brick, one and half brick, half brick and brick on edge walls as per drawings.

c) Constructing brick work to lines, levels, batters, pillars, curve, projection, cutting, tooting etc. in strict conformity with the drawings and to any position or shape, to any heights or levels including raking out joints and housing frames, fixtures etc.

d) Necessary charges of outside scaffolding work for construction of external brickwork from outside to have fair face on external surface.

e) Curing brick work.

f) Extra labour for bonding brick work to R.C. works as specified.

g) Removing of all stains and adhering mortar lumps on the brick work surface.

h) Cost of reinforcement in half brick walls and brick on edge walls.

i) Raking out joints for receiving plaster as specified.

5.9 Measurements:

a) Half brick thick and brick on edge walls shall be measured in sq.m. unless otherwise mentioned.

b) One brick wall and thicker walls shall be measured in cum. Brick walls upto and including 3 bricks in thickness should be measured in multiples of half bricks which shall be deemed to be inclusive of mortar joints. Widths of more than three bricks in walls will be measured actually and limited to the width specified.

c) No deduction or addition shall be made on any account for :-

i) End of dissimilar materials (i.e. joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels steps etc.) upto 0.1 Sqm. in section.

d) For details of measurements not mentioned elsewhere in the contract, the method of measurement should be as per relevant I.S. Code.

5.10 Brick flat soling:

For soling the bricks shall be of approved, quality and round, hard, tough, durable, dense, clean, free from soft spots, cracks decay and other defects. Brick bats shall not be used. All the fillings shall be watered and compacted to get maximum consolidation. All necessary trimming or filling for laying of the soling in line and required grade shall be done.

The sub-grade shall be marked by stacks and strings for required depth for laying of soling. In line and required grade shall be done.

The bricks shall be laid on flat (unless otherwise specified) touching each other. Brick shall be laid in parallel rows breaking bond or in herring bone pattern as directed and firmly embedded true to line and filled with local sand. Measurement shall be in sqm.

6.0 Floor finishing works

6.A Artificial stone flooring, dado and skirting

a) Preparation of subgrade

The surface of the structural slab shall be struck of reasonably true and at a level average 40 mm. below the level of finished floor. All water, laitance or dirt on the surface of the structural slab shall be removed before the base course is laid. The slope required should be provided in the concrete of the structural slab to obtain uniform thickness of artificial stone towards the predetermined positions of outlets.

b) Base Course

The mix for the base of the artificial stone shall be 1 part of Portland cement, 2 parts of fine aggregate and 4 parts of coarse aggregate by volume. The stone chips for the base course should be 6 mm. and down and should be properly screened and washed before use. Not more than 27.1/2 litres (5.1/2 gallons) of mixing water including the moisture in the aggregate shall be used for each bag of Portland cement in the mixture. The concrete shall be of the driest consistency possible to work with a sawing motion of the strike off board or straight edge. Changes in consistency shall be obtained by adjusting the proportions of aggregate and cement. In no case, shall be the specified amount of water exceeded.

c) Sectors

Artificial stone flooring shall be laid in sections not exceeding 1.5 sqm. With a maximum length of 1.5 M as directed. Flooring of the panels laying diagonally shall be completed first. The edges of the panels to be concreted shall be bounded by about 50 mm. wide oiled wooden battens of the finished floor thickness. Immediately before the placing of the concrete the sub-base will be given a coat of neat cement grouting.

d) Top Layer

After striking off the base course to the required slope, it shall be compacted with a wood flat. The surface shall be tested with a straight edge to direct high and low spots which shall be eliminated, before the concrete of the base course has hardened, the topping shall then be floated with a wooden float to render the surface even. After the surface is slightly hardened it shall be trowelled three times at intervals, so as to produce a uniform and hard surface. Excessive trowelling in the earlier stage shall be avoided. Trowelling of rich mix of dry cement and fine aggregate on to the surface shall not be permitted.

The whole thing left undisturbed for 10 to 13 hours. After this period the whole floor should be left flooded with water for a minimum period of 14 days.

e) When working on alternate bay principle of the ponding of flooring should be deferred till the whole floor is complete. But the portions already completed should be occasionally damped with water by moist sand till the whole floor is complete. After this the whole floor will be flooded with water. For coloured finishes a suitable colour mixture shall be added to top cement finishing coat. The quality of colouring matter to be added to cement should be in the proportion of one part of pigment to three parts of Portland cement mixed thoroughly and screened before

making to paste. The pigment shall be of approved manufacturer and tints shall be uniform. Any cracks, rust, disfiguration of discolouring of surfaces shall have to be made good without any extra charges to the satisfaction of the Employer / Consultants.

f) Rates to include

Apart from other factors mentioned elsewhere in this contract the rate quoted for 'Artificial stone flooring' shall include for the following :

i) All labour, materials and equipment, cleaning the sub-grade, laying base course and top layer to have finished 40 mm. thick flooring as per above specifications.

ii) Curing.

iii) Cleaning the floor from all stains etc.

Mode of Measurement

The measurement shall be square metre for the actual flooring provided.

6A.2 Artificial stone dado and skirting

The specification for materials and workmanship will be same as that of artificial stone flooring except that the finished thickness of dado and skirting will be 20 mm. The thickness of base course and top layer to be adjusted, accordingly to have a finished thickness of 20 mm. after polishing. The rate quoted for the same shall include for all the stages as mentioned in case of flooring except that the finished thickness will be 20 mm. Dado and Skirting shall be in square metre. The measuring of skirting or dado shall be on the basis of wall length of area in contact with skirting and the dado respectively.

6.B Cast in Situ Granolithic concrete floor topping with hardener

a) Metallic Hardening Compound

The compound shall be of approved quality consisting of uniformly graded iron particles, free from non-ferrous metal particles, oil, grease, sand, soluble alkaline compound

b) The surface of the structural slab shall be struck of reasonably and at a level average 40 mm. or otherwise required to suit the thickness of floor finish as mentioned in the Schedule of Quantities below the level of finished floor. All water, laitence or dirt on the surface of the structural slab shall be removed before the base course is laid. The slope required should be

provided in the concrete of the structural slab to obtain uniform thickness of concrete floor towards the predetermined positions of outlets / levels.

c) The mix for the base of the concrete floor shall be one part of cement, 2 parts of fine aggregate and 4 parts of coarse aggregate by volume. Not more than 27.1/2 litres (5.1/2 gallons) of mixing water, including the moisture of the aggregate shall be used for each bag of Portland cement in the mixture. The concrete shall be of the driest consistency possible to work to with a sawing motion of the strike off board straight edge. Changes of consistency shall be obtained by adjusting the proportions of aggregates and cement. In no case the specified amount water shall be exceeded. The base course shall have minimum thickness of 28 mm. for 40 mm. finished flooring.

d) Sectors

Concrete flooring shall be laid in sections not exceeding 4 SM. (with a maximum length of 2.0 M) in squares or rectangles. Flooring of the panels laying diagonally shall be completed first. The edges of the panels to be concrete shall be bounded by wooden battens. Immediately before the placing of the concrete the sub-base will be given a coat of cement slurry which shall be thoroughly brushed into the prepared surface.

e) Topping

This shall consist of minimum 12 mm. thick layer of mix 1:2 (1 cement mixed with hardener: 2 stone aggregate 6 mm. nominal size) by volume or as otherwise specified with which metallic hardening compound is mixed in the ratio of 1:4 (1 metallic concrete hardener: 4 cement) used by weight. Concrete hardener shall be dry mixed thoroughly with cement on a clean dry platform. This dry mixture shall be mixed with coarse aggregate of specified size in the ratio of 1:2 (1 cement mixed with hardener: 2 coarse aggregate) by volume and well turned over. Just enough water shall then be added to this dry mix as required for flooring concrete.

The mixture so obtained shall be laid in minimum 12 mm. thickness on cement concrete floor within 2 to 4 hours of its laying. The topping shall be laid true to provide a uniform and even surface. It shall be firmly compacted with the bottom concrete by using screed vibrators. After the initial set has started. the surface shall be finished smooth and true to slopes with steel floats.

The junction of floor with wall plaster, dado or skirting and the finished operations shall be dealt with as described earlier.

f) Curing

The floor shall be kept continuously moist for at least 14 days by means of wet gunny bags, 50 mm. thick layer of damp sand spread over the surface or pooling water on the surface.

g) Polishing

After curing period is over the granolithic concrete surface shall be polished with floor cutting machine (single cut) as per direction to achieve required polish finished surface. Polishing shall be done if specifically mentioned in the Schedule of Quantities.

h) Clearing the surface

The top surface of the granolithic concrete shall be cleaned properly by sweeping to remove dust and dirt. The top surface shall wetted and washed with clean water.

i) Rates to include

Apart from other factors mentioned elsewhere in this contract the rate quoted for "Concrete floor topping with hardener" shall include for the flooring.

j) All labour, materials and equipment, cleaning the sub-base, laying base course and top layer with hardener, polishing, steel dividers etc. complete.

6.C Ceramic Tiles Dado:

a) Tiles:

Spartek/Kajaria/Somany/Romano/Bell make ceramic tiles including specials shall be of approved make and quality. Samples of tiles shall be got approved by the Employer/Consultants, who will keep them in the site office of Employer / Consultants for verification as to whether the materials brought, used conform to the approved samples.

b) Mortar Backing:

All joints in the face work shall be raked out to a depth equal to not less than the width of the joints or as directed by the Employer/Consultants. Concrete surface shall be properly hacked. All dirt, soot, oil, or any material which might interfere with satisfactory bond shall be removed. The surface shall be cleaned and scrubbed with fresh water and kept wet for 6 hours prior to applying backing mortar. The dado work shall not be commenced unless the preparatory work is passed by the

Employer/Consultants. The proportion of mortar for backing shall be 1:3 cement mortars. Sand in mortar bedding shall be from approved surface.

The thickness of mortar backing shall not be less than 12 mm. and not more than 20 mm. to match with adjacent finished surface.

c) Fixing Dado Tiles:

Dado work shall be done only after fixing tiles on the floor. The white glazed tiles/ceramic tiles shall be soaked in water for at least 2 hours before being used for dado work. Tiles shall be fixed with waterproof adhesive of approved quality and make. The back of tiles shall be covered with a layer of adhesive and the tiles shall then be pressed on the backing surface and gently tapped against the wall with a wooden mallet. The fixing shall be done from bottom of wall upwards without any hollows in the bed or joints. Each tile shall be fixed as close as possible to the one adjoining mortar so that all tiles faces are in one vertical plane. The joints between the tiles shall not exceed 1.5 mm. in width. Joints of the tiles shall be pointed with white cement with admixture of pigment to match with the shade of tiles. If doors, windows or other openings are located within the dado area, the sills, jambs, angles etc. shall be provided with white glazed tiles/ceramic tiles and appropriate cut pieces according to the foregoing specification and such tiled area shall be measured along with the dado.

Fixing of tiles with waterproof adhesives shall be done as per manufacturer's specification.

d) Cleaning:

After the tiles have been fixed the surplus adhesive and cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing the dado or skirting work shall be washed and thoroughly cleaned.

Rates to include:

Apart from other factors mentioned elsewhere in this contract, the rates for the item of dado or skirting shall include the following:-

i) Backing Mortar.

ii) Providing and fixing tiles including all cutpieces in waterproof adhesive on backing mortar.

iii) Jointing of the tiles with white cement slurry with pigment.

iv) Curing.

v) Cleaning.

vi) All labour, materials, use of tools and equipments for carrying out the items as specified above.

e) Mode of Measurement:

Dado shall be measured in square metre for the actual area provided.

6.D Ceramic Tile Flooring

D. Materials

a) Spartek/Kajaria/Somany/Romano/Bell make approved quality and shade Ceramic tiles shall be used. They should have breaking strength of 400 – 450 kg. / Sqm.

b) Sizes of the tiles shall either be (300 x 300) mm. or any other sizes suggested / approved by the Employer / Consultants.

c) Thickness shall be 8 mm.

d) Tolerance in length, breadth and thickness - ± 1%

Samples of tiles shall be got approved by the Employer / Consultants, who will keep them at the site office of the Employer / Consultants for verification as to whether the materials brought and used conform to the approved samples.

D.2 Workmanship

D.2.1 Concrete base and mortar bedding

The base of cement concrete be laid and compacted to a reasonably true plain surface and to the required slopes and below the levels of the finished floor to the extent of thickness of the tiles and mortar bedding. Cement concrete base shall be paid under separate item.

Before spreading mortar, sub floor or base shall be cleaned or all dirt, scum, latiance and all loose materials and then well wetted without forming any pools of water on the surface. In case of R.C.C. floors, the top shall be left a little rough. All points of level for the finished paving surface shall be marked out. The mortar shall then evenly and smoothly spread over the base by the use of screed battens. The thickness of mortar bed shall not be less than 15 mm. or otherwise approved by the Employer / Consultants. Unless otherwise specified, the proportion of mortar bedding shall be composed of one cement and 4 medium sand by volume.

D.2.2 Laying, Curing and Cleaning

Tiles shall be laid in position and tamped down gently with a wooden mallet to make it level with other tiles. The surface during laying shall be frequently checked with a straight edge batten so as to obtain a true surface and level. The joints of the tiles shall be 3 – 4 mm. wide and shall be filled with neat white cement slurry admixtured with pigment to match the colour of the tiles. To maintain a perfect gap between tiles a uniform thick hard board strip can be placed between the tiles during laying.

Finally, cleaning and finishing off must be carried out as grouting proceeds, all traces of adhesive and cement must be removed with a sponge dipped in cleaned water.

D.3 Rates to include

Apart from other factors mentioned elsewhere in this contract, the contractor's rate quoted shall include for the following:

a) Cleaning for the base and providing and laying bedding mortar and levelling mortar where required.

b) Providing and fixing the tiles with waterproof tile fixing adhesive on the bedding mortar.

c) Filling of joints of tiles with neat white cement slurry with admixture of pigment to match the colour of the tiles.

d) All labour and materials and use of tools and carrying out the item as specified above, cleaning, finishing, curing complete as directed.

D.4 Mode of Measurement

Measurement for tile flooring shall be in square metre on actual area laid.

6.E Kota Stone Flooring:

It shall be of selected quality, hard, sound dense and homogenous in texture free from cracks, decay and weathering and flaws. These shall be machine cut to the requisite thickness, they should be the colour indicated in the Schedule of Quantities or as directed by the Employer/Consultants.

The slab shall have the top (exposed) face polished before being brought to site.

The slabs shall conform to the size required. Before starting the work, the contractor shall get the samples of slabs approved by the Employer/Consultants.

E.1 Dressing and Rubbing:

Each slab shall be cut to the required size and shape and machine cut and fine chisel dressed at all the edges of the full depth. The sides thus dressed shall have a full contact if a straight edge is laid along. The sides shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be True Square and free from chippings giving a plane surface.

Thickness shall be as specified in the Schedule of Quantities.

E.2 Bedding:

Bedding for the kota stone slabs shall be cement mortar 1:2 (1 cement 2 coarse sand) of average thickness 20 mm. as given in the description of the item. Minimum thickness at any place shall be not less than 10 mm.

E.3 Laying:

Sub-grade shall be cleaned, wetted and mopped. Mortar of the specified mix and thickness shall then be spread on an area sufficient to receive one slab. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped gently to bring it in level with the other slabs. It shall then be lifted and laid aside. Top surface of the mortar shall then be corrected by adding fresh mortar at hollows or depressions. The mortar is then allowed to harden a bit. Over this surface, cement slurry of honey like consistency at 4.4 Kg. of cement per square metre. The edges of the slabs already paved shall be buttered with white cement with pigment to match the shade of the kota stone slabs as given in the description of item. The slab shall then be gently placed in position and tapped to the adjoining slab. The joint shall be as fine as possible. Surplus cement on the surface of the slab shall be removed. The slabs fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster, skirting or dado. The junction between the wall and floor shall be finished neatly. The finished surface shall be true to lavels and slopes as directed by the Employer/Consultants. Machine polishing to achieve high polished surface and cleaning of the whole floor would be done as per direction.

Rates to include:

Apart from other factors mentioned elsewhere in this contract, the rates for item of kota stone flooring shall include for the following:

a) All labour, materials and equipment, cleaning the sub-base, laying mortar bed and cement grout and fixing kota stone slabs as specified above and making up the joints, pigments, white cement etc.

b) Any cutting and waste if required.

c) Curing.

d) Machine polishing and cleaning the floor from all stains etc.

Mode of Measurement:

The measurement shall be n square metre for the actual kota stone flooring provided.

6.F Granite Stone work in wall lining:

F.1 Materials:

The granite slab and tiles shall be of approved shade, sources and quality as mentioned in the Schedule of Quantities and their sizes and the thickness shall be as shown on the drawings and as approved by the Employer/Consultants. They shall be of selected quality, dense, uniform and homogenous in texture and free from cracks or their structural defects. It shall have even and crystalline grains. The surface shall be machine polished, true and even and perfectly plain surface and edges machine cut true and square. The rear face shall rough/grooved enough to provide a key for the mortar. No slab shall be thinner than the specified thickness at its thinest part. The dimensions of the slabs and tiles shall be as specified. A few approved samples of finished slab and tiles to be used shall be deposited by the contractor in the office of the Employer/Consultants. Unless otherwise mentioned, the thickness of slabs and tiles shall be average 20 mm. and 8 mm. respectively.

F.2 Mortar:

The mortar used shall be of the mix as specified in the Schedule of Quantities.

F.3 Laying and Fixing:

The granite slabs and tiles shall be sufficiently wetted before laying to prevent absorption of water from mortar.

They shall then be fixed with mortar/waterproof adhesive of approved quality as per direction of Employer/Consultants.

For granite slabs, adjoining slabs shall be secured each other by means of upper pins 75 mm. long and 6 mm. dia.

The slabs shall also be secured to the backing masonry work/concrete surface by means of 25 mm. x 6 mm. brass cramps of 150 mm. long or other sizes as required.

Pins, cramps etc. shall be got approved before use. They shall be fixed using cement mortar 1:2 (1 cement and 2 coarse sand).

Granite slab shall be fixed on concrete surface with waterproof adhesive where cramps cannot be used, on base mortar surface of proportion 1:2 (1 cement: 2 coarse sand) and copper pins for side joints as per direction. Granite tiles shall be fixed with waterproof adhesive on the base prepared with cement mortar (1:3) and joints pointed with jointing materials of approved quality and shade to match with shade of tiles as per direction unless otherwise stated in the Schedule of Quantities.

F.4 Joints and Pointing:

All joints shall be full of mortar and special care shall be taken to see that the joint between the centre of the mass being compacted at the time of depositing proceeds by means of a suitable type, the facing stone slabs and the back masonry is properly filled with mortar. The hollowness behind the veneer stone slab or post jointing the back masonry can be detected by tapping the face stone and any such defective work shall be rectified by relaying the stone slab. The face joints shall be uniform, straight and as fine as possible but not more than 1.5 mm. and in face joints, the full depth of the slab shall be filled with polysulphide sealant or any other approved materials for the pointing.

F.5 Curing and Protection:

Green work shall be protected from rains by suitably covering the same. The work shall be kept constantly moist for a period of at least seven days.

F.6 Mode of Measurement:

The measurement shall be square metre for the actual finished surface area of granite stone slab/tiles laid.

F.7 Rates to include:

Apart from other factors mentioned elsewhere in this contract, the rates for item of granite stone work shall include for the following:-

a) All labour, materials, equipment, scaffolding, cleaning sub base bedding and jointing mortar, pigment, white cement, waterproof adhesive, polysulphide sealant, or other approved materials gunmetal pin and brass cramp for granite slab work.

b) Any cutting and wastage as required for finishing to recess, jambs, window sill, edges etc.

c) Curing.

d) Cleaning the wall from all stains etc.

e) Work at any level.

f) Providing 'V' grooving at joints as per direction.

## 6.G Vitrified Tiles Flooring

### G.1 Materials

a) Johnson/Naveen/Bells make approved quality and shade vitrified/ceramic tiles shall be used.

b) Sizes of the tiles shall either be approx. (600 x 600) mm. or any other sizes suggested / approved by the Employer / Consultants

c) Thickness shall be approx. 9 to 10 mm.

d) Tolerance in length, breadth and thickness ± 1%.

Samples of tiles shall be got approved by the Employer / Consultants, who will keep them at the site office of the Employer / Consultants for verification as to whether the materials brought and used conform to the approved samples.

### G.2 Workmanship

#### G.2.1 Concrete base and mortar bedding

The base of cement concrete be laid and compacted to a reasonably true plain surface and to the required slopes and below the levels of the finished floor to the extent of thickness of the tiles and mortar bedding. Cement concrete base shall be paid under separate item or otherwise as mentioned in the Schedule of Quantities.

Before spreading mortar, sub floor or base shall be cleaned or all dirt, scum, latiance and all loose materials and then well wetted without forming any pools of water on the surface. In case of R.C.C. floors, the top shall be left a little rough. All points of level for the finished paving surface shall be marked out. The mortar shall then evenly and smoothly spread over the base by the use of screed battens. The thickness of mortar bed shall not be less than 15 mm. or otherwise approved by the Employer / Consultants. Unless otherwise specified, the proportion of mortar bedding shall be composed of one cement and 4 medium sand by volume.

G.2.2 Laying, Curing and Cleaning

Tiles shall be laid in position with tile fixing adhesive and tamped down gently with a wooden mallet to make it level with other tiles. The surface during laying shall be frequently checked with a straight edge batten so as to obtain a true surface and level.

Finally, cleaning and finishing off must be carried out as grouting proceeds, all traces of adhesive and cement must be removed with a sponge dipped in cleaned water.

G.3 Rates to include

Apart from other factors mentioned elsewhere in this contract, the contractor's rate quoted shall include for the following:

a) Cleaning for the base and providing and laying bedding mortar and leveling mortar where required.

b) Providing and fixing the tiles with waterproof tile fixing adhesive on the bedding mortar.

c) Filling of joints of tiles with neat white cement slurry with admixture of pigment to match the colour of the tiles.

d) All labour and materials and use of tools and carrying out the item as specified above, cleaning, finishing, curing complete as directed.

G.4 Mode of Measurement

Measurement for tile flooring shall be in square meter on actual area laid.

7.0 Wood work and Joinery:

7.1 Timber:

i) Unless otherwise specified, all timber for frames and shutters for doors, windows, ventilators, etc. shall be of approved quality and shall be free from knots, shakes, fissures, flaws, sub-cracks and other defects. The planed surface shall be smooth and free from blemishes and discoloration.

ii) All timber for carpentry and joinery in touch with masonry or concrete shall be creosoted before fixing.

iii) All full fabricated timber shall be air seasoned at site of work for a period of not less than two months to allow for any shrinkage that may take place. The preparation of timber for joinery is to commence simultaneously with the beginning of the project work generally and

should proceed continuously until all the wood work is prepared and fixed/stacked on or near the site as the case may be.

7.2 Holdfasts:

Three holfasts shall be fixed to each post of the door frame. The M.S. holfasts shall be of the size as mentioned in the Schedule of Quantities and shall be fixed to the frames by means of screws and not nails. The other end of the holfasts shall be fixed into jambs with 1:2:4 R.C.C. of dimensions as directed. Ends of holdfasts will be fish tailed.

Whenever the frames are abutting to concrete surface approved metal expansion fastener as directed shall be provided for frame, hangers, rough grounds etc.

The rates quoted for wood work and joinery shall exclude the cost for all types of holdfasts or Raw Plugs or other approved fasteners.

The items of holdfast, metal fasteners etc. shall be paid as a separate item as described in Schedule of Quantities. The rate for holdfast shall include for cement grouting and fixing to framework with screws etc. The rate for metal fasteners shall include for nuts etc. as required.

7.3 Workmanship and Constructions:

a) The workmanship shall be first class and to the approval of the Employer/Consultants. Scantlings and board shall be accurately sawn and shall be of required width and thickness. All carpenters' work shall be wrought except where otherwise described. The workmanship and joinery shall be accurately set out in strict conformity according to the drawings and shall be framed together and securely fixed in approved manner and with properly made joints. All work is to be properly toned shouldered, wedged, pinned, braced etc. and properly glued with approved quality glue to the satisfaction of the Employer/Consultants.

b) Screws:

Unless otherwise specified all screws to be used in woodwork and joinery shall be of cadmium plated and of approved quality. The size (diameter and length) should conform to those specified in hardware schedule.

c) Tolerance:

1.5 mm. (1/16") will be allowed for each wrought face of sizes specified except where described as finished in which case they shall hold to the full dimensions.

d) Protection:

All edges of timber frames etc. shall be protected from being damaged during construction by providing rough timber casting securely fixed and other adequate protective measures.

e) If it is decided by the Employer to provide antitermite treatment, the building contractor shall co-ordinate his work suitable as directed by the Employer/Consultants.

f) Door/Window frames shall have cut rebate. Planted rebates shall not be permitted.

g) Where door frames arefixed flush with plaster t o wall, teak wood cover mould 40 mm. x 12 mm. as per drawings shall be provided all round and shall be painted or polish finished to match with finished shutters. This will be paid as a separate item as described in Schedule of Quantities.

7.4 Wooden Flush Shutters: (Solid Core Type)

Sold core flush shutters shall be commercial or teak veneered type as specified in the item manufactured by M/s. National Plywood, M/s. Sitapur Plywood Manufacturer Ltd., M/s. Green Timber Industries (P) Ltd. or other approved manufacturer registered with ISI and shutter shall bear ISI mark. An approved sample shall be deposited in the office of the Employer/Consultants at site for reference. The shutter will be provided with lipping. Finished thickness of the shutter shall be as mentioned in item. Shutter should be not pressed and phenol formaldehyde should be used as glue.

7.5 Factory made paneled shutters

Shutters shall be manufactured from Kiln Seasoned and chemically treated commercial hardwood of approved quality. Thickness and sizes of styles, rails etc. shall be as specified in the Schedule of Quantities and or drawings. Panel shall be of phenol bonded plywood (BWP) conforming to I.S. 303 of latest edition of thickness as specified in the Schedule Quantities. Panel shall be in a single width piece. Shutters shall be manufactured conforming to the relevant I.S. specification and an approved sample shall be kept in the site office of the Employer / Consultants for reference.

7.6 Wooden Handrail:

Wooden handrail will be of specially selected Indian teak wood fixed to concrete or metal balustrades with concealed screws and dowels. All bends, miters, covers, moulds etc. will be strictly to proper shape and finely smoothed with sand papers. The handrail shall be finished with french polishing or painting as per

direction of the Employer/Consultants. The rate should include cost of polishing /painting and also the wastage of materials for the completed works.

7.7 Hardware fittings:

All hardware fittings for doors shall be oxidized iron, iron, brass, and anodized aluminium as specified in the Schedule of Quantities. These hardware fittings shall be obtained from approved manufacturers and shall bear ISI mark wherever avails. The samples for the fittings shall be submitted to the Employer/Consultants for the approval. Hardware fittings for door shutters shall be paid as separate item as given in Schedule of Quantities. The rate for hardware fittings shall include for supplying, fitting and fixing the fittings with necessary cadmium plated screws, washers bolts, nuts etc. as required. All locks shall be provided with keys in duplicate and rate shall include for the same.

Approved samples of hardware fittings shall be deposited with Employer/Consultants for reference.

7.8 Rates to include:

Apart from other factors mentioned elsewhere in this contract the rate for item of wood work and joinery shall include for the following:

A. Items of scantling:

i) All labour, materials and equipments for fixing framework as per drawing excluding the cost of holfasts, Rawl plugs, or other fastener etc.

B. Items of shutters:

i) All labour, materials and equipments for carrying out the work as per drawing.

ii) Labour for fitting the shutters in position (excluding the cost of fittings) as per drawing.

7.9 Mode of Measurement:

All measurements shall be as per relevant section of I.S. 1200 of latest edition.

i) Scantling shall be measured in cum. The sectional area shall be the area of the least square, or rectangles from which the scantling may be cut. The length shall be actual length of timber required for the purposes including the extra portion required for jointing.

ii) Shuttering shall be measured in square metre for closed door shutters area i.e. rebate to rebate without extra measurement for rebates and/or splayed meeting styles of door.

8.A Steel Doors, Windows and Ventilators:

8.1 I.S. Specification:

Unless stated the Indian Standard Specification applicable for steel doors, windows and ventilators shall be IS: 1038 of latest edition "Specification for steel doors, windows and ventilators" and shall be manufactured from hot rolled steel sections conforming to I.S. 7452 of latest edition.

8.2 Opening:

All the windows and ventilators shutters should open outside unless otherwise specified.

8.3 Fabrication:

Both the fixed and opening frames of the doors, windows and ventilators shall be formed by cutting section to required lengths, and metres. The corners shall be electrically welded. Sash bars of the units shall be toned and revetted into the frames.

Slots shall be cut in the fixed frames and the hinges shall be welded into a slot in the outer frame and other lead of the hinge rivetted to the opening shutters.

8.4 Handles, Pegstays:

Each side hung shutter shall be provided with extended non-friction Hopes type hinges and pegstay arms 300 mm. (12") long and shall have holes to keep the shutter open in three different position upto 90 degree (The peg and the arm for the pegstay shall be revetted). The handle shall be mounted on a handle plate and the plate shall be welded to the opening frame. The handle shall have two points nose which will engage with suitable tapered brass striking plate provided on the fixed frame to keep the shutter open in a slightly open position as well as in a fast position.

8.5 Top/Bottom hung Ventilators:

Top hung and bottom hung ventilators shall be provided with two plain hinges, with 300 mm. (12") pegstay arms, which will keep the shutter open in three different positions and will act as a stopper too.

8.6 Centre-hung-ventilators:

Centre hung ventilators shall be made with two outer frames with mastic waterproof compound embedded between these two outer frames. They shall also be provided with a spring catch which when pulled by a cord. The upper half shall open inside and the lower half shall open out.

8.7 Beading:

Where metal beading is specified in the drawing or elsewhere for fixing the glazing, the contractor should provide windows with threaded holes for fixing the beading with screws.

8.8 Samples of Windows:

A typical approved sample window should be kept in the office of the Employer/Consultants at site until the satisfactory completion of the building. All windows and ventilators supplied and fixed at site should be of the same quality as of the approved sample; otherwise they shall be rejected.

8.9 Employer/Consultants' approval:

All windows and ventilators are subject to the approval of the Employer/Consultants and they shall be strictly in accordance with the specification without any bends, etc.

8.10 As per drawings:

All windows and ventilators shall be manufactured as per drawings supplied to the contractor.

8.11 Fixing to brick work/concrete:

Steel windows and ventilators shall be fixed to brick work by means of standard M.S. lugs of size of mentioned in I.S. 1038 of latest edition and to concrete work by means of 125 mm. long counter sunk screws with rawl plugs or other approved metal (brass) fastener after drilling into concrete with a power drill. Steel windows/ventilators etc. shall be fixed as per manufacturer's recommendations or I.S. specifications. Holdfasts shall be grouted in concrete (1:2:4) mix of dimensions as directed. Quoted rates shall cover for all these factors.

8.12 Structural sufficiency of windows:

All windows, doors and ventilators shall be manufactured from a standard extruded section of approved, appropriate sizes suitable for the particular type and size of the windows etc. Details shop drawings including the full design of every type of windows and ventilators shall be furnished in duplicate, for approval before undertaking the work. Contractor shall assume full responsibility

regarding soundness of the windows, doors and ventilators and adequacy of the windows, doors and ventilators and adequacy of the sections used for the particular sizes required providing appropriate stiffness and strength. If in the opinion of the Employer/Consultants deficiencies in the sections used are found, the contractor shall replace the windows, ventilators, etc. at his expenses by windows and ventilators etc. made from approved sections.

8.13 Import License:

No import license shall be made available for obtaining any material not available in India.

8.14 All types of Windows:

Rates quoted for steel windows and ventilators shall cover for all types of windows and ventilators whether of standard sizes or purpose made. Where composite continuous windows over long lengths (in plan) are required, rates shall cover for millions, transoms at vertical or horizontal junctions of approved design, rates should also cover for partly fixed and partly openable type of continuous windows shutters of any type like side hung, centre hung, top hung, etc. as per detailed drawings.

8.15 Glazing:

Unless otherwise mentioned the whole of the glass shall be of 2.8 mm. thick or other thickness as mentioned in the Schedule of Quantities sheet glass and free from speck, valves, bubbles and other imperfections. The glazing shall be fixed with bead or bedded and packed and putting with putty suitable for use in tropical countries. Putty for glazing to wood work shall be best oil putty. In case of metal windows it shall be special gold size putty. The glass should be obtained from approved manufacturer. Prior to placement of order the sample for all glasses to be used will have to be approved by the Employer/Consultants as regards their quality and tint etc. and the same should be kept in the office of the Employer/Consultants. The quality of all the glasses should be used in the site should conform with the approved one in quality otherwise the Employer/Consultants will be at liberty to reject the same for which no claim shall be entertained. On completion of the works the general building contractor shall clean and wash all the glass and leave the same perfectly clean and in tidy condition.

8.16 Rates to cover:

Unless otherwise stated, contractors rate for steel windows, ventilators shall, apart from any other factors mentioned elsewhere in this contract, include for providing and fixing the following:-

a) Window/Ventilator frames and shutters with hinges as described.

b) M.S. hodfasts or lugs as specified in I.S. 1038 of latest edition in the position and as per design of I.S. specification or where fixed to concrete 125 mm. long countersunk screws with rawl plugs or other approved fasteners.

c) Rolled Steel Mullions.

d) Transomes with projected weather bars for side hung shuttering and plain ones for fixed windows.

e) Aluminium beading with screws.

f) Bolts, nuts, screws.

g) Manganese brass spring catches.

h) Chords for centre hung windows.

i) Grouting of holdfasts in 1:2:4 concrete.

8.17 Measurement:

Measurement shall be in square metre.

8.B Aluminium Door, Window etc.:

All aluminium doors, windows, jallies, curtain wall etc. Shall be procured from A Class manufacturer subject to the approval of the Employer/Consultants. Aluminium sections for fabricating frame work, doors, windows, jallies, etc. shall be of extruded sections as manufactured by Indian Aluminium Co. Ltd. or approved equivalent. Extruded section shall have a well thickness as specified in the Schedule of Quantities or detail drawings. All sections shall be approved by the Employer/Consultants before fabrication is taken up. Doors, frames and mullions, transoms shall be anodized to required thickness in a bath of sulfuric acid to provide a uniform casting. A protective transparent coating shall be applied to the Sections before shipment from the Factory. All works for doors, windows and frames etc. shall be fitted and shop assembled to a first class job and ready for erection. Shop joints shall be made to hairlines and then welded or braced. Work on the above, other than described shall be carefully fitted and assembled with neat joints with concealed fasteners. Wherever possible, joint shall be made in concealed location and on edges of doors field connections of all work may be made with concealed screws or other approved type of fasteners. All fasteners connecting between aluminium members or between aluminium and concrete shall be either high strength aluminium or of stainless steel. Glazing beads shall be shop fit type without visible screws and shall of sizes to accommodate various thickness of glazing as specify to the Schedule of Quantities. All works shall be adequately traced and reinforced as necessary for strength and

rigidity. The members of the framework shall be of one piece and no joint shall be allowed unless the same has prior approval of the Employer/Consultants. Fabrication drawings for the aluminium curtain wall, jallies etc. shall be prepared by the contractors based on the design of the Consultants indicating The detailed of frame work, fixing arrangement and other necessary details well in advance of the actual fabrication work and casting of structural element supporting the jallies, sample of the jallies, curtain wall etc. unit fabricated as per approved drawing shall be produced for approval of Employer/Consultants before commencement of bulk fabrication of jalli units, curtain wall etc. at shop.

B.1 Handling and storage of fabricating materials:

All aluminium doors, windows, curtain wall, jallies etc. shall be packed and crated properly before despatch, to ensure that there will be no damage to the fabricated materials. Loading into Wagons/Truck shall be done with care to ensure safe arrival of materials at site to undamaged condition.

All the fabricated materials at site shall be stored under cover in such a way to prevent damage or distortion. Special care shall be taken to prevent staining of aluminium products by mortar etc. after erection at site.

B.2 Acceptance Criteria:

For fabricated items:

a) Overall dimensions shall be within 1.5 mm. of the size shown on drawings.

b) Mullions, transoms etc. shall be n one length and permissible deviations from straightness shall be limited to 1.5 mm. from the axis of the member.

c) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm. For double leaf doors, the gap at the meeting stiles shall not be more than 1.5 mm.

d) Door leaves shall be undercut where shown on drawings.

e) Doors, windows, frames and curtain wall frame work etc. shall be on a true place, free from wrap or buckle.

f) All welds shall be dressed flush on exposed and contact surfaces.

g) Correctness of location and smoothness of operations of all shop installed hardware and fixtures.

h) Provision for hardware and fixtures like floor spring etc. as directed to be installed at site.

i) Glazing beads shall be cut with mitred corners.

j) Glazing clips, fixing devices etc. shall be supplied in adequate numbers.

k) Shop coats shall be properly applied.

l) Exposed aluminium surfaces shall be free from scratches, stains and discoloration. Anodizes surfaces shall be present a uniform and pleasing look.

m) Anodizing thickness shall be minimum 15 micron.

B.3 For installed items:

a) Installations shall be at correct location, elevation and in general, on a true vertical plane.

b) Fixing details shall be strictly as shown on drawings.

c) Assembly of composite units shall be strictly as per drawings with mastic caulking at transoms and mullions, gaskets, weather strips etc. complete.

d) All openable sections shall operate smoothly without jamming.

e) All frames on external walls shall be mastic caulked to prevent leakage through joint between frames and masonry.

f) Locks, fasteners, floor spring etc. shall be fitted in position properly. Keys shall be non-interchangeable.

g) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint of same quality as shop paint.

B.4 Method of Measurement:

a) Supply and installation of doors shall be measured in number of each type used or in Sqm. as specified in the Schedule of Quantities. The types shall be as shown on drawings and described in Schedule of Items.

b) Supply of windows shall be measured in square metres correct to two places of decimal. The width and height shall be measured overall from out to out of the frame. The height and width shall be measured correct to 0.5 cm. The Jalli and curtain wall shall be measured in Sqm. The height and width shall be measured correct to 0.5 cm.

9.0 Cement plaster (internal and external):

a) Preparation of surface:

The walls to be plastered to have all joints raked out to a depth of 10 mm. if no already done. R.C.C. surface shall be properly hacked to get good key to the plaster. All dust and cily matter, if any, shall be brushed and cleaned and surface to be plastered shall be kept wet for 6 hours before plastering is commenced.

b) Proportion of Mortar:

The plaster in walls, lintels, columns, ceiling, ceiling beams, projected slabs, rails, chajja, marquise, domes etc. shall be done with sand cement mortar in the proportion as described in the Schedule of Quantities. No more cement mortar shall be prepared than that can be used within half an hour.

c) Application of Plaster:

The mortar shall be applied evenly with force on the surface to be plastered. The mortar surface shall be finished at once by being rubbed over with a trowel till the cement appears on the surface. All corners, angles and junctions shall be truly vertical and horizontal as the case may be carefully and neatly finished. Rounding of corners and junctions where required shall be done without extra charge. The mortar shall adhere to the surface intimately when set and there should be no hollow sound when struck.

d) When neat cement finish is specified over the plaster surface. A coat of pure Portland cement slurry, 1.5 mm. thick shall be applied and well rubbed to the plaster surface while the plaster surface is still fresh.

e) When no finish is specified, the plastered surface shall be rubbed well to an even place with a wooden flat for external surface and finished smooth with a steel trowel for internal surface.

f) Rates to include:

Apart from other factors mentioned elsewhere in this contract rates for the item of plaster shall include the following:-

i) Erecting, dismantling and removing the scaffolding.

ii) Preparing the surface to receive the plaster.

iii) Providing cement plaster of the specified average thickness.

iv) All labour, materials, use of tools and equipment to complete the plastering as per specification.

v) Curing for 7 days.

vi) Any moulding work if shown on the drawings or as specified unless separately provided in the tender.

vii) Labour for plastering the surface in two operations when thickness of plaster is more than 12 mm. thick.

viii) Plaster work in bends, arises, rounded angles, fair edges, narrow returns, quirks 'V' joints, splays, drip mouldings, making good to metal frame junctions with skirting of dado narrow width and small quantities, making good round pipes, conduits, timbers, sills, brackets, railings, etc. and making good after all the sub-contractors or nominated sub-contractors have done their work.

ix) Neat cement finish when specified in the item.

g) Mode of Measurement:

Plaster shall be measured in square metre.

Walls:

The measurement of wall plastering shall be taken between the walls or partitions (the dimensions before plastering shall be taken) for the length, and from the top of floor and skirting depending upon the situation to the ceiling for the height.

Deductions:

For jambs soffits, sills, etc. for openings not exceeding 0.5 Sqm. each in area, ends of joists, beams, posts, girders, steps etc. not exceeding 0.5 Sqm. each in are, and openings not exceeding 3 sqm. each, deductions and additions shall be made in the following manners:

a) No deductions shall be made for ends of joists, beams, posts, etc. and openings not exceeding 0.5 sqm. and no additions shall be made for reveals, jambs, soffits sills etc. of these openings or for finishing the plaster around ends of joists, beams, posts, etc.

b) Deductions for openings exceeding 0.5 Sqm. but not exceeding three Sqm. each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings:-

i) When both faces of wall are plastered with the same type of plaster, deduction shall be made for one face only.

ii) When two faces of wall are plastered with different type of plasters or if one face is plastered and other pointed, deductions shall be made in the plaster or pointing on the side on which the width of reveals is less than that on the other side but no deduction shall be made from plaster or pointing on the other side. Where widths of reveals on both faces of wall are equal, deduction of 50 per cent of area of opening on each face shall be made from areas of plastering and/or pointing as the case may be.

iii) When width of door frame is equal to thickness of wall or is projecting beyond thickness of wall, full deduction for opening shall be made from each plastered/pointed face of the wall.

iv) In case of openings of area above 3 Sqm. each deductions shall be made for the openings but jambs, soffits and sills shall be measured.

Ceiling:

i) Ceiling shall be measured between the walls or partitions and the dimensions before plastering shall be taken.

ii) Ceiling with projected beams shall be measured over beam and the plastered sides of beams shall be measured and added to plastering on ceilings.

10. Rule Pointing:

The external brick work to be pointed, as shown on drawings is to be executed with specially selected bricks uniform in size and colour and with true and undamaged faces and arises. The joins are to be raked out at least 12 mm. (1/2") deep and pointed with line gauge in cement. No cutting of bricks or facing up with coloured plaster will be allowed.

11. Plaster of Paris Punning:

If the plastered surface is to be finished with plaster of Paris punning, the surface shall be combed slightly with the wire brushed or nails before it is completely set to form key for plaster of paris punning. The surface shall be only damped but not soaked before the application of plaster of Paris punning. The gypsum for preparing punning shall be approved quality. It shall be dry and free from lumps and shall be suitably packed in watertight bags or containers. Paste shall be prepared by adding required quantum of water and sand shall be used before it sets. No dropping paste shall be used in the work. Punning shall be applied to the prepared surface with steel trowel to a thickness required to make the surface produce perfectly smooth and even surface, working from top to bottom. The

finished surface shall not show any sign of disintegration topping or piling. The surface shall be protected from injury and damage.

11.1 Rates to include:

Apart from other factors mentioned elsewhere in this contract, rates for the item of plaster of paris punning shall include the following:

i) Erecting, dismantling and removing the scaffolding.

ii) Preparing the surface to receive the said finish.

iii) Providing plaster of paris punning of the required thickness to make the surface perfect smooth and even including cost of materials.

iv) Any moulding work if shown in the drawings or as specified.

v) Finishing in bends, arises, rounded angles, fair edges, narrow returns, quirk, 'V' joints, splays, drip mouldings, making good to metal frames, junctions with skirting or dados, narrow widths and small quantities, making good round pipes, conduits, timbers, sills, brackets, railings etc. and making good after all the sub-contractors or nominated sub-contractors have done their works.

11.2 Mode of Measurements:

The measurement shall be in square metre. The mode of measurement shall be as applicable to that for plaster.

12. White washing, colour washing and distempering

12.A i) White washing

a) Materials

White wash shall be prepared from 5 parts of stone lime and 1 part of shell lime. The lime shall be dissolved in tub with sufficient quantity of water (about 4/5 litre / kg. Of lime) and the whole thoroughly mixed and stirred until it attains the consistency of thin cream. The wash shall be taken out in small quantities and screened thorough a clean coarse cloth. Clean gum dissolved in hot water shall then be added in suitable proportion of 4 kg. of gum Arabic per cum. of lime to prevent the white wash coming off easily when rubbed. Indigo as necessary (upto 3 gm per kg. of lime) shall be mixed as per standard practice.

b) Scaffolding

This shall be double or single according to requirements and as directed. If ladders are used, pieces of old gunny bags or cloth rags shall be tied on their tops to avoid damage or scratches to the plastered surfaces, etc. Proper stage scaffolding shall be erected when white washing the ceiling.

c) Preparation of surface

The surface shall be prepared by removing all mortar droppings and foreign matter and thoroughly cleaned with hair or fibre brush or other means as may be ordered by the Employer / Consultants to produce an approved clean and even surface. All loose pieces and scales shall be scrapped off and holes, cracks etc. stopped with mortar to match with the surrounding finish. The mortar should be cured sufficiently.

d) Application of white wash

On the surface so prepared the white wash shall be laid on with a brush. The first stroke of the brush shall be from top downwards, another from bottom upwards over the first stroke, and similarly one stroke from the right and another from the left over the first brush before it dries. This will form one coat, each coat must be allowed to dry and shall be subject to inspection and approval before the next coat is applied.

When dry, the surface shall show no signs of cracking. It shall present a smoothened uniform finish free from brush marks and it should not come off easily when rubbed with a finger. Minimum 3 coats of white wash shall be applied.

No portions in the surface shall be left out initially to be patched up later on.

For new work, the white washed surface shall present a smooth and uniform finish.

Doors, windows, floors and other articles of furniture etc. shall be protected from being splashed upon. Splashing and droppings, if any, shall be removed and the surfaces cleaned.

e) Rates to include

Apart from other factors mentioned elsewhere in this contract, the rates for white wash include for the following:-

i) All labour, materials, equipment required for white washing.

ii) Scaffolding including erection and removal.

iii) Providing and preparing the white wash.

iv) Preparing the surface for white wash including the scaffolding.

v) Applying the white wash in three coats minimum. If a proper even surface is not obtained to the satisfaction of the Employer / Consultants in 3 coats, contractors shall carry out additional coats of white wash to approval, at contractor's expense.

f) Mode of measurement

The measurement shall be in square metre. The mode of measurement shall be as applicable to that for plaster.

12.B Distempering

Providing Oil bound Distemper

a) Material

The oil bound distemper shall be of approved quality colour and shade manufactured by ICI, Berger Paints (India) Ltd., M/s. Asian Paints Ltd.

b) Scaffolding

This shall be double or single as required and directed.

c) Preparation the surface

The surface to be distempered shall be cleaned and all cracks, holes and surface defects shall be repaired by applying putty, made of plaster of paris mixed with water. All irregularities shall be sand papered smooth and wipped clean. The surface so prepared must be completely dry and free from dust before distempering is commenced. In the case of walls newly plastered, special care shall be taken to see that it is completely dry before any treatment is attempted.

d) Priming Coat

The priming coat shall be applied over the complete dry surface in the manner recommended by the manufacturer.

e) Application of Distemper

The instruction of the makers shall be followed regarding the preparation of the surface and application of priming and finishing coats. Distemper shall not be mixed in a larger quantity than is actually required for a day's work. Distempers shall be applied in dry weather with broad stiff brush in long parallel strokes. The treated surface shall be allowed to dry and harden. Second or succeeding coats shall not be applied until the preceding coat has been passed by the Employer / Consultants. Two more coats of distemper shall be given in exactly the same manner as the first one but only after the earlier coat laid has thoroughly dried.

f) Rates to include

The rates shall include all labour, materials equipment and tools for carrying out the following operations:-

i) Providing the primer and distemper and mixing the distemper.

ii) Scaffolding.

iii) Preparing the surface to receive the priming and finishing coats.

iv) Applying the priming coats.

v) Applying the distemper in 2 coats minimum, if a proper even surface is not obtained to the satisfaction of the Employer / Consultants in 2 coats, contractor shall carry out additional coats of distemper to approval, at contractor's expense.

g) Mode of measurement

Similar to that for white washing.

13. Plastic Emulsion Paint:

13.1 Material:

The emulsion paint and primers in general shall be of approved quality colour and shade of approved manufacturers.

13.2 Scaffolding:

This shall be double or single as required and directed. If ladders are used, pieces of gunny bags or cloth bags shall be tied on their tops to avoid damage or scratches to the plastered surfaces etc. proper stage scaffolding shall be erected when panting the ceiling.

13.3 Preparation of the Surface:

The surface to be painted shall be cleaned and all cracks, holes and surface defects shall be repaired with plaster of paris for spot filling, and with filler prepared with whiting, water and a little quantity paint for filling and levelling the wider areas.

13.4 Priming coat:

The priming coat of the cement primer of approved quality make shall be applied over the completely dry surface in the manner as recommended by the paint manufacturers.

13.5 Application of Emulsion Paint:

The recommendation of approved paint manufacturer, whose product is used, shall be followed regarding the preparation of the surface and the application of the priming and finishing coats. The contractor shall arrange for technical assistance and supervision from the paint manufacturer, during the execution of the painting work. After the priming coat has been applied and perfectly dried, all holes, scratches, if any, shall be repaired as mentioned in preparation of surface and then the second coat of approved shade and manufacturer shall be evenly applied and allowed to dry. The third coat shall be carefully applied to achieve smooth and even surface after the previous coat has dried up. Minimum 3 coats of paint shall be applied inclusive of primer coat. If a proper and even surface is not obtained to the satisfaction of the Employer/Consultants in 3 coats, Contractor shall carry out additional coats of painting to approval, at contractor's expenses. Care shall be taken that dust or other foreign materials do not settle or disfigure the various coats.

13.6 Rates to include:

Apart from other factors mentioned elsewhere in this contract, the rates for the item of plastic emulsion paint shall include for the following:-

i) All labour, materials and equipment necessary to carry out the work.

ii) Supplying the approved emulsion paint for priming and finished coats.

iii) Preparing the surface for receiving the primer and finishing coats.

iv) Scaffolding including its erections and dismantling.

v) Application of one primer coat and minimum two coats of finishing. If a proper and even surface is not obtained to the satisfaction of Employer/Consultants in 3 coats mentioned above, the contractor shall carry out additional coats of painting to approval at contractor's expense.

vi) Protection to painted surface till dried and handed over.

vii) Expense, if any, for supervision and technical assistance supplied by the approved paint manufacturers.

13.7 Mode of Measurement:

The measurement shall be in Square metre. The mode of measurement shall as applicable to that for white washing.

14. Cement based painting:

a) Material:

External waterproofing cement based paints shall be approved colour and of approved manufacturer.

b) Preparation of surface:

Before painting is commenced on surface all dirt, oil, grease, efflorescence and organic material shall be completely removed. The surface shall be wetted by sprinkling of water with fine spray. The surface shall be sprayed several times with a few minutes intervals between each spraying to allow the moisture to soak into the surface.

c) Application:

Cement based paint solution shall be applied by the surface with hair brush to get uniform finish. After the first coat of paint has dried it shall be cured with water at least for 24 hours, before the application of the second coat should be elapsed between the two coats. The meaning of one coat shall be as described for white washing.

d) Curing:

Cement based paint work shall be kept damp at least for 7 days.

e) Rates to include:

Apart from other factors mentioned elsewhere in this contract, the rate of providing cement paint shall include for the following:

i) All labour, materials and equipment to provide cement paint.

ii) Scaffolding, including erecting and removing.

iii) Preparing the surface as stated above.

iv) Applying 2 coats of approved cement based paint, if a proper and even surface is not obtained to the satisfaction of the Employer/Consultants in the coats applied, the contractor shall provide additional coats of painting to approval, at contractor's expense.

v) Curing as stated above.

vi) Mode of Measurement:

Measurement shall be in square metre and as applicable to white wash. Nothing extra shall be allowed for painting on rough surface, for example, external sand faced plaster, rough cast plaster etc.

15. Painting, French Polishing:

15.A Painting:

a) Material:

Ready mixed oil paints and primer, in general shall be of approved quality, colour and approved manufacturer. These materials shall be in sealed tins and shall be opened in the presence of the Employer/Consultants at site.

b) Preparation of Surface

i) Iron and Steel Works:

Surface to be painted shall be thoroughly cleaned, sand papered and/or rubbed with emery cloth, if necessary, to remove grease, mortar or any other foreign materials. In case of rusted surface, it shall be first cleaned with wire brushes till the corroded rust is removed, the prepared surface shall be shiny and free from brush marks, patches, blisters and other irregularities. The surface thus finished shall be got approved for painting.

ii) Wood work:

All surfaces to be painted shall be thoroughly cleaned sand papered and removed of all foreign materials. In case of surfaces having knot and nail holes, this shall be filled with knotting and stopping materials. The knotting materials shall consist of pure shellac dissolved in methylated spirit. Stopping materials shall consist of putty. The surface thus treated shall be allowed to dry and then sand papered smooth.

c) Application:

After preparing the surface, a primer coat shall be applied. The primer coat shall be ready mix of approved make and manufacturer. After the primer coat is applied and perfectly dried, all holes, cracks, etc. which shall remain, shall be filled in with putty and the surface thus treated shall be allowed to dry and then sand papered smooth. Then a second coat of paint of approved shade and manufacturers shall be evenly applied and allowed to dry. The third coat shall be carefully applied to achieve smooth and even surface after the previous coat has dried up. Minimum 3 coats of paint shall be applied inclusive of a primer coat. If a proper and even surface is not obtained to the satisfaction of the Employer/Consultants in 3 coats, contractor shall carry out additional costs of painting to approval, at contractor's expenses. Care shall be taken that dust or other foreign materials do not settle or otherwise disfigure the various coats.

d) Rates to include:

Apart from other factors mentioned elsewhere in this contract, the rate for the item of painting shall include for the following:

i) All labour, materials equipment necessary to carry out the work.

ii) Supplying the approved paint for priming and finishing coats.

iii) Preparing the surface including knotting and stopping for receiving the priming and finishing coats.

iv) Scaffolding including its erection and dismantling.

v) Application of at least one primer coat and two coats of finishing for wood work and at least two finishing coats for steel work unless otherwise specified. If a proper and even surface is not obtained to the satisfaction of the Employer/Consultants, contractor shall carry out additional coats of painting to approval of contractor's expense.

vi) Protection to painted surface till dried and handed over.

Mode of Measurement:

Painting to wood work and steel work shall be measured separately, as per I.S. 1200 (Part XV) of latest edition.

15.B French Polishing:

French polish to be used shall comply with I.S. 348 of latest edition in the requirements of quality.

Before french polish is applied, the surface of wood work shall be prepared in the same manner as for painting. The wood to be polished should be first painted

with filler composed of 1 part of whiting mixed with 0.53 part of methylated spirit. After drying, it should be fairly sand papered. On the wood work thus treated a thin coat of french polish shall be applied and allowed to dry. After drying, the surface shall be lightly rubbed with a fine sand paper prior to the second and third coats. The surface shall show an even polished surface and be approved by the Employer/Consultants.

i) Rates to include:

Similar to that of painting.

ii) Mode of Measurement:

Similar to that of painting.

16.A Waterproofing treatment to roofs:

A.1 Material:

a) Waterproofing compound conforming to IS 2645 of latest edition, cement, brick bats, sand etc. of approved quality.

A.2 Preparation of surface

The roof and sunken floor surface and vertical wall surfaces shall be thoroughly cleaned with wire brushes. All loose scales shall be removed and chipped of to receive cement plaster and cement slurry.

A.3 Laying of Treatments

A.3.1 Horizontal Surface

a) One layer cement slurry with admixture of waterproofing compound conforming to IS 2645 of required quantity to be spread on the prepared surface.

b) Cement mortar (1:4) of required thickness as specified in the Schedule of Quantities shall be laid with admixture of waterproofing compound conforming to IS 2645 of latest edition as per manufacturer's specification.

c) A layer of brick bats (coba) of required thickness as specified in the Schedule of Quantities is to be laid over the mortar layer to get the required gradient for drainage. The joints between the brick bats shall be kept between 15 to 25 mm. wide. Joints are to be filled with cement slurry / cement mortar (1:4) with admixture of waterproofing compound of required proportion as per manufacturer's specification. Thereafter curing shall be done for two days.

d) The top surface is to be finished smooth with cement plaster (1:4) of required thickness with admixture of waterproofing compound as per manufacturer's specifications. Thereafter curing shall be done for two weeks.

A.3.2 Vertical surface / side wall

a) One coat cement slurry with admixture of waterproofing compound conforming to IS 2645 of required quantity to be applied on the prepared surface upto required height or as shown in the drawing.

b) One layer of cement plaster (1:4) with admixture of waterproofing compound as per manufacturer's specifications. Curing shall be done for two weeks.

A.3.3 Junction of Horizontal and Vertical surface

a) A vatta (Gola) of specified design as shown in drawing shall be made with brickbats and cement mortar (1:4) with admixture of waterproofing compound as per manufacturer's specifications.

b) One layer of cement plaster (1:4) with admixture of waterproofing compound as per manufacturer's specifications. Curing shall be done for two weeks.

Note

i) The proportion of waterproofing compound to be used in respect of ordinary Portland cement shall be minimum one percent by weight of cement.

ii) The above specifications are for general guidance any additional treatment is required to provide 10 (ten) years guarantee shall be provided at no extra cost.

iii) Work shall be executed through specialized firm viz. M/s. Overseas Waterproofing Corporation, M/s. India Waterproofing Co., Mumbai.

iv) Treatment to vertical surface for the sunken floor shall be provided on completion of plumbing work.

A.4 Rates to include

a) All labour, materials, equipment and different methods of operation necessary to complete the work including preparation of surface.

b) All necessary measure/additional treatment if required for 5 YEARS guarantee as per specifications of the specialized firm.

A.5 Mode of Measurement

The measurement shall be in square metre for actual area treated.

A.6 Guarantee:

10 (Ten) years guarantee shall be provided on non judicial stamp paper of Rs. 100.00 only at the approved Proforma enclosed with the tender, duly signed by the Main Contractor and the specialized firm who have executed the work.

In the unlikely event of treatment becoming necessary subsequently during the guarantee period, required inspection and treatment shall be carried out free of cost by the contractor.

16.B Waterproofing treatment to sunken floor, covered terrace etc. with Polyurethane coatings

B.1 Waterproofing treatment to Sunken floor in four layers (1st layer cement slurry with waterproofing compound conforming to IS 2645 as per manufacturer's specification, 2nd layer 20 mm. thick cement plaster 1:3 (1 cement : 3 coarse sand) with waterproofing compound as per manufacturer's specifications, 3rd layer applying blower upon or / residual bitumen and 4th layer PVC sheet.

Material

Clear the surface, wet the RCC surface. Apply 1st course of applying cement slurry over the wet surface @ 4.4 kg. / Sqm. As per approved manufacturers proportion. 2nd course of 20 mm. thick cement plaster 1:3 (1 cement: 3 coarse sand) mixed with waterproofing compound as per approved manufacturer's specification over the cement slurry over the wet surface, 3rd course to be applied on the plaster surface when the surface shall be thoroughly dry after cleaning surface properly and apply blower or / residual bitumen hot at 1.7 kg. / Sqm. Of area to be covered. The 4th course of 400 micron thick PVC sheet of approved quality overlaps at joints of PVC sheet should be 100 mm. wide and rested to each other with bitumen @ 1.7 kg. / Sqm. The rates to be coated with necessary tools and tackles with materials and labour.

B.2 Preparation of surface

The flat surface and vertical wall surface upto 250 mm. from level shall be thoroughly cleaned with wire brushes. All loose scales shall be removed and chipped of to receive cement concreting screeding.

B.3 Rates to include

a) All labour, materials, equipment and different methods of operation necessary to complete the work including preparation of surface.

b) All necessary side and end laps as per manufacturer's specification.

B.4 Mode of Measurement

The measurement shall be in square metre for actual exposed area covered by all coarse.

B.5 Guarantee

10 (Ten) years guarantee shall be provided on non judicial stamp paper of Rs. 100.00 only at the approved Proforma enclosed with the tender, duly signed by the Main Contractor and the specialized firm who have executed the work.

In the unlikely event of treatment becoming necessary subsequently during the guarantee period, required inspection and treatment shall be carried out free of cost by the contractor

17. Iron Mongery:

17.1 Rain water pipes and Spouts:

The rain water pipes where shown on the drawings shall be iron pipes (heavy), of the diameter as specified in the Schedule of Quantities, of approved manufacturer with socketed ends jointed as follows:-

a) For heavy cast iron pipes with spun yarn upto half the socket depth and the balance packed with cement mortar (1:2).
Where required these are to be run in the chase left or cut in wall, columns slabs. For exposed lengths of pipes those are to be neatly secured clear from the finished wall face with clip or bracket, nailed or screwed to hard wood tapering plugs embedded in walls.

All cast iron rain water pipes must have shop coat of anticorrosive paint. The exposed cast iron pipes shall be painted to outside with two coats of synthetic enamel paint of approved shade, colour and manufacture over a coat of yellow zinc chromate primer.

The mouth of the rainwater pipe shall be fixed with C.I. grating and the pipe jammed in position in 1:2:4 cement concrete with stone chips and neat finish on the surface.

The rate for the work shall include supplying and fixing of materials, cutting, making chases, mending, 2 coats of painting over a coat of yellow zinc chromate primer, jointing, etc. and for the complete work in all respects. Unless otherwise specified in the Schedule of Quantities, the rate

shall also including supplying, fixing and jointing etc. all the specials required for the complete work.

Rain water spouts shall be G.I. pipes (medium) cut to exact length as per drawing or direction of the Employer/Consultants and fixed in position in 1:2:4 cement concrete the adjoining surface being finished in neat cement. The exposed faces shall be painted with 2 coats of painting over a coat of yellow zinc chromate primer.

17.2 Cast Iron Spun Rain Water Pipes (A Class):

17.2.1 Pipes:

The rain water pipes where shown on the drawings shall be cast iron spun pipes (A Class), of the diameter as specified in the Schedule of Quantities, of approved manufacturer with socket and spigot ends and shall conform to I.S. 1536 of latest edition in all respects. The pipes and specials shall be suitable for jointing with lead unless otherwise specified and only one standard special shall be used.

17.2.2 Joints:

Jointing of the pipes and specials shall be lead caulked joint. The spigot shall be carefully centered in the socket by two or three laps of treated spun yarn (soaked into hot tar or bitumen and dried) twisted into ropes of uniform thickness, wall caulked into the back of the socket, leaving the requisite depth for the lead. Lead shall be rendered thoroughly fluid and each joint shall be filled in by pouring.

Unless otherwise stated the quantity of lead and spun yarn for each joint in cast iron pipes and fittings shall be as under:-

| Diameter of pipe in mm. | Weight of lead in kg. per joint | Weight of spun yarn in kg. per joint |
|---|---|---|
| 150 mm. | 3.4 | 0.2 |
| 200 mm. | 5.0 | 0.30 |
| 300 mm. | 7.2 | 0.48 |

The above quantity of lead and spun yarn given above are provisional and a variation as permissible as per I.S. 3114 of latest edition.

17.2.3 Testing of Joints:

All joints shall be made leak proof. Test shall be carried out by filling the system with water by plugging the outlets suitably. Any defects is visible shall be cut and made good as per direction.

17.2.4 Laying/Fixing of Pipes:

Vertical stack of the pipe line including specials shall be secured by fixed to wall by providing special type of clamps made for the purpose with 40 x 6 mm. m.s. flat as per drawing and the clamps shall be fixed to wall by cement concrete (1:2:4), including cutting wall and mending good to damages to match with the adjacent surface.

17.2.5 Painting:

All the exposed pipelines shall be painted with two coats of synthetic enamel paint of approved shade and quality over a coat of yellow zinc chromate primer. Inside face of pipes and fittings shall be painted with two coats of anticorrosive paint having tar or other suitable base.

17.2.6 Rates to include:

Apart from other factors mentioned elsewhere in this contract, the contractors' quoted rate shall include for the following:

a) All cutting to length, labour, hoisting and fixing in position.

b) Cost of all materials including wastage, cast iron gratings, clamps, cast iron grating, jointing materials.

c) Cutting wall, mending good to damages and jamming materials.

d) Tools and Plants, equipment.

e) Scaffolding and work at all levels.

f) Testing of joints.

g) Painting as specified.

17.3 M.S. Grills, Railing and Gates:

M.S. grills; railings and gates shall be fabricated and fixed in position strictly as per design and drawings. All intersections or meetings of all members shall be welded and the workmanship shall be high grade quality to the entire satisfaction of the Employer/Consultants. After fixing in position, these shall be cleaned off dust, dirt, rust or scales and rubbed with emery and an anticorrosive priming coat with yellow zinc chromate shall be applied.

The rate for M.S. grills to window shall also include the cost of wood screws to be used for fixing, for M.S. railing the cost of 1:2:4 cement concrete for jamming the hold fasts of the railing. The rate is for the complete work in all respects.

18. Collapsible Gate

The components of the collapsible steel shutters shall be of mild steel. Shutters shall be manufactured as per the following specifications.

Top and bottom guide rails shall be 40 x 40 x 12 mm. Tee, vertical channels of size 20 mm. x 10 mm. x 2 mm. (@ 3.50 kg./m.) at 100 mm. apart in fully stretched position and 20 mm. x 5 mm. M.S. flat as collapsible bracings properly rivetted and washered including 38 mm. steel rollers including locking arrangements.

Collapsible gate will be of approved manufacturer. The rate should include the cost of rails, runners, channels including locking and hanging arrangements. It will be fitted and fixed in position with lugs set in cement concrete and including cutting necessary holes, chasing etc. in wall floors etc. and making good damages including one coat of yellow zinc chromate primer complete. The rate shall be inclusive of all these operations unless otherwise mentioned in the schedule of quantities.

19. Rolling Shutters:

General:

Rolling shutters shall be supplied in the following alternative types of as specified in Schedule of Quantities. The shutters shall be complete with accessories. The fixing arrangement shall be as per the drawing with regard to whether it shall be fixed on the inside or outside between jumbs of opening, on or below the lintel, etc.

a) Self coiling type (Push and Pull type or manually operated type). It shall be used upto a maximum of about 8 sqm. Clear area without ball bearings and upto area of about 12 sqm. with ball bearings.

b) Gear operated type (Mechanical type : It shall be fitted with ball bearings. It shall be used upto a maximum of about 25 sqm. clear area, if the rolling shutter is operated by a bevel gear box and crank handle and upto a maximum of about 35 sqm. clear area, if the rolling shutter is operated by chain wheel and hand chain mounted directly on the work sheft.

Shutter shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm. wide for shutters upto 3.5 m. width and not less than 1.25 mm. thick and 80 mm. wide for shutters 3.5 m. in width and above unless otherwise specified.

The guide channels shall be of mild steel deep channel section and of rolled pressed or built up (fabricated) joint less construction. The thickness of shee used shall not be less than 3.15 mm.

Hood covers shall be made of mild steel sheets not less than 0.90 mm. thick. For shutters having width 3.5 m. and above, the thickness of m.s. sheet for the hood cover shall be not less than 1.25 mm.

20. Standard Specifications:

Unless otherwise specified elsewhere in this contract, all work under this contract shall be carried out in accordance with the technical specification and the latest issue of the Indian Standard Specification applicable to the particular class of work. If Indian Standards are not formulated for any particular material of work, the relevant British Standard Specification shall apply. Relevant issue of I.S. specifications applicable to the particular work have been described along with the specification for the respective works. In case of any confusion or dispute regarding meaning and interpretation of any specification for the respective works, the decision of the Employer/Consultants shall be final and binding on the contractor.

## LIST OF MATERIALS OF APPROVED BRAND AND/OR MANUFACTURER

### CIVIL WORK

| Sl. No. | Description | | Approved Brand/Manufacturer |
|---|---|---|---|
| 1. | Ordinary Portland / Blast Furnace Slag Cement of 53 grade | : | Century, Lafarge, Ambuja, Grasim, Ultratech. |
| 2. | Steel | : | TATA, SAIL, VIZAG STEEL (VSP) |
| 3. | Vitrified Tiles (Matt finish) any suitable & approved size | : | Naveen, Bell, Kajaria, Somany |
| 4. | Ceramic Tiles – Floor & Dado any suitable & approved size | : | Kajaria, Somany, Bell |
| 6. | Floor Hardening Compound | : | Kironite, Ironite, Feronite, Floronite. |
| 7. | Flush Door Shutters | : | Approved manufacturer with ISI mark. |
| 8. | Plywood for Panel Doors | : | Green Ply, Century, Kit Gold, Globe |

| | | | |
|---|---|---|---|
| | | | withISI mark. |
| 9. | Waterproofing Compound | : | :M/s. Structural Waterproofing Co. Pvt. Ltd.<br>M/s. Sika Qualcrete Pvt. Ltd.<br>M/s. Choksey Chemicals Pvt. Ltd.<br>M/s. Pidilite Industries Ltd.<br>M/s. Pagel Concretech Technologies (P) Ltd. |
| 10. | Rolling Shutter | : | Approved manufacturer with ISI mark. |
| 11. | Collapsible Gate | : | Approved manufacturer. |
| 12. | Aluminium Doors, Windows, Curtain Wall, Structural Glazing Structural | : | M/s. INDAL / BECO or equivalent Structural Glazing : Wicona Glazing |
| 13. | Synthetic Enamel Paints, Distemper, Plastic Emulsion Paints | : | ICI, Berger Paints (India) Ltd.<br>Asian Paints Ltd. |
| 14. | Kiln Seasoned and Chemically treated timber and factory made panel door shutter | : | Approved manufacturer. |
| 15. | Glazing | : | M/s. Modiguard.<br>M/s. Tribeni Glass.<br>M/s. Window Glass.<br>M/s. Gujarat Gurdain Ltd. |
| 16. | Door Closer | : | Ranjan,Everite,Garnish,Tiger, niversal. |
| 17. | Paver Block | : | Eurocon / Pavit / Altra |
| 18. | Lock | : | Godrej / Dorset |
| 19. | Laminates | : | Royale Touche<br>OPTUS Laminates, VIRGO Industries |

## Technical Specification
## of 11kV, 26.3kA, 630A Vacuum Circuit Breaker Switch Board:-

### SWITCHBOARD DETAILS:-

The 11 kV VCB switchboards shall be of floor mounting, sheet steel clad, free standing, and dust and vermin proof, compartmentalized type VCB switchboard. The switchboard shall be suitable for 11 kV, 3 Ph., 3 W, 50 Hz , AC system and complete with 3AH0 Breaker (11 kV VCB), air insulated Cu Bus bar of 60X10 sq.mm size and suitable for a short circuit capacity of 26.3 kA for 1Sec. Switchgear should be as per latest IEC 62271-200. All the compartments of the panel should be segregated from each other by means of earthed metallic sheet steel. The shutters which should be provided for safety purpose must also be of earthed metallic sheet steel only. The shutter mechanism should be coupled with the movement of the withdraw-able truck and not with the contact arm of the breaker. Except the bus bar compartment, all the compartments of each cubicle should be independent from the similar compartment of the adjacent panels.
The bus bar compartment should run from end to end without any inter-panel barriers so as in the event of internal arc inside the bus bar compartment, the arc will travel along the length of the switchboard. The width of each panel in the switchboard should not be less than 600mm. The 8MV88 Plus switchboard will be painted with light grey, shade no. RAL 7032, both inside and outside with IP-4X ingress protection. The switchboard shall comprise with

### 11 KV, 630A, 26.3KA HT INDOOR THREE-PANEL VCB SWITCH BOARD

### High-Voltage door:-.

During switching operations, the high-voltage door should remain closed and mechanical interlock should prevent opening of door when the switching device is in service and is switched ON.
The position of the withdraw-able section, the CLOSED/OPEN switch position of the switching device, the operating cycle counter and the “spring charged” indication should be visible through pressure-resistant inspection windows in the high-voltage door.

### Withdraw-able parts (Truck with Switching Device):-

The minimum rated current of VCB must be 630A for future provision. The different panels should be equipped with the following switching devices / functions as per requirement:
Withdraw-able vacuum circuit-breaker section (Truck mounted VCB) Withdraw-able PTs.
Vacuum circuit-breakers can able to be CLOSED or OPENED with high-voltage door closed both in test and in service position.
The shutter mechanism should be coupled with the movement of the withdraw-able truck and not with the contact arm of the breaker.
The low-voltage wires between the withdraw-able part and the low-voltage compartment should be connected through a 32/64 pin LV plug connector.
Withdraw-able parts should be able to be easily be taken out or moved into the panels on a collapsible ramp by means of a truck. Withdraw-able truck can be able to easily racked-in or racked out from Test to Service or service to test within the panel, by means of a crank lever mechanism. The breaker should not be turned "ON" or "OFF" in any position other than "Test" or "Service" Position. The rack-in and rack-out operation can only be performed with a double-bit key. Rack-in and Rack-out mechanism without such a key is not at all acceptable.

**Switching device compartment:**

When the withdraw-able part is moved, positively driven metal shutters should open or close automatically. The shutters must cover the fixed contacts comprising round copper bars in epoxy encapsulation connecting to the bus bar compartment and to the cable compartment in a safe-to-touch manner.
The withdraw-able part compartment must have metal partition walls to the bus bar compartment, to the connection compartment and to adjacent panels.
Withdraw-able voltage transformers with primary fuses should be mounted in the cable compartment and can be withdrawn from the front after removing the circuit breaker as per requirement. PT in the VCB chamber truck or top bus mounted PT is not at all acceptable.
A wiring duct for low-voltage wires should be arranged on the left side in the withdraw-able part compartment and covered with removable metal covers.

**Switching devices**

The switching device must be Vacuum Circuit Breaker. The Vacuum Interrupter rating shall not be less than 630A.The mechanism is provided with Motor Spring Reserve Drive (MSRD) with gear box arrangement. The gear box should be sealed for the lifetime.
A suitable mechanical de-latching facility must be provided for the spring charging mechanism so that in the event of failure of spring charge limit switch, the drive mechanism will get automatically de-coupled.
An anti-pumping auxiliary contactor should be an integral part of the Circuit Breaker operating mechanism itself.

Mechanical ON/ OFF push buttons are provided for emergency purpose so that the same can be operated in the event of control supply failure without opening the VCB compartment front door.
The Switching device of same rating is interchangeable.

The drive mechanism must match perfectly with that of the Vacuum Interrupter.
The Trolley mounted VCB Manufacturer and the Vacuum Interrupter Manufacturer must be same.

**Service Condition:**

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under following tropical conditions: -
i) Max. Ambient air temperature (dig. C): 40
ii) Min. Ambient air temperature (dig. C) : 10
iii) Maximum Relative Humidity (%) : 100
v) Installation: Indoor (IP4X)

**Main Technical features of VCB:**

a) Rated Voltage-11kV
b) Maximum Voltage: 12 kV
c) Rated Power frequency withstand Voltage-28kV
d) Rated Impulse Withstand Voltage-75kVp
e) Rated short time withstand current (rms)1 sec-26.3kA
f) Rated peak withstand current- 66kA
g) Rated short circuit breaking capacity-26.3kA
h) Rated frequency-50 Hz

**The VCB Panel should comprise of following-**

- Fabricated Housing.
- Automatic safety shutter mechanism should be coupled with the movement of the withdrawable truck and not with the contact arm of the 3AH0 breaker.
- Triple pole horizontal isolation and horizontal draw-out type VCB.
- Mechanical interlock.
- The shutter mechanism should be coupled with the movement of the withdrawable truck and not with the contact arm of the breaker.
- Thermostat control Space Heater 230V A.C.
- 3 Nos. Current Transformers of dual core and class of accuracy-1.0 having CTR: -100-50/5-5A, Cl:1.0, 5P10 with 15VA Burden for both core
- 11kV/rt3 /110V/rt3, 3 Ph draw out, dry type potential transformer mounted in the cable compartment with suitable VA Burden and class of accuracy complete with HT & LT Fuses- 96sqmm. Digital Ammeter with selector switch.
- 96sqmm. Digital Voltmeter with selector switch.
- 96sqmm. Digital Multi-function Meter as Load Manager. The MFM should have the following parameters : V(L-L & L-N), A, PF(for 3-Phases), Frq, kW(for 3-Phases), kVA(for 3-Phases), kVAR(for 3-Phases), System Phase Angle, kWh (Import, Export), kVAh, kVARh(Import, Export), RPM, Hour Run, Max and Min System Voltage/ Current, no of auxiliary interrupt, kVA Demand, Kw Demand(Import, Export), Max. kW (Import, Export) / KVA/ Current Demand.
- Numerical non-communicable 3 O/C+ 1 E/F IDMTL Type Protection Relay with High Set Instantaneous unit with In-Built Trip Circuit Supervision Feature.

- Master trip relay.
- 2 Nos.3-Element Auxiliary Relay (for WTI Alarm & Trip).
- Red / Green/ Amber/ Blue/White Indicating lamps for ON / OFF /TRIP /SPRING CHARGE /TRIP CKT HEALTHY/R, Y, B Phase Indication/AC On/ DC on indication in the 8MV88 Plus panel.
- Pistol Grip, Spring Return, Breaker Control Switch (T-N-C).
- Power Pack for 110V DC control supply for Closing & Tripping Coil, Relays, Indication Lamps.
- Power Pack to be fed from the secondary side of the potential transformer.
- Buzzer for fault indication with accepts push button.
- Push Button for Emergency trip.
- Panel Illumination lamp.
- Other Misc items like Space Heater, Thermostat, fuse etc.

## Technical Specification for DRY TYPE (CAST RESIN) TRANSFORMER:

### SCOPE

The specification covers design manufacture, testing packing and delivery of 3 phase 50 Hz Dry type Cast resin distribution transformer of rating 315KVA – 11/0.433 KV
It is not the intent to specify completely herein all the details of the design and construction of equipment. However the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation upto the Bidder's guarantee, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.
It is intended to embrace the latest & best technology available in the market & hence dilution in the specification below is not accepted. Any Manufacturer / Contractor shall not approach for any deviation from below specification. If found doing so, the consideration of manufacturer / contractor as bidder shall be cancelled.
The manufacturer should have manufacturing base in India or should offer from product from Plant based out in Europe. Product manufactured in china , korea are not accepted

### TOLERANCES:

Tolerances onallthedimensionsshallbeinaccordancewithprovisionsmadein therelevant IS/IECstandards/ and inthesespecifications.

### GUARANTEE:

The equipment shall be guaranteed for the period of two years from the date of commissioning. The equipment found defective within above guarantee period shall he

replaced / repaired by the supplier free of cost, within one month of receipt of intimation.

**SYSTEMPARTICULARS:**

The transformers shall be suitable for indoor installation with following system particulars and should be suitable for service under fluctuations in supply voltage as permissible under Indian Electricity Act & Rules there under.

a) NominalSystemVoltage : 11kV
b) CorrespondingHighestSystemVoltage : 12kV
c) Neutralearthling : Solidlyearthed
d) Frequency :50Hzwith±3%Tolerance

**SERVICECONDITIONS:**

Equipment to be supplied against the specification shall be suitably design to work satisfactorily under following tropical conditions:-

| | | |
|---|---|---|
| Maximum ambient temperature (Degree Celsius) | : | 45 |
| Minimum ambient temperature (Degree Celsius) | : | 10 |
| Relative humidity (% range) | : | up to 95% |
| Altitude | : | <1000metres |

The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitably designed to work satisfactorily under these conditions.

**STANDARDS**

ThematerialsshallconforminallrespectstotherelevantIndian /InternationalStandardSpecification, withlatestamendmentsthereof;someofthemarelistedbelow:

| | | |
|---|---|---|
| a. | IS: 5 | Coloursforreadymixedpaintsandenamels. |
| b. | IS:1180 | Threephasedistributiontransformersuptoand including100kVA,11KV |
| c. | IS:11171/IEC 60076-Part 11 | Dry type transformer |
| d. | IS:2099 | Bushing |
| e. | IS:3347 | Dimensionsforporcelaintransformerbushingforusein normallyandlightlypollutedatmospheres |

Material 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 material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authenticEnglishtranslationsshallbefurnishedalong withtheoffer.

**SPECIFICTECHNICALREQUIREMENT:**

**1.0** StandardKVARatings:-

**1.0.1** Thestandardratingsoftransformersshallbe 315KVA ,11/0.433KV

**1.1** Nominalvoltageratings

i) Primaryvoltage -11kV

ii) Secondaryvoltage - 0.433kV

**1.2** ThewindingsofthetransformersshallbeconnectedtoDelta(Δ)ontheprimarysidean d star (Y)onthesecondary side.TheneutraloftheLTwindingshallbebroughtouttoaseparate terminal.ThevectorgroupshallbeDyn11.

**1.3** PercentageImpedance: 6.25% at75degC(subjecttoIS tolerance)

**1.4** TemperatureRise;

i) Averagewindingtemperatureriseoveranambienttemperatureof50deg.Cs hall notexceed90°C by resistancemethod.i.e.Max.Temperature ofwinding shall notexceed155°C.

ii) Core,metallicpartsandadjacentmaterialshallinnocasereachavaluethatmay damagethis materialorreducetheirlifeexpectancies.

## DESIGN & CONSTRUCTION

## CORE

ThecoreshallbeofPrime gradecoldrolledgrainoriented(C.R.G.O)annealedsteel lamination, havinglowlossandgoodgrainproperties, coatedwithinsulation,bolted togethertotheframesfirmlytopreventvibrationornoise.Allcoreclampingbolts shallbeeffectivelyinsulated. Thecomplete designofcoremustensurepermanency ofthecorelosseswithcontinuousworkingofthetransformers. Transformer shall be of BOLTLESS core design.

Core shall be purchased Directly from Manufacturer or from their accredited Marketing organization of Repute & not through any agent. Bidder has to submit manufacturer's name during bidding having sufficient credential & Core has to be purchased from the approved manufacturer.

Stage inspection of the core shall be done at manufacturer's premises & inspection call shall be given with following Documents

a) Invoice of the supplier
b) Mill's test certificate
c) Packing list
d) Bill of landing & Bill of Entry certificate by customs

## WINDING:

H.V. &L.V.Coils

i) HV coil should be casted with epoxy resin & should be premixed with active filler which should make the coil self extinguishing & should comply to fire behavior class F1 as per IEC 60076

ii) LV Winding LV Winding shall be made from Copper / Aluminum Foil Pre Impregnated with class F epoxy resin so as to have lower stray losses & higher withstand capacities under bolted short circuit conditions

iii) Manufacturer should comply to Climatic test category of C2 & Environmental category of E3 as per IEC 60076 so as to withstand changing climatic variations & should able to withstand high degree of pollution & humidity up to 95%

iv) Transformer shall be self extinguishing – F1 Certified as per IEC 60076-Part 111

**CLEARANCES: Clearances provided shall be strictly as per IS 11171 / IEC 60076**

**H. T. & L. T. BUSHING:**

For 11KV Bushing will be used and for 433 volts, 1 kV Bushing shall be used. Bushing of the same voltage class shall be interchangeable. Bushing with same plain shades as per IS 3347 amended up to date shall be mounted on the side of the enclosure and not on the top cover. Only sheet metal pocket shall be provided for mounting of HV bushing and the same shall not be fixed on pipes. Sheet metal pocket shall be designed in such a way that all HT bushing shall be remaining parallel and equidistance throughout. Bushing having type tested as per IS 3347 amended up to date shall only be acceptable.

**TERMINAL MARKING PLATES AND RATING PLATES:**

Terminals shall be provided with terminal marking plates. The transformer shall provide with riveted rating plate of minimum 8 SWG aluminum anodized material sheet in a visible position. The entries of the rating plate shall be indelibly marked (for example by etching, engraving or stamping).

The marking as 'DSIR.' and ' Sr. No….' of Transformer will be engraved on Transformer enclosure, below L.T. Bushings.

The name of the company, order No., capacity, month and year of manufacturing shall be engraved on the enclosure of transformer just below the nameplate clearly visible. The engraving can be done on separate plate which shall be firmly welded to enclosure and shall form integral part of the enclosure.

*C2/E2/F1 shall be engraved in the rating plate.*

**TECHNICAL PARAMETERS OF 315KVA DRY TYPE 11KV/415V, THREE PHASE DISTRIBUTION TRANSFORMERS**

| | | |
|---|---|---|
| a) | Rating – | 315KVA |
| b) | Applicable standard | IS-2026 |
| c) | Cooling | AN |
| e) | Rated System Voltage | 11kV/433V |
| f) | Frequency | 50Hz with ± 3% tolerance |
| h) | Phases | Three |

| | | |
|---|---|---|
| i) | Impedance | 6.25% at 75deg C (subject to IS tolerance) |
| j) | Service | Indoor |
| k) | Duty | Continuous |
| l) | Overload Capacity | As per IS2026 |
| m) | Vector Group (Three Phase) | Dyn11 |
| n) | Tap Changer | Off Load Tap changer on HV winding ±5% in steps of 2.5% of taps by link |
| o) | Core Material | The core shall be built up with thin laminations of Prime grade. Non-ageing, low loss, high permeability cold rolled super grain oriented silicon steel. |
| P) | Climatic Class | C2 |
| q) | Environmental class | E2 |
| r) | Fire Class | F1 |
| s) | No load loss | 1.1KW (IS tolerance) |
| t) | Load Losses | 4.2 KW (IS Tol) @ 75 degree celcius & at full load |
| u) | IP degree | IP00 |
| v) | Dimension | L*B*H : 1760*1560*1890 mm |

**TESTANDINSPECTION:**

**ROUTINETESTS: Manufacturer's Lab should have NABL accreditation so as to ensure transformer's geniuneity on various design parameters**

**i)** Alltransformersshallbesubjectedtothefollowingroutinetestsatthemanufacturer'sworks.

**ii)** Thetestsaretobecarriedoutinaccordance withthedetailsspecifiedinIS2026orasagreed uponbetweenthepurchaserandthemanufacturer.

1. Measurementofwindingresistance.
2. Ratio,polarityandphaserelationship.
3. Impedancevoltage.
4. Loadlosses.
5. No-loadlossesandNo-loadcurrent.
6. Insulationresistance.
7. Inducedovervoltagewithstand.
8. Separatesourcevoltageswithstand.

**iii)** Alltheroutinetestsshallbeconductedinthesuppliers'laboratoryattheircost.

**iv)** Heatruntestshallbearrangedfreeofcostontheunitselectedfromthe1st lotbyemployer's representative. The test should be done at NABL accredited lab only

**v)** The calculations to confirm the thermal ability as per Clause no. 9.1 of latest IS: 2026 Part-I or equivalent International Standard shall be submitted to Inspecting Engineer.

vi) Partial discharge test shall be carried out on one transformer & value shall be less than 10 Pc

## DRAWINGS:

A set of following drawings shall be submitted by the Bidder.

i) General Dimensional drawing
ii) Coredetailsdrawing.
iii) Rating & Diagram Plate Drawing.
iv) HV/LV Bushings
v) Operation andMaintenanceManual.

## CLEANINGANDPAINTING:

Thesurfaceoftheenclosureshallbeproperly pre-treated/phosphateinasevenenclosure processandshallbeappliedwithapowdercoatingof40micronsthickness. Thepowder coatingshallbeofdarkadmirablygreencolourfortransformer. Powdercoatingshallbe suitableforoutdooruseonly.Theseventankprocessfacilityshallbeenhance toensure properqualityforoutdoorapplication.
Themonthandyearofsupplyshallbepaintedin**redboldEnglish**letteringatsome conspicuousplaceonthetransformer,whichshallbeclearlyvisiblefromtheground.

## Acceptancetests

Thetransformersshallbesubjectedtothefollowingroutine/acceptancetestin presenceofpurchaser's representative attheplaceofmanufacture beforedispatchwithoutanyextra charges.Thetestingshallbecarriedoutinaccordancewith IS: 1180andIS: 2026.

1. Checkingofweights,dimensions,fittingandaccessories,tank sheetthickness,oilquality, material,finishandworkmanshipasperGTP/QAPlanandcontractdrawings.
2. Physicalverificationofcorecoilassemblyandmeasurementof fluxdensityofone unitofeach rating,ineveryinspectionwithreferenceto shortcircuittestreport
3. Alltestsasspecifiedinclause6.1

## INSPECTION

Alltestsandinspectionshallbemadeattheplaceofmanufacturerandunlessotherwiseespecially agreed uponthemanufacturerandthepurchaseratthetimeofpurchase. Themanufacturershallaffordthe inspectorrepresentingthepurchaserallreasonablefacilities,withoutchargetosatisfyhimthat thematerial isbeingfurnishedinaccordancewithspecification.Themanufacturershallprovideallservicesto establishandmaintainqualityofworkmanshipin hisworks and that of his sub-contractors to ensure the mechanical / electrical performance of components, compliancewithdrawings,identificationandacceptabilityofallmaterials,partsandequipment asper latestqualitystandardsofISO 9000.

Alongwith thebidthemanufacturershallprepare QualityAssurance Plan identifyingthevariousstages of manufacture, qualitychecksperformedateachstageandtheCustomerholdpoints. Thedocumentshall alsofurnishdetailsofmethodofchecking,inspection andacceptancestandards/values andgetthe approvalofpurchaserorhisrepresentative beforeproceedingwithmanufacturing. However,purchaseror hisrepresentative shallhavetherighttoreviewtheinspection reports,qualitychecksandresultsof manufacturer's inhouseinspectiondepartmentwhicharenotcustomerholdpointsandthemanufacturer shallcomplywiththeremarksmadebypurchaserorhisrepresentativeonsuchreviewswithregar dsto furthertesting,rectificationorrejectionetc. Manufacturershouldsubmitthelistofequipmentfortesting along withlatestcalibrationcertificatesto thepurchaser.
Purchasershallhaveeveryrighttoappointathirdparty inspectiontocarryouttheinspectionprocess. The purchaserhastherighttohavethetestcarriedoutathisowncostbyanindependent agencywhereverthe disputeregardingthequalityofsupply. Purchaserhasrighttotest1%ofthesupplyselectedeitherfrom the storesorfieldto checkthe qualityoftheproduct.Incaseofanydeviationpurchaserhaveeveryrightto rejecttheentirelotorpenalizethemanufacturer,whichmayleadsto blacklistingamongotherthings.

**QUALITYASSURANCEPLAN:**

TheBiddershallinvariablyfurnishfollowinginformationalongwithhisbid,failingwhichhisbids hallbe liableforrejection.Informationshallbe separatelygivenforindividualtypeofequipmentoffered.

i. Statementgivinglistofimportantrawmaterials,namesof sub-suppliersfortherawmaterials,list ofstandardsaccordingtowhichtherawmaterialsaretested.Listoftestsnormallyc arriedouton rawmaterialsinthe presenceofBidder'srepresentative,copiesoftestcertificates.
ii. Informationandcopiesoftestcertificatesasin(I)aboveinrespectofboughtoutac cessories.
iii. Listof manufacturingfacilitiesavailable.
iv. Levelofautomationachievedandlistofareas wheremanualprocessing exists.
v. Listofareasin manufacturingprocess,wherestageinspectionsare normallycarriedoutfor quality controlanddetailsofsuchtestsandinspection.
vi. Listoftestingequipmentavailablewiththebidderfor finaltestingofequipmentalong with validcalibrationreportsshallbe furnishedwiththebid.Manufacturershallpossess0.1class instruments for measurementoflosses.
vii. QualityAssurancePlan(QAP)withholdspointsforpurchaser'sinspectionasperA nnexure.

ThesuccessfulBiddershallwithin30daysofplacementoforder,submitfollowinginformationto the purchaser.

i. Listofrawmaterialsas wellasboughtoutaccessoriesandthe namesof sub-suppliersselected fromthosefurnishedalong withoffer.

ii. Typetestcertificatesofthe rawmaterialsandboughtout accessories.

Thesuccessful Biddershallsubmittheroutinetestcertificatesofboughtoutaccessories andcentral excise passesforrawmaterialatthetimeofroutinetesting.

## DOCUMENTATION

The Biddershall furnish along with the bid the dimensional drawings of the items offered indicatingallthefittings.

i. Dimensional tolerances

ii. Weight of individual components and total weight

## PACKING&FORWARDING

Thepackingshallbedoneas perthemanufacturer'sstandardpractice.However,itshouldbe ensured thatthepackingissuchthat,thematerial wouldnot getdamagedduringtransitbyRail/Road/Sea.
ThemakingoneachpackageshallbeasperthereIevantIS.

## TECHNICAL SPECIFICATION FOR MEDIUM VOLTAGE DISTRIBUTION PANEL:-

## DISTRIBUTION PANELS

Main Distribution Panels, Sub-Distribution Panels and Final Distribution shall be covered under this section. Panels/ Boards shall be suitable for operation on 3 Phase/ single phase, 415/ 240 volts, 50 cycles, 4 wire system with neutral grounded at transformer. All Distribution panels shall be CPRI tested design and manufactured by a approved manufacturer. CPRI certificate shall be made available.

## SCOPE

The scope of supply covers design, manufacture, testing and supply of Type-Tested Assemblies (TTA) as per IS 8623-1 / IEC 60 439-1 for Power & Motor Control Center for Voltages upto 1000 V. Distribution panels shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993.

### Standards Applicable:

The equipments covered under this specification shall conform to the latest revisions of relevant Indian and International Standards some of which are listed below.

IS 8623-1 1993 : Specification for low voltage switchgear & control gear assemblies
IEC 60439 / 61439 : Specification for low voltage switchgear & control gear assemblies
IS 61641 2008 : Specification for Internal Arc Containment test
IS 13947 1993 : General requirements of Switchgear and Control Gear for Voltage not exceeding 1000V AC or 1200V DC.
IS 11353 1985 : Guide for uniform system of marking Identification of Busbar and Terminals.
IS 13703 1993 : Low voltage fuses
IS 2705 1992 : Current transformers

IS 694 1990 : PVC insulated cables for voltages including 1100 V with Copper and Aluminum conductor).
IS 1248 198 : Direct Acting Electrical Indicating Analog
IS 8623 1993 : Low voltage Switch gear & control gear assemblies
IS 5082 : Electrolytic Aluminum & Aluminum bush bar, Trucking system, Rod tubes & sections for Electrical purposes.
IS 13779 1999/ : AC Electric Meters / Static Meters.

**Site Conditions**

1.1. Location - Tarapith
1.2. Altitude above main sea level - above sea level.
1.3. Maximum Temperature rise - As per IEC
1.4. Design Ambient Temperature- 45º C
1.5. Atmosphere - Dusty
1.6. Relative Humidity Max - 95%
1.7. Relative Humidity Min - 10%

**General Requirement and Selection of Components:**

- ✓ PMCCs can be of double Front and compartmentalized bolted construction.
- ✓ Degree of Protection for the Panels should be IP 40/42/54 in accordance to the location of the panel.
- ✓ All ACB panels shall be preferably single tier.
- ✓ Vertical bus bars of MCC panels shall be accessible from side of panel without removing feeder base plate.
- ✓ All Incoming ACB's shall be MDO / EDO Type.
- ✓ PMCC Incomer shall be Suitable for Top Bus duct entry / Top & Bottom cable connection.
- ✓ All Outgoing Air Circuit Breakers shall be of Manual / Electrical Draw-Out Type as specified in the SLD.
- ✓ All Outgoing MCCB/Motor Feeders shall be Non Draw-out type mounted on a single base plate for ease of removal.
- ✓ All ACBs shall have integral LSIG Protection thro Micro Processor based Release.
- ✓ The ACB & MCCB releases should be detachable & upgradeable at site.

***Construction Features:-***

- The switch board shall be metal clad sheet steel enclosed cubicle, fully compartmentalized, floor mounting type suitable for indoor installations. All the doors and covers shall be fully gasket to prevent any ingress of dust. The enclosure shall be for Indoor type and completely dust, damp and vermin proof. Gasket used for all doors shall be of double lip type.
- The switchboard cubicles shall have structural steel frame work enclosed on all sides and top by CRCA sheet steel of minimum thickness.
- The switchboard shall have integral base frame.
- Removable undrilled gland plates shall be fitted for bottom cable entry.
- All fixing bolts, screws etc. appearing on the panel shall be so arranged as to present a neat appearance.
- Door hinges shall be concealed type.

- Components shall not be mounded on side, bottom rear side plate in MCC feeder.
- Front access shall be available to all components in each cubicle which require adjustment, maintenance or replacement.
- Switchboard shall be suitable for Seismic zone III / V. The same shall be tested either at ERDA/CPRI only for seismic test. Test Certificate only from ERDA / CPRI acceptable & needs submission at the time of drawing approval.
- Switchboard shall be tested for Internal Arc Containment as per IEC 61641 for enhanced operator safety.

*Bus bars and insulating materials*

- **The bus bars connections and bus taps to individual feeders shall be by means of electrolyte Copper / Aluminium / Alstan bus bar suitably tested to conform to Type Tested Assemblies (TTA) as per IS 8623-1 / IEC 60439 -1 &2 to be quoted. Busbars shall be color coded for ready identification of phases. The busbar sizes shall be determined taking into consideration the continuous rating and fault level of 50 KA (1 sec) without exceeding the final temperature as per IEC.**

- Auxiliary busbars each of minimum 25 sq. mm thick electrolytic tough pitch copper shall be provided for following applications. Exact number of busbars shall depend on various controls, metering and auxiliary power distribution requirements.

a) Panel / Motor space heater supply – 230 V AC (2 wires)
b) AC / DC control supply for breaker tripping closing and indication circuits
c) Control supply for breaker spring charging motors, closing coil & indication-
d) Control supply for motor starter control circuits-

* Neutral Bus bar shall be provided in a separate compartment other then main busbar compartment
* The busbars shall be supported of regular intervals using FRP, SMC or DMC insulators It should have Very high Comparative Tracking Index (CTI > 600 as per IS 2824)
* Only zinc / blue passivated or cadmium plated high tensile strength steel bolts, nuts & washers etc., shall be used for all busbar joints & supports.
* The busbars shall be colour coded using identifying colour rings at regular interval. Red, Yellow & Blue colour shall be used for phases & Black for neutral. The earth busbar shall be identified with Green colour rings at regular intervals.
* Minimum clearance between phases / live parts shall be 25 mm and phases / live parts / neutral to ground shall be 19 mm except on the equipment terminals.
* Spare contacts shall be wired upto terminal block. Auxiliary contacts in the "trip" circuit shall close before the breaker main contacts close and shall open

after the main contacts have opened. All other contacts shall operate simultaneously with the main contacts.

* The circuit breakers shall be equipped with Integral Micro Processor based Numerical Relays which shall have current setting, ammeter digital display & bar graph indicating load level.

*Earthling*

Earthling - Two earth terminals shall be provided on each side of switchboard. An earth bar of at least 50 x 10 mm Aluminium suitable for 30kA for 1 sec. shall be provided. The earth bar shall be electrically continuous and shall run the full extent of each board. This earth bar shall be on the same side as the cable entry. Each unit shall be constructed to ensure satisfactory electrical continuity between all metal parts not intended to be alive and earth terminals of the unit. Suitable holes with bolts and nuts shall be provided at each end of earth bar of switchgear for connection to a main earthling grid. The earth bar shall be accessible in each cable entering compartment either directly or through a branch extension to ground the cable armor and shields. 10 mm Ø holes shall be drilled and hardware for connection provided through the earth bus.

***Internal Wiring:***

- ✓ Minimum size of conductor for power circuits shall be 2.5 sq. mm copper or 6 sq. mm aluminum.
- ✓ All control wiring except CT secondary wiring shall be carried out with minimum 1.5 sq. mm copper conductor. CT secondary wiring shall be carried out with 2.5 sq. mm copper conductor.
- ✓ All wiring shall be securely fixed and neatly arranged to enable easy tracing of wires.
- ✓ All terminal blocks and wires shall be tagged for identification in accordance with IS 11353.
- ✓ All wiring for external connections shall be brought out to the individual terminals on a readily accessible terminal block; all terminal block shall be shrouded or provided with transparent covers.
- ✓ Clamp type control terminal blocks shall be provided for outgoing control cables. Minimum 10% spare terminals shall be provided for future use. Control terminal block shall be separated from power terminal blocks by means of an insulating barrier.

***Cable Terminations and Marshalling Box:***

- ✓ Cable entry to switchgear shall be from bottom of the switchgear as specified in the technical particulars.
- ✓ Ample space shall be provided in the cable compartment to accommodate XLPE insulated aluminum conductor cable as specified in the technical particulars.
- ✓ Removable undrilled gland plate shall be provided for termination of Cables.

*Painting and Finishing*

All metal works and metal parts of the switchboards shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphatising, passivation and then sprayed

with a high corrosion resistant primer. The finishing treatment shall be by application of synthetic Light Grey Shade RAL7035.

***Name Plates & Label***

* One nameplate giving designation of the switchboard shall be affixed prominently on top. Details of designation shall be specified.
* Labels giving following details shall be affixed on each feeder panel:-
* Feeder No - As per feeder list
* Equipment tag Number and Description
* Rating (KW/KVA/AMP)
* All components whether mounted inside the switchboard or on the door shall be permanently and clearly labeled with reference number and/or letter of their function. These labels should be fixed so that they are easily visible.
* Labels for feeder panel designation shall be fixed on the front side of respective panels with Special rivet made of nylon. These labels shall be identical size to permit interchange.

***Testing and Inspection***

* All routine tests specified in relevant Indian Standards and witnessed by buyer.
* Vendor shall submit all following type test report as per IS 8623-1 / IEC 60439 / 61439-1&2 standards at the time of drawing approval / offer submission:
    - Short Circuit withstand test for main Busbar and neutral Busbar
    - IP test certificate for IP 54 /42 /40
    - Seismic test for Zone III / Zone V as classified on the Seismic graph of India for the project site location.
    - Internal Arc Containment test as per IEC 61641

* Operation of all meters.
* Secondary wiring continuity test with a low voltage (6 volts) tester.
* Insulation test with 1000 volts megger, before and after H. V. test.
    - H. V. test at 2.5 kV for 1 min..
    - Earth continuity test with a low voltage (6 volts) tester.
    - Simulating control circuits for various operations of feeders, remote indicating lights and other remote operations, if any.
    - C. T. Polarity Test.

## Technical Requirements - PMCC

### 1. General Requirements

| | | |
|---|---|---|
| 1.1. | Service | : Indoor |
| 1.2. | Enclosure | : CRCA sheet steel |
| 1.3. | Min Degree of Protection location of panel | : IP 54 / IP 42 / IP40 dependent on |
| 1.4. | Execution | : Single / Double front |
| 1.5. | Incomer ACBs & Bus Couplers | : Electrical Operated - Draw out |
| 1.6. | Outgoing ACBs | : Manual Operated – Draw Out |
| 1.7. | Outgoing / Motor Feeders specs) | :Non Draw-out&Drawout* (*separate |
| 1.8. | Extensibility | : Extensible on both sides |

### 2. Enclosure

| | | |
|---|---|---|
| 2.1. | Sheet steel thickness (mm) | : Base frame/ Channel – 2.5 mm<br>Load Bearing member - 2 mm<br>Internal partitions - 1.6 mm |
| 2.2. | Surface treatment | : 7 Tank surface treatment. |
| 2.3. | Painting | : Epoxy painted. |
| 2.4. | Paint shade | : RAL 7035 |

### 3. Main Busbar

| | | |
|---|---|---|
| 3.1. | Material | : Electrical grade Aluminum / Copper; type tested. |
| 3.2. | Rated continuous current | : As per SLD |
| 3.3. | Maximum operating Temperature | : As per IEC 60 439 / 61 439-1 & 2. |
| 3.4. | Rated short time current (KA- RMS) | : 65kA sym for 1 Sec. |
| 3.5. | Rated dynamic short circuit Withstand current (Peak) | : 135kA peak |
| 3.6. | Heat shrinkable sleeving | : Yes with Shrouds for Joints |
| 3.7. | Current rating of vertical busbar/ Droppers in vertical section | :As per requirement |
| 3.8. | Busbar support | : SMC/DMC |

### 4. Earth Bus

| | | |
|---|---|---|
| 4.1. | Material | : Aluminium/GI 50x10Sq.mmsize (min.) |
| 4.2. | Short circuit capacity (KA) | :30kA current for 1 Sec. |

### 5. Relay / Protection

ACBs - Incomers : LSING.
Outgoings : LSIG

Outgoing Distribution feeders : 75KW and above rating shall have Microprocessor Relay with Communication facilities to DCS

**6.0 Indicating Meters**

Given below are the functions of metering usually provided by conventional meters? These functions are envisaged to be performed by numerical type relays income and there will be a separate ammeter and voltmeter apart from numerical relay. All other feeders shall be having load manager as mentioned in the specification.

The requirements for meters are as follows:

| | | | |
|---|---|---|---|
| 5.1. | Type | : | Moving Iron type |
| 5.2. | Size | : | 96 Sq.mm |
| 5.3. | Scale | : | 240 Deg. |
| 5.4. | Input | : | 1 A for Ammeter |
| 5.5. | Type of connection | : | 3 Phase, 3 Wire systems. |
| 5.6. | Mounting | : | Flush |

**Wiring**

Type of wire : 1100V grademultistrand copper

Colour coding for AC and DC wiring : Required Size

: 1.5 sq.mm for control 2.5Sq.mm for CT circuits.

5.7 Ferruling : Cross ferruling required.

**7.0 Cables**

| | | |
|---|---|---|
| 1.1. | Power cable entry | :Bottom |
| 1.2. | Control cable entry | :Bottom |
| | Lugs and glands | :NA for power and control cable Terminations. |

**8.0 Tranducers**

- Output Range : 4-20mA DC Isolated
- Input : 1A, 110V AC / 1A
- Accuracy : 0.5% of full scale
- No. of Output : 2 Channels
- Load Resistance : 600 Maximum (Ohms).

## *SWITCHGEAR SPECIFICATIONS*

### *AIR CIRCUIT BREAKERS (ACB)*

**General**

Air Circuit Breaker should have 3/4-Poles, Electrically/Manually Operated Horizontally Draw out Type (EDO/MDO) as per single line diagram (SLD). The circuit breaker used in the circuit shall have breaking capacity 65 kA for 1 sec and Service Breaking Capacity of the breaker should be 100% of the Ultimate

Breaking Capacity (at 433V+/- 10%) and Short Time Withstand Capacity for 1sec. The ACB breaking capacity performance certificate shall be submitted for category B according to IEC 60947-2.

ACB shall be rated for operational voltage Ue upto 433V, Insulation voltage Ui: 1000V and impulse withstand voltage Uimp of 12KV. Air circuit breaker main contacts shall be encased in reinforced polyester casing and shall offer double insulation from the operator at breaker front face. ACB shall be fully tropicalized as standard.

ACB must be maximum 2 cycle breaker i.e. breaking time (Opening time arcing time) must be within 40 ms. Any breaker with more break time shall not be accepted. Closing time shall be ≤ 80ms. ACB shall preferably be equipped with inbuilt making current release so that breaker closing of fault trips instantaneously and minimum effect goes to the main contact of the breaker.

Arc chutes of the ACB shall be equipped with metallic filters to reduce effects perceptible from the outside during current interruption and zero safety clearance is required around the ACB.
The draw-out operation shall be possible through closed door.

Three positions of the moving part shall be possible:

1 - Connected position - all auxiliary and main circuits engaged

2 - Test position - all auxiliary circuits engaged all main circuits disconnected

3 - Isolated position - all circuits disconnected.

Construction

## General features

Air circuit breaker shall be designed in such a way that maintenance may be carried out as a function of their use. To ensure reduced maintenance, electrical durability (without maintenance ) at 433V at In shall be minimum 6 000 cycles up to 2000A, 5000 cycles from 2500A to 4000A and 1500 cycles for values greater than 4000A. Mechanical durability (without maintenance) shall be minimum 10000 cycle's upto 4000A and 5000 cycles above it.

No safety clearance shall be required around draw out circuit breakers.

The operating mechanism shall be of the Open/Closed/Open stored-energy spring type. The closing time shall be less than or equal to 70 ms.

Air circuit breakers shall of Molded case technology i.e. main contact shall be encased in a reinforced polyester casing and offer double insulation from the operators on the breaker front face.

## Main contacts

The main contacts shall be designed such that no maintenance shall be required under normal conditions of use.
The main contacts shall be equipped with a visual wear indicator that may be accessed by removing the arc chutes, for immediate assessment of contact wear without requiring measurements or specific tools.

## Arc chutes

The arc chutes shall be removable on site.
Arc chutes shall be equipped with metallic filters to reduce effects perceptible from the outside during current interruption.

## Draw out mechanism

The draw out operation shall be possible through a closed door.
Three positions of the moving part shall be possible:
1- Connected position - all auxiliary and main circuits engaged
2- Test position - all auxiliary circuits engaged all main circuits disconnected
3- Isolated position - all circuits disconnected.

## Safety requirements

**1.** A door interlock shall be provided so that it shall not be possible to open the door until the air circuit breaker moving part is in the disconnected position.

**2.** Insulated safety shutters shall be provided over the incoming and outgoing main circuits and over the auxiliary circuits. An interlocking shall be provided to prevent insertion of a circuit breaker having a rating higher than the current rating of the fixed part, into that fixed part.
**3.** The racking handle shall be showed on the air circuit breaker in such a manner as to be accessible without defeating the door interlocking.
**4.** The rack-in or rack-out operation shall be interlocked in such a manner that the breaker should automatically locked in disconnected, test and connected position and any changes in position can be initiated only after pushing the acknowledgement push button. Visual indication shall also be there to know the position of the breaker.

**Electrical auxiliaries**

All electrical auxiliaries i.e. Shunt Trip, Under voltage, Closing Coil should have tool less connector with dedicated slots with window to identify the auxiliaries without opening the front cover and their position should in the front panel to guaranteed the separation between Power & Control circuits and also Motor operator shall be field adaptable without adjustment or the necessity for any tool (except a screwdriver). They shall be fitted into a compartment which under normally loaded conditions has no metalwork energized from the main poles exposed with it. Any adaptation carried out thus shall not increase the breaker volume. It shall be possible to connect all auxiliary wiring from the front face of the air circuit breaker, this wiring shall be taken through a set of disconnecting contacts, so that all auxiliary wiring is automatically disconnected in the isolated position. Shunt trip and closing coil of continuous rating suitable for 230V AC shall be provided. ACB shall be 230V AC motor operated spring charged accessories fitted in it.

**Mechanical indicators**

Mechanical indicators on the front panel of Air circuit breakers shall indicate the following status conditions:

1. “ON” (main contacts closed) Spring charged.
2. “ON” (main contacts closed) Spring discharged.
3. “OFF” (main contacts open) Spring charged – circuit breaker ready to close.
4. “OFF” (main contacts open) Spring charged – circuit breaker not ready to close.
5. “OFF” (main contacts open) Spring discharged.

**Environmental aspects**

Production site organization shall be certified to comply with ISO 9002 and ISO 14001standards.
Air circuit breakers shall be supplied in recyclable packing.
The manufacturer shall implement non polluting production processes that do not make use of chlorofluorocarbons, chlorinated hydrocarbons, ink for cardboard markings, etc.
Environmental considerations and processing of materials at end of service life. The manufacturer shall provide instructions on the removal, dismantling and processing of Air circuit-breaker materials at the end of service life (material composition, weight, toxicity).

Air Circuit breaker shall be of RoHS and WEEE compliant.

## Release of Air Circuit Breaker

### General

The release shall be of microprocessor based.
The release unit shall be interchangeable on site for adaptation to changes in the installation.
The sensors shall be non-magnetic or of the Rogowski type for accurate current measurements up to Ics value.
The release shall measure the true rms value of the current.
The release shall comprise a thermal memory to store temperature-rise data in the event of repeated overloads or earth faults.
The release shall have both rotary dial and keypad for settings and display.
The release shall have Zone selective interlocking feature (ZSI) to interconnect upstream ACB and downstream ACB/MCCB to ensure faster tripping in case any downstream device fails to trip.

### Protection

The ACB control unit shall offer the following protection functions as standard:
Long-time (LT) protection with an adjustable current setting and adjustable time delay setting (minimum 5 settings each) Short-time (ST) protection with an adjustable pick-up and time delay (minimum 5 settings each).
Instantaneous (INST) protection with an adjustable pick-up (minimum 5 settings)
Current and time-delay settings shall be indicated in amperes and seconds respectively on a digital display.
Earth-fault protection with an adjustable pick-up and time delay (minimum 5 setting for each) shall be provided if indicated on the appended single-line diagram and BOM.

### Measurements

An ammeter and voltmeter with a digital display shall indicate the true rms values of the currents and voltage for each phase. If called by the BOM, the release shall be capable of measuring energy values also.
An LED bar graph shall simultaneously display the load level on the three phases.
A multimeter shall store in memory and display the maximum current value observed since the last reset. The data shall continue to be stored and displayed even after opening of the circuit breaker.
Separate microprocessor (application specific) shall be used for metering and protection.

### Maintenance

The last ten trip history shall be stored in register that may be consulted locally (type of fault or alarm).
Maintenance indicators shall be displayable on request on the front panel.
Operations counter.

## Communication option (if required in BOM)

On option Air Circuit Breaker shall be capable of communicating the following data via a bus.
Circuit-breaker status (open/closed, connected/disconnected/test, tripped on a fault, ready to close)
Control-unit settings;
Tripping causes.
The measurements processed by the control unit: current, voltage, power, energy, PF.
It shall be possible to remotely control the circuit breaker.
It shall be possible to modify circuit-breaker settings:
Settings within the range defined by the switches on the front panel of the control unit;
Settings of the protection functions and the alarms.

## MOLDED CASE CIRCUIT BREAKER (MCCB)

The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2/ IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI/ ERDA or any accredited international lab.
MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating molded case with high withstand capability against thermal and mechanical stresses
The breaking capacity of MCCB shall be as specified in the schedule of quantities. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu). MCCBs for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/ IS 13947-2. The breaker as supplied with ROM should meet IP54 degree of protection.

## CURRENT LIMITING & COORDINATION

The MCCB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables and let-through energy curves for all.

### Protection Functions

- MCCBs shall be equipped with Thermal-magnetic (thermal for overload and magnetic for short-circuit protection) trip units.
- Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorized access to the settings.
- Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of rms current values, electromagnetic compatibility, etc.)
- Protection settings shall apply to all poles of circuit breaker.
- All Microprocessor components shall withstand temperatures up to 125 °C

## TESTING

a. Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.
b. Original test certificate of the MCCB as per IEC60947-1&2 or IS13947 shall be furnished.

**INTERLOCKING**

Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

a. Handle interlock to prevent unnecessary manipulations of the breaker.
b. Door interlock to prevent the door being opened when the breaker is in ON position.
c. Defeat-interlocking device to open the door even if the breaker is in ON position.

- The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. All MCCBs shall have adjustable over load & short circuit pick-up both in Thermal magnetic and Microprocessor Trip Units.
- The trip command shall override all other commands.

## *MOTOR PROTECTION CIRCUIT BREAKER (MPCB)*

Motor circuit breakers shall conform to the general recommendations of standard IEC 947 -1, 2 and (VDE 660, 0113 NF EN 60 947-1-2-4, BS 4752) and to standards UL 508 and CSA C22-2 N°14.

The devices shall be in utilization category A, conforming to IEC 947-2 and AC3 conforming to IEC 947-4.MPCB shall have a rated operational and insulation voltage of 690V AC (50 Hz) and MPCB shall be suitable for isolation conforming to standard IEC 60947-2 and shall have a rated impulse withstand voltage (U imp) of 11 kV. The motor circuit breakers shall be designed to be mounted vertically or horizontally without de rating. Power supply shall be from the top or from the bottom. In order to ensure maximum safety, the contacts shall be isolated from other functions such as the operating mechanism, casing, releases, auxiliaries, etc., by high performance thermoplastic chambers. The operating mechanism of the motor circuit breakers must have snap action opening and closing with free tripping of the control devices. All the poles shall close, open, and tripsimultaneously. The motor circuit breakers shall accept a padlocking device in the "isolated" position.

The motor circuit breakers shall be equipped with a "PUSH TO TRIP" device on the front enabling the correct operation of the mechanism and poles opening to be checked. The auxiliary contacts shall be front or side mounting, and both arrangements shall be possible. The front-mounting attachments shall not change the breaker surface area. Depending on its mounting direction the single pole contact block could be NO or NC. All the electrical auxiliaries and accessories shall be equipped with terminal blocks and shall be plug-in type. The motor circuit breakers shall have a combination with the downstream contactor enabling the provision of a perfectly co-ordinated motor-starter. This combination shall enable type 1 or type 2 co-ordination of the protective devices conforming to IEC 60947-4-1.Type 2 co-ordination shall be guaranteed by tables tested and certified by an official laboratory: LOVAG (or other official laboratory).The motor

circuit breakers, depending on the type, could be equipped with a door-mounted operator which shall allow the device setting. The motor circuit breakers shall be equipped with releases comprising a thermal element assuring overload protection and a magnetic element for short-circuit protection. In order to ensure safety and avoid unwanted tripping, the magnetic trip threshold (fixed) shall be factory set to an average value of 12 Ir.
All the elements of the motor circuit breakers shall be designated to enable operation at an ambient temperature of 60°C without de rating. The thermal trips shall be adjustable on the front by a rotary selector. The adjustment of the protection shall be simultaneous for all poles. Phase unbalance and phase loss detection shall be available. Temperature compensation (-20°C to +60°C).

## *MINIATURE CIRCUIT BREAKER (MCB)*

Miniature Circuit Breaker shall comply with IS-8828-1996/ IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/ 415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B, C, D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/ IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.
The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

## *EARTHING*

Earthling shall be provided as per IS: 3043-1987.

## *PAINTING*

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphate, passivaiting (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/ outside shall be as per BOQ confirming to IS Code No.5.

## *LABELS*

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

## *METERS*

i. All voltmeters and indicating lamps shall be through MCB's.

ii. Meters and indicating instruments shall be flush type.
iii. All CT's connection for meters shall be through Test Terminal Block (TTB).
iv. CT ratio and burdens shall be as specified on the Single line diagram.

## *CURRENT TRANSFORMERS*

Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondaries for operation of associated metering.
The CTs shall confirm to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

## *POTENTIAL FREE CONTACTS*

Potential free contacts shall be provided for connection to Building Automation System in panels indicated in Schedule of Quantities.

### CONTACTOR

Contactor shall be built into a high strength thermoplastic body and shall be provided with an are shield for quick are extinguishing. Silver alloy tips shall be provided to ensure a high degree of reliability and endurance under continuous operation. The magnet system shall consist of laminated yoke and armature to ensure clean operation without hum or chatter.
Starter's contactors shall have 3 main and 2 No. NO/ NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta Starters. The insulation for contactor coils shall be of Class "E".

Coil shall be tape wound vacuum impregnated and shall be housed in a thermostatic bobbin, suitable for tropical conditions and shall withstand voltage fluctuations. Coil shall be suitable for 240/ 415 + 10% volts, 50 cycles AC supply.

### THERMAL OVER LOAD RELAY

Thermal overload relay shall have built in phase failure sensitive tripping mechanism to prevent against single phasing. The relay shall operate on the differential system of protection to safeguard against three phase overload, single phasing and unbalanced voltage conditions.
Auto-manual conversion facility shall be provided to convert from auto-reset mode to manual reset mode and vice-versa at site. Ambient temperature compensation shall be provided for variation in ambient temperature from –5deg C + 55 deg C.

All overload relays shall be of three element, positive acting ambient temperature compensated time logged thermal over load relays with adjustable setting. Relays shall be directly connected for motors upto 35 HP capacity. C.T. operated relays shall be provided for motors above 35 HP capacities.

## INDICATING PANEL

All meters and indicating instruments shall be in accordance with relevant Indian Standards. Meters shall be flush mounted type. Indicating lamps shall be of low burden, and shall be backed up with 2 amps MCB/ MPCB as per relevant fault level and toggle switch.

## TESTING

Testing of panels shall be as per following codes:

a. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages up to and including 1000 VAC.
b. IS: 13947: 1993 Degree of protection
c. IS: 5578 & 11353: 1985 Arrangement of bus bars.

## WIRING

In wiring a distribution panel it shall be insured that total load of various distribution panel and/ or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing. All wiring shall be only.

## ANTI-CONDENSATION SPACE HEATERS

1 No. 100 W, 240 volts, single phase, 50 Hz AC Anti Condensation space heaters controlled by thermostat and protected by 6 amps MCB's or MPCB's as per fault level at the panel shall be provided in each vertical section of main LT panel and 1 No. 60 watt Anti Condensation space heater with thermostat shall be provided in each cable alley of main distribution boards and sub distribution boards.

## INSTALLATION

Installation of all LT panels shall include but not limited to the following to complete the installation, testing and commissioning:

a. Transporting materials from stores to exact location of installation.
b. Supply and installation of required base frame made of MS angle or channel sections and duly painted with black paint.
c. Positioning, aligning, fixing, assembling, and installation of LT panel issued free of cost by Client after carrying out proper cleaning and inspection.
d. Site supervision, testing for proper functioning/ operation, and pre-commissioning tests.

## COMMISSIONING AND ONSITE TESTING

a. All switchboards shall be tested for dielectric test with 1000V mugger.
b. All earth connections shall be checked for continuity.
c. All busbar connections shall be checked and tightened properly.
d. All cable terminations and terminal shrouding shall be checked if they are properly done.
e. The operation of protective devices shall be tested by secondary injection test.
f. The operation of circuit breaker shall be tested for all interlocks.
g. Functional test shall be done for all ACBs, MCCBs and other components.

h. Indicating lamps and meters shall be checked for proper working.

## FINAL DISTRIBUTION BOARDS

Final Distribution Boards (FDBs) shall be suitable for operation on 3 Phase/ single phase, 415/ 240 volts, 50 cycles, neutral grounded at transformer. The DB shall be minimum di-electric strength of 2.5 KV/ Sec. All Distribution Boards shall manufactured by a manufacturer listed in Appendix-I.
FDB's shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993.

## CONSTRUCTION FEATURES

FDB's shall be made out of 1.6 mm thick high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of FDB shall be folded and braced as necessary to provide a rigid support for all component. FDB shall be suitable for indoor/ outdoor installation, wall mounting free standing type, in double door construction. The Final Distribution Boards shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement. All removable/ hinged doors and covers shall be grounded by 4.0 sqm tinned stranded copper connectors. Final Distribution Boards shall be suitable for the climatic conditions. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage upto and including 1100V AC.
All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self-threading screws shall not be used in the construction of FDBs.
Knockout holes of appropriate size and number shall be provided in the FDB's in conformity with the location of cable/ conduit connections. Detachable sheet steel gland plates shall be provided at the top/ bottom to make holes for additional cable entry at site if required.
Final Distribution Boards shall comprise of the following: -

a. A panel for mounting where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.
b. Installation accessories shall be part of the DB for fixing conductor and rails for mounting MCB's and RCCB's etc. neutral bus bars & earthing bus bars required in the circuit. All busbars in the FDB shall be insulated type.
c. Service cable/ interconnection shall be part of the Distribution Boards.
d. The board shall be installed at a height such that the operating is within reach of the normal human height i.e. 1.2 to 1.8 meters from finish floor level.

e. Degree of protection shall be IP-52 for indoor application, IP-54 for kitchen and IP-55 for outdoor application.
f. All three phase distribution boards shall have 4 rows and single phase distribution boards shall have single rows for housing of MCB's and RCCB's unless noted otherwise.
g. Flush mounting of a DB made easy and perfect fit is achieved with clearly visible anti insertion marking.
h. Phase segregation to be maintained in all three phase distribution boards.
i. Earthling shall be provided in each FDB's.

### EARTHING

Earthling shall be provided as per IS: 3043-1987.

### PAINTING

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivaiting (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/ outside shall be of Siemens gray painting shade No. RAL-7032 of IS Code No. 5.

### LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

### TESTING

Testing of panels shall be as per following codes:
a. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages upto and including 1000 VAC.
b. IS: 13947: 1993 Degree of protection

### WIRING

In wiring a distribution panel it shall be insured that total load of various distribution panel and/ or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

## GENERAL SPECIFICATION OF H.T. CABLE

### Scope:

The section covers the supply, installation, storing, laying, fixing, jointing/termination, testing and commissioning of high voltage XLPE insulated armoured sheathed aluminum conductor cables laid in built up trenches, directly buried underground, on cable trays,

clamped directly to wall or structures etc., as called for in the drawing. The contractor shall provide all materials, labour, equipment, scaffolding etc., as required for the completion of HV cables, as called for.

**Standards Applicable**

The following standards and rules shall be applicable:

IS 1255:83 Code of practice for installation and maintenance of power cables upto and including 33kV rating (Amendment I)

IS 7098 : 85 Cross linked polyethylene insulated PVC (Part2) sheathed cables.

IS 8130 : 84 Conductors for insulated electric cables and flexible cords.

The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed. Installation of cables shall be done by an approved, qualified and experienced person in this trade.

**Material:**

The HV cables shall be 11kV, Aluminium Conductor CROSS LINKED POLYETHYLENE steel tape armoured cable laid underground and or in masonry trenches as shown on drawings. The conductor shall be made of Electrical purity aluminium wires and stranded together and compacted. The cable shall be of 3 Core type. The insulation shall be of high quality cross linked polyethylene applied by extrusion process. Both conductor and the insulation are provided with shielding made of Semi Conducting compound. Armouring is applied over inner sheath and shall be of flat steel strips. The outer sheath shall be of heat resisting tropodur (PVC compound.) This shall be of black colour.

**Inspection:**

All cables shall be inspected upon receipt at site and checked for any damage during transit.

**Joints in Cables:**

The contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoidance of jointing cable. This apportioning shall be got approved by the Owner/Consultant before the cables are cut to lengths. Where joints are unavoidable, the location of such joints shall be got approved by the Owner/Consultant.

**Jointing Boxes For Cables:**

*Cable joint boxes shall be of appropriate size, suitable for aluminium conductor XLPE insulated cables of 1000 volts ratings, and shall be of approved equal.*

**Jointing Cables:**

*All cable joints shall be made in suitable, approved cable joint boxes. Jointing of cables in the boxes and the filling in of compound shall be done in accordance with the best practice in trade, in accordance with manufacturer's instructions and in an approved manner. All straight T-joints shall be done in epoxy mould boxes with TROPOLIN/M-*

*SEAL epoxy resin or approved equal. All jointing accessories shall also be manufactured by Indian Cable Corporation/CCI or approved equal. All terminal ends of conductors shall be heavily soldered up to at least 50mm length.*

*All cables shall be jointed colour to colour and tested for continuity and insulation resistance before jointing commences. The seals of cables must not be removed until preparations for jointing are completed. Joints shall be finished on the same day as commenced and sufficient protection for the weather shall be arranged. Joints shall be made by means of suitable solder for conductors, the conductors being firmly butted into the connections or thimbles or ferrules and the whole soldered with proper solder and soldering flux or resin. The conductors shall be efficiently insulated with high voltage insulating tape and use of spreaders of approved size and pattern. The joints shall be completely filled with epoxy compound being topped as necessary to ensure that the box is properly filled.*

Cable Terminations:

*Cable termination shall be done in terminal cable box using cable glands and the cables ends sealed with sealing compound. The cable boxes of transformers shall be filled with bituminous compound manufactured by CCI or approved equal.*

Bonding of Cables:

*Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armoured clamp and gland. The clamps must grip the armouring firmly to the gland or casing, so that in the event of compound movement no undue stress is passed into the cable conductors.*

Lying of Cables:

*HV cables shall be laid either buried directly underground or in Masonry/Concrete trenches. The cable buried underground shall be at minimum depth of 1Mtr. from the ground level. Sand cushion of not less than 80mm shall be provided both above and below the cable with a Protective concrete slab on the top of the sand layer. The cable trench shall be back filled and compacted.*

Protection of Cables:

The cable shall be protected by placing pre-cast reinforced 50mm thick (1:2:4) concrete slabs 200mm wide on the top layer of sand for the length of the cable. Where more than one cable is running in the same trench, the concrete blocks shall cover all the cables and shall project **minimum 80mm on either side of the cables. Cables under road crossings and any surfaces subjected to heavy traffic shall be protected by running them through Hume pipes of suitable size.**

Excavations and Back Fill:

All excavations and back fill including timbering, shorting and pumping required for the installation of the cables shall be carried out by the Contractor in accordance with the drawings and requirements laid down elsewhere. Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layers not exceeding 150mm. Each layer shall be properly rammed and consolidated before laying the next layer. The Contractor shall restore all surfaces, roadways, sidewalks curbs, walls or other works cut by excavation to their original condition, satisfactory to the Owner/Consultant.

**Markers and Warning Plate:**

Approved CI cables markers shall be provided along the route of the cable at every 30M distance and at both ends of road crossing, indicating "H.V. Cables" and "M.V. Cables" as applicable. Special C.I markers shall be provided at all buried cable joints indicating "External Cable Joint".

**Testing of Cables:**

Prior to buying cables, following tests shall be carried out:

- Insulation between phases and between phase and earth for each length of cables, before and after jointing.
- For H.T Cables, high voltage test by applying 52kV (rms) for 11 kV cables for 5 minutes between conductor and screen/armour earth.
- On completion of cable laying work, the following tests shall be conducted in the presence of the Construction Manager.
- Insulation Resistance Test (sectional and overall)
- Continuity resistance test.
- Sheathing continuity test.
- Earth test.
- Conductor resistance test.

**Partial discharge test.**

All tests shall be carried out in accordance with relevant Indian standard code of practice and Electricity Rules. The Contractor shall provided necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests.

**Storing:**

All cables shall be supplied in drums. On receipt of cables at site, the cables shall be inspected and stored in drums with flanges of the cable drum in vertical position. The end of the cable shall be sealed for water tightness.

**Embossing:**

The cables shall be embossed every 300mm along the length of the cable showing the voltage grade and the year of manufacture of the cables.

**Measurement**

Mode of measurement is as follows:

All power cables including fixing accessories as described in specifications and BOQ are measured in linear meter (Rm).

Power cable terminations are measured in Number (No).

**TECHNICALSPECIFICATION OF M.V. CABLES & CABLE TRAYS:**

**SCOPE:**

This section covers the supply, installation storing, laying, fixing, jointing / termination, testing and commissioning of Medium Voltage PVC insulated PVC Sheathed armoured aluminium/ copper conductor cables (1.1 kv) laid in built up trenches, directly buried underground, on cable trays, in pipes, clamped directly to wall or structures etc. as called for in the drawing. The contractor shall provide all materials, labour, equipments, scaffoldings etc., as required for the completion of M.V. Cables, Cable Trays etc., as called for.

**STANDARDS APPLICABLE**

The following standards and rules shall be applicable.

IS: 8130-84 Class II, Conductors for insulated electric cables.
IS: 7098(II)/ 85 PVC insulated PVC sheathed cables.

The individual cores shall have continuous numbering of the core all along its length and also be provided with identification ferrules at both ends. Individual control cables shall have 20% spare cores.

FRLS cables shall be used for fire protection system controls to prevent flame propagation, smoke reduction and to avoid toxic gas emission in the event of a fire. FRLS compound shall be tested rigorously for oxygen index as per ASTM D2863, acid gas generation to IEC 754-1, smoke density to ASTM D 2843 and flammability to SS 424 1475 class F3, IEEE 383 and IEC 332-1.

Manufacturer's name, ISI Mark, cable size and type shall be clearly embossed at regular intervals on all cables.

**TYPE AND QUALITY**

Medium voltage cables shall be circular, multicore aluminium conductor, PVC insulated, PVC sheathed and steel wire armoured or steel tape armoured construction or unarmoured..The conductors of cable shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq.mm size and above.

M.V power cables shall have 3, 3.5 or 4 cores, as required and shall have conductors made from electrical purity aluminium conductors conforming to IS: 8130 - 84.

Armouring of galvanized round steel wires or galvanized flat steel strips shall be provided over the inner sheath. Outer sheath of PVC shall be extruded over the armouring.

Unless otherwise specified, all control cables shall be multicore,1100V grade XLPE insulated, armored and overall PVC sheathed with stranded copper conductors of 2.5

sq.mm, conforming to IS 7098 (PT-1)/ IS 8130 Class 1. Cores shall be identified by colour scheme of XLPE insulation.

## RATING:

The cables shall be rated for a voltage of 650/1100 Volts.
Core Identifications:
Cores shall be provided with the following colour scheme of PVC insulation:

1. Single Core : Green yellow for earthling.
2. Two Cores : Red and Black, Blue & Black, Yellow & Black.
3. Three Cores : Red, Yellow & Blue
4. Four Core : Red, Yellow, Blue & Black

## INSPECTION:

All cables shall be tested inspected at manufacturer's works. However upon receipt at site, cables shall be checked for physical damages during transit.

## JOINTS IN CABLES:

The contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoidance of straight cable jointing. This apportioning shall be got approved by the Construction Manager. Before the cables are cut to lengths.
Where straight joints in cable are unavoidable, the use and location of such straight joints shall be got approved by Construction Manager.

## JOINTING BOXES FOR CABLES:

Cable joint boxes shall be of appropriate size, suitable for XLPE insulated armoured cables of particular voltage rating.

## JOINTINGCABLES:

All cable joints shall be made in suitable, approved cable joint boxes, jointing of cables in the joint boxes and the filling in of compound shall be done in accordance with manufacturer's instructions and in an approved manner. All straight joints shall be done in epoxy mould boxes with epoxy resin only of makes/types as indicated in the list of approved makes. All terminal leads of conductors shall be heavy soldered upto at least 50mm length.
All cables shall be joined colour to colour and tested for continuity and insulation resistance before jointing commences. The seals of cables shall not be removed until preparations for jointing are completed. Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged. The conductors shall be efficiently insulated with high voltage insulating tape and by using spreaders of approved size and pattern. The joints shall be completely filled with epoxy compound and taped so as to ensure that the box is properly filled.

Epoxy compound shall be filled as follows:

Equal quantities of resin and hardener shall be mixed thoroughly by hand until the mixture is free from white patches and has uniform colour. No water, oil or any other liquid shall be added to the mixture to make it soft as is will affect the properties of the compound. The mixture shall be used within 30-40 minutes of mixing. The on which epoxy compound is to be used, shall be free from dust, rust, oil, grease and shall be dry. The joint neither be disturbed nor moved till the epoxy compound is completely hardened. A smooth surface can be made by rubbing a damp cloth smoothly on the compound before it sets. The joints shall be painted after they have completely hardened.

Alternatively, ready mix of epoxy cable jointing compound may also be used. In all cases manufacturer's recommendations shall be strictly adhered to.

## CABLE MARKERS

All underground cables and cable joints shall be marked on the surface by markers generally manufactured and tested to the requirements of relevant Bureau of Indian Standards. Approved CI cable markers shall be provided at every 30m along the route of the cables and at both ends of road crossing, indicating cable joints and cables as applicable. Special CI markers shall be provided at all buried cable joints indicating "Electrical Cable Joints". CI plates duly engraved with the size of the cable and the place it serves shall be tied to the cable at regular intervals of 5m for easy identification of cables.

## TERMINATION OF CABLES

Cable termination shall be done in terminal box or cable end box or distribution boards, or apparatus/ equipments. Terminations are to be made with mechanical and glands be tinned/nickel plated, anti corrosive, three piece improved pattern which is to grip inner and outer PVC sheaths as well as the armour of the cable. The cable ends or the core conductor are to be connected by solder less lugs or sockets using crimping tool of approved make for all cables.

All terminations of cable conductors and base conductors shall be mechanically and electrically sound and shall comply with the requirements of IEE regulations.

The connectors or connecting sockets are to have such dimensions so as to limit temperature rise.

When required the water tightness of the terminal boxes may be obtained by filling with a compound preferably plastic flame-retarding and non-dripping type within the normal range of temperatures.

When the cable is cut during the course of installation, the open ends are to be sealed immediately by means of self-adhesive non-hygroscopic tape over a wax water seal to make an air and watertight joint.

## INSTALLATION OF CABLES

Cable shall be laid in a manner as indicated on the drawings. Generally cables are laid in the following manner.

i. In the underground masonry trench.
ii. On the cable tray/or on cable ladders.
iii. Buried underground.
iv. Through pipe sleeves.

Various installation methods are discussed in the following paragraphs.

Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable. The cable drums shall be placed on jacks before unwinding the cable. The cable drums shall be rotated in the direction as indicated by the manufacturer. Care shall be exercised in laying cables to avoid forming kinks. The drums shall be unrolled and cables run over wooden rollers, placed at intervals not exceeding two (2) meters.

## GENERAL

All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of service.
When cables pass through holes in metal work, precautions shall be taken to prevent abrasion of the cables on any sharp edges.

In every vertical cable ladder, channel, duct, trunking or cable trench containing cables and exceeding three meters in length, internal barriers shall be provided so as to prevent the air at the top of the unit from attaining an excessively high temperature. In every vertical cable shaft, cable trench or any passage of cable through wall, ceiling, floor barriers against spread of fire and smoke shall be provided for compliance with IEE regulations.

Where cable passes through walls, ceiling, floor, it shall run through sleeves of PVC pipes or hume pipes of adequate diameter. After pulling the cable through sleeves, both the ends of the sleeves shall be sealed water tight with fire-resistant material to prevent spread of fire and seepage of water.
Generally along each cable route either in trench or in cable trays/ladders or in pipe separate Two Nos. of earth strips/wires shall run exposed.
Where an installation comprises medium voltage cables as well as extra low voltage circuits, precaution shall be taken in accordance with IEE regulations and shall be physically separated by minimum of 300mm distance.
Metal sheaths and armour of all cables, metal conduits, ducts, trunking, and bare earth continuity conductors associated with such cables, which might otherwise come into fortuitous contact with other fixed metal work shall be effectively bonded there to earth so as to prevent appreciable potential difference at such possible points of contact.
If it is necessary to install cables in a situation where flammable and/or explosive dust, flammable volatile liquid/vapor/gas is likely to be present or where explosive materials are handled or stored, the cabling shall be as per IEE regulations.

## UNDERGROUND INSTALLATIONS

The cables shall be laid in an excavated trench. The depth of the trench shall be minimum 900mm. below the final ground level but shall be decided on the number of

cables to be laid in the trench so that the vertical distance between two adjacent layers of cables shall not be less than 350mm. The width of the trench shall be decided on the number of cables to be laid in the trench so that the distance between two adjacent cables shall not be less than one able diameter.

Before laying cables the bottom of the trench shall be well compacted and the cables shall be laid on a 100mm fine sand bedding. The second layer of 150mm of fine sand then be spread over the cable and shall be further covered by 150mm of compacted soil. For the second layer of the cable same procedure shall be repeated.

The cables shall be protected by placing precast concrete tiles or burnt bricks over the cables on top layer of sand and for the full length of underground cables. Where more than one cable is running in the same trench, the concrete tiles/bricks shall cover all the cables and shall project a minimum of 80mm on either side of the cables.

In any case the top layer of the cables shall be minimum 600mm below the finished level of the ground.

The top of the cable trench shall be well compacted till the finished level of the ground and shall be approved by the Construction Manager. If required a laboratory compaction test shall be carried out in presence of the Construction Manager.

H.V., M.V cables shall not be laid in the same trench/cable tray and/or along side of water main.

Cables under road crossings and any surfaces subjected to heavy traffic shall be protected by running them through hume pipes of suitable size.

The relative position of the cables laid in the same trench shall be preserved and the cables shall not cross each other as far as possible. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius of bend not less than 15 times the diameter of the cable. Minimum 3 meters long loop shall be provided at both sides of every straight joint and 5 meters at each end of the cable. Distinguishing marks shall be made at the cable ends for identification.

Insulation tapes of appropriate voltage and in red, yellow, and blue colors shall be wrapped just below the sockets for phase identification.

All the excavation and back fill including timbering, shoring, and pumping required for the installation of the cables shall be carried out as indicated on the drawing and as per requirements laid down elsewhere or as per Construction Manager's direction. Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layers not exceeding 150mm. At each layer compaction test shall be carried out in presence of Construction Manager. Each layer shall be properly rammed and consolidated before laying the next layer. The contractor shall restore all surfaces, roadways, side walls, curbs, walls, landscaping or other works cut for excavation to their original condition, the satisfaction of the Construction Manager. Suitable approved type cable markers shall be installed along the cable route & where change of direction takes place.

## CABLES INSTALLED INSIDE THE BUILDING

The cables inside the building shall be installed in one of the following manner, as indicated in the drawing and approved by the Construction Manager.

## INSTALLED IN BUILT-UP TRENCH

The cables laid on the bottom of the structural trenches shall not lie freely upon the trench bottom. They shall be raised to prevent the possibility of their coming into contact with deleterious materials.
The cables laid in the trench shall be laid on angle iron brackets/cable tray/cable ladder/cable troughs/cable racks as indicated on the drawings, and as approved by the Construction Manager. Where cables are clamped to the wall a minimum clearance of 100mm shall be maintained between wall and cable and minimum 150mm vertical clearance shall be maintained between two cables. Where cables are laid on brackets the brackets shall not be fixed more than 500 mm apart to avoid sag in the cables, where the cables are laid on cable tray/ladder/troughs/racks, minimum 300 mm distance shall be observed between adjacent tier of tray/ladder/ troughs/racks, and cable shall be fixed minimum 25mm away from the wall, and minimum of one cable diameter distance shall be observed between two adjacent cables. Cables shall be properly fixed with the tray/ladder/troughs/racks with cable tie or saddles or straps.

## CABLES ON CABLE TRAYS/LADDERS UNDER THE CEILING OR ON WALL

Where cables are installed under/above suspended ceiling or below ceiling or on wall, they shall be laid on a perforated G.I. cable tray/ladder type cable tray and shall be run in such positions that they are not liable to be damaged by contact with the floor or the ceiling or other fixtures.

The cable tray/ladder shall be properly fixed with tie rod to the ceiling. The concrete inserts for fixing the tie of shall be put in place while casting the slab. If insert plates are not placed in position, Anchor fasteners shall be fastened to support cable trays. The cable tray route shall be co-ordinate with other services to avoid crisscross of all the services.
While laying the cables on the tray minimum one cable diameter distance shall be observed between two adjacent cables. 25% space shall be kept spare for any future installation.
The trays shall be made of 16 SWG/12 SWG G.I. perforated sheet having minimum 50mm depth. The width of perforation shall be maximum 10mm spaced at maximum 20mm distance. The width of the cable tray shall be selected so as to accommodate required number of cables to be laid on it, with minimum separation of minimum one cable diameter between two adjacent cables. The cables shall be tied with the cable tray with nylon strip.

## CABLES INSTALLED IN THE MECHANICAL ROOM

The cable reaching the motors in the mechanical room or plant room or machines room or service area shall be laid on cable tray except where indicated in masonry underground trenches.

The cable reaching the motors shall be protected by rigid galvanized conduits up to a height of 300mm above the floor.
Above that height, the cable shall be protected by means of oil tight flexible metallic G.I. conduits to the terminal box of the motor. The connection between the rigid conduit and the flexible conduit shall be done by a rewett coupling of an approved type.

The flexible conduit shall be properly fixed with the terminal box of the motor by means of double hexagonal check nut.

## CABLE TRAY

GI Cable tray shall be manufactured to comply with the specifications of National Electrical Code (NEC) and National Electrical Manufacturer's Association (NEMA).

Cable trays shall be of steel as per IS 226 and galvanized and the thickness of galvanization shall be not less than 110 microns. All bolts nuts and washers shall also be galvanized and shall conform to IS 1363- 60 for quality, threading and dimensions before galvanizing. Hot dip galvanizing shall conform to IS 2633 Galvanizing of each member shall be carried out in one complete immersion. The galvanizing shall be uniform, clear, smooth, continuous and free from acid spots. Quality of zinc used for galvanizing shall be of 98.8% purity.

Cable trays shall generally be of the following type :

| | |
|---|---|
| i. For power cables of medium voltage and high voltage | - ladder type with slotted angles. |
| ii .For control cables and low voltage cables | - perforated sheet extra steel slotted angle type. |

Perforated cable trays shall be generally of channel type and the perforations in the trays shall be either 8 x 15mm or 10 x 20mm oval holes. Control cables, extra low voltage cables and instrument cables shall be laid on perforated cable trays.

Ladder type cable trays shall be made out of 50 x 50 x 6mm slotted M.S. angles for the rungs and channels for the side rails. Pitch of the rungs shall be not more than 250mm centre to centre. Rungs shall be welded to the side rails.

**Cable trays shall be of standard sizes :**

Length: 2500mm
Width: 300/450/600/800/1000mm as required.
Flange of perforated tray: 75/100mm
Height of side rail (ladder type): 62.5mm
Thickness of sheet steel - 2.0mm to 3.0mm as per width of tray.

The flange and width of the cable trays shall be decided based on the diameter and the number of cables running through each section of the cable tray.

Accessories for Cable Trays

Following accessories of cable trays, as required, shall be supplied with the cable trays.

Coupler plates

90 deg bends - Horizontal and Vertical.
Tees - Horizontal and Vertical.
Reducers
4-way cross
Tray covers
Fasteners.

Accessories also shall be hot dip galvanized, thickness of galvanizing being not less than 110 microns.

## TESTING

Prior to laying cables, and prior to energizing the cables, following tests shall be carried out:-

Insulation Resistance test between phases and phase to neutral and phase to earth.
Continuity test of all the phases, neutral and earth continuity conductor.
Sheathing continuity test.
Earth resistance test of all the phases and neutral.

All tests shall be carried out in accordance with relevant Indian Standard Code of practice and Indian Electricity Rules. The Contractor shall provide necessary instruments, equipments and labour for conducting the above test and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Construction Manager and results shall be recorded in the prescribed forms.

## STORING:

All the cables shall be supplied in drums. On receipt of cables at site, the cables shall be inspected and stored in drums with flanges of the cable drum in vertical position. The end of the cable shall be sealed for water tightness.

## MEASUREMENT

*Mode of measurement is as follows:*

All power cables including fixing accessories as described in specifications and BOQ are measured in linear metre (Rm).

Power cable terminations are measured in Number (No)

Control cables including terminations are measured in linear metres (Rm)
Cable trays and conduit/pipes are measured in linear metres (Rm).

## TECHNICAL SPECIFICATIONS OF WIRING SYSTEMWIRING SYSTEM
## SCOPE

The scope of work under this section generally covers internal wiring for lights, fans, exhaust fans, call bells, fan coil units, geysers, power sockets etc., The contractor shall provide all materials, labour, equipment, scaffoldings, etc., as required for the completion of wiring installation called for. The wiring shall generally be done using PVC insulated copper conductor wires in PVC conduit as called for including providing switches, sockets, plug tops, fan regulators, outlet boxes etc.,

## STANDARDS APPLICABLE

The applicable standards for above work shall be as listed below:

| | |
|---|---|
| IS: 732 | Code of practice for electrical wiring installation (System voltage not exceeding 650V). |
| IS: 1646 | Code of practice for fire safety of buildings (General Electrical installation). |
| IS: 2667 | Fittings for rigid steel conduits for electrical wiring. |
| IS: 3480 | Flexible steel conduits for Electrical wiring. |
| IS : 3837 | Accessories for rigid steel conduit for electrical wiring. |
| IS : 694 | PVC insulated cables. |
| IS : 2509 | Rigid - non-metallic conduits for electrical wiring. |
| IS : 6946 | Flexible (Pliable) non-metallic conduits for electrical installation. |
| IS : 1293 | 3 Pin plugs and sockets. |
| IS : 8130 | Specifications for conduits for electrical installation. |
| IS : 3854 | Switches for domestic purpose. |
| IS : 3415 | Fittings for rigid non-metallic conduits. |
| IS : 4648 | Guide for electrical layout in residential building. |
| IS : 9537 | Conduits for electrical installation. |
| IS : 302 | General and safety requirements for household and similar electrical appliances. |
| IS : 3043 | Code of practice for earthling. |
| IS : 5216 | Guide for safety procedures and practices in electrical work. |
| | Indian Electricity Act and Rules. Regulations for the electrical equipment in buildings issued by the Bombay Regional Council of Insurance association of India, EB. |

All standards and codes mean the latest.

## POINT WIRING FOR LIGHTS, FANS, EXHAUST FANS & 6A CONVENIENCE SOCKETS

A point wiring shall consist of the branch wiring from the distribution board together with a switch/fan regulator as required, including providing conduit and accessories, the ceiling rose or pendant holder or a swan holder, or ceiling fan hook box or socket etc., with suitable termination. Point wiring shall include, in addition, the earth continuity conductor/wire from the distribution board to the earth pin/stud of the outlet/switch box and to the outlet points.

The point wiring shall be carried out in the under mentioned manner:

a) Supply, installation, fixing of conduits and GI pull wire with necessary accessories, junction/pull/inspection/switch boxes and outlet boxes/Fan hook box etc. Switches, switch plates and switch boxes are not required for the lights which are controlled directly from the MCB DB's.
b) Supplying and drawing of wires of required size including earth continuity PVC insulated wire.
c) Supply, installation and connection of flush type switches, sockets, cover plates, switch plates, and fixing fan regulator, lamp holder, ceiling rose etc.,
d) The point shall be complete with the branch wiring from the distribution board to the outlet point, through switch board, conduit with accessories, junction, pull, inspection boxes, control switch, socket, outlets boxes, ceiling roses, lamp holder, connector, extension cord wire, flexible conduits etc.

## POINT RATE

For purposes of measurements and payments the rate for point wiring for lights/fans etc., is divided into two parts.

a) Circuit Main
b) Point Wiring.

a) Circuit Main for Light/Fan Point

The circuit main for lights/fan/6A sockets (where 6A sockets connected to light circuit) shall include the wiring from the MCB distribution boards' upto the first switch/light point/fan point. This is measured in linear meter. The scope of work under this section shall include

i) Supply and wiring in concealed/surface conduit from DB's to first switch/light/fan point.
ii) Providing and installing PVC insulated copper conductor earth wire.
iii) Providing and installing GI fish wire (pull wire) in the conduit.
v) Termination of wires in DB's and switches using proper tinned copper lugs of crimping type.
v) Providing and installing necessary pull/junction boxes where necessary.

b) Point Wiring

The rate for point shall include supply, installation, and connection, testing and commissioning of point wiring in conduit. The points shall be measured in No/sets for the set/group of lights controlled as mentioned in BOQ.

The exact scope of work included in the point wiring for the purposes of measurement is enumerated as stated below

i) Wiring starting from the first switch/light/fan point, where the circuit main is terminated to the various lights/fans/sockets (where 6A sockets connected to light circuit loop), and then looping between the switches/lights/fans/6A sockets etc.
ii) Providing and installing all necessary switches, switch plates, sockets, pull/junction/fan hook boxes etc. as called for.

iii) Providing and installing insulated earth continuity wire in each conduit along with the wiring system.
iv) Providing and installing G.I. fish wire (pull wire) in the conduits.
v) Providing and installing ceiling roses, lamp holders where necessary.
vi) Providing and installing PVC insulated, PVC sheathed flexible three cores 1.5 sq.mm extension cords including flexible conduits from light/fan outlet points mounted at ceiling point to the light/fan outlet.

Wiring for 6A Sockets, 16A Power Sockets for Equipment Wiring Except where 6A sockets connected to the lighting loop which are measured in Number of points, the measurement for wiring of 6A/16A sockets and wiring for power outlets is done as follows :

i) Length of circuit wire including conduit, accessories and earth wire for power wiring is measured together in linear metre.
ii) The socket outlet with outlet box is measured in Numbers.

## SYSTEM OF WIRING

Unless otherwise mentioned on the drawings, the system of internal wiring shall be as follows:

The system of wiring shall consist of single core, PVC insulated, 650/1100 Volt grade, stranded copper conductor wires/cables laid through concealed or exposed PVC/GI/MS conduits as mentioned elsewhere or as directed by owner/consultant.

GENERAL:

Prior to laying and fixing of conduits and light outlet boxes, contractor shall carefully examine the layout drawings and prepare detailed shop drawings, indicating the exact location of light outlets, with distances marked, conduit routing, with sizes, number of wires run in each conduit, control switch location etc., The contractor shall obtain the approval of all shop drawings by the owner/consultant prior to the installation of conduits. Any discrepancy noticed in the design drawings shall be brought to the notice of the owner/consultant. Any suggestions or modification suggested by the contractor shall have approval of Client/ Consultant before execution.

Type of Installation

Unless otherwise specified all conduits for surface wiring shall be heavy gauge rigid PVC conduits and all concealed installation including conduits running above false ceiling shall be heavy guage rigid PVC.
All conduits buried in grade or in damp wet areas shall be heavy gauge G.I. conduits.

a) Concealed Wiring shall be done using PVC conduits in the following areas

i) Staircase area lighting.
ii) Wiring inside offices.
iii) Wiring in the false ceiling area.
iv) All other areas where surface conduit is not specifically mentioned.

b) Surface Wiring shall be done using Heavy Gauge PVC Conduit.

i) Wiring installation in the electrical sub-station room, D.G.room.
ii) Pump room, sewage treatment plant room.
iii) Ventilation fan room, AHU room, and electrical room.

c) Conduit Installation in False Ceiling Area

The PVC conduits shall run exposed using above false ceiling.

## TECHNICAL SPECIFICATIONS OF CONDUITS

### CONDUITS:-

Generally concealed electrical wiring installation shall be in PVC Rigid conduits.

### PVC CONDUITS:

Non-metallic conduits and accessories shall conform to IS 9537 (part 3) - 1983, IS 2509 & IS 3419 and each conduit shall bear the ISI Mark. PVC conduits shall be of the black, round, heavy gauge polyvinyl chloride (PVC). The conduit shall be plain end type as specified in IS 2509-1973/IS 2537-1983. The conduit internal surface shall be smooth. Only approved quality factory made bends/accessories shall be used. Minimum size of conduits shall be 20mm diameter. PVC conduits shall be rigid un plasticized, heavy gauge having minimum wall thickness of 2.0mm up to 25mm diameter conduit and 2.5mm wall thickness for all sizes above 25mm diameter.

### CONDUIT ACCESSORIES:-

### 1> PVC CONDUIT BENDS & COLLARS

The PVC conduit bends & collars shall be of heavy duty and preferably of the same make as of conduit. This shall conform to IS 9537/1983 Part III with ISI Mark where necessary bends or diversion may be achieved by means of using bends and or circular inspection boxes with adequate and suitable inlet and outlet termination. In case of recessed installation system. The bends shall be properly secured & flush with the finished wall surface. Elbows shall not be used. No bends shall have radius less than 2 1/2 times the outside diameter of the conduit.

### 2> PVC/INSPECTION/JUNCTION/PULL BOXES

The Inspection/pull box/junction box, where used, with relevant PVC conduit installation shall be of heavy gauge PVC and conform to IS specification and shall match with the conduit sizes. The box shall be round/square rectangular with conduit stub projection for termination of conduit. The box shall be of minimum 50mm deep and the size of box shall be suitable to pull/make necessary joints of wires inside the boxes. Extra deep boxes are preferred. The boxes shall have flush

type cover. The colour of plate shall match the colour of paint of the surface where installed. The boxes shall have concealed screwed socket for fixing the ceiling rose.

## INSTALLATION OF CONDUIT:-

## CONCEALED CONDUIT SYSTEM

Unless otherwise Specified, all wiring shall be in heavy gauge rigid PVC conduit embedded in wall, or ceiling and concealed in the false ceiling. The size of the conduit shall be selected in conformity with I.S. code and as specified in the table given below. Factory made conduit bends and accessories shall be used. PVC Conduit shall be jointed using Solvent Cement as recommended by the conduit supplier. The conduit in ceiling slab shall be straight as far as possible. Before the conduits are laid in the ceiling, the position of the outlet points, controls, junction boxes shall be set out clearly as per the dimensions and to minimise off-sets and bends. Before the reinforcement rods are kept in position electrical contractor shall mark in paint the position of outlet points and conduit drop on the shuttering. When the outlet boxes are kept in position and before pouring the concrete, all outlet boxes shall be filled with paper to avoid entry of concrete into the box. Conduits in ceiling shall be bonded to the reinforcement rods with G.I. bonding wire at intervals not more than 1000mm, to secure them in position. PVC deep light outlet / pull boxes shall be provided as required. The conduit in ceiling slab shall be laid above the first layer of reinforcement rods to avoid cracks in the ceiling surface. In general the conduit shall not be laid directly on the shuttering surface to avoid cracks in the ceiling surface.

Conduits concealed in the wall shall be secured rigidly by means of steel hooks / staples at min. 750 mm intervals. Before conduit is concealed in the walls, all chases, grooves shall be neatly made to proper required dimensions using electrically operated groove cutting tools to accommodate number of conduits. The outlet boxes for control switches, inspection and draw boxes shall be fixed as and when conduits are being fixed. The recessing of conduits in walls shall be so arranged as to allow at least 12mm plaster cover on the same. All grooves, chases etc. shall be refilled with 1:4 cement mortar and finished up to wall surface before plastering of walls is taken up by the general civil contractor. Horizontal chases in walls are not allowed. Where unavoidable, prior permission of owner/consultant shall be obtained before making any chasing. Where conduits pass through expansion joints in the building, adequate expansion fitting or other approved devices shall be used to take care of the relative movement. Whenever the conduits terminate into control boxes, distribution boards etc. conduits shall be rigidly connected to the boxes/boards with check nuts on either side of the entry. After conduits, junction boxes, outlet boxes etc. are fixed in position, their outlets shall be properly plugged with PVC stoppers or any other suitable materials, so that water, mortar, vermin or any other foreign materials do not enter into the conduit system. All conduit ends terminating into an outlet shall be provided with bushes of PVC or rubber after the conduit ends are properly filed to remove burrs and sharp edges.

Necessary G.I. pull wires shall be inserted into the conduit for drawing wires before concreting. Insulated earth wires shall be run in each conduit originating from the panel board up to the Light, Socket and Switch boxes. If the Electrical Contractor forgets to install any conduit/boxes etc., before the plastering/painting work is done by other

agencies, he may be permitted to install the same with prior permission of owners/ consultant and he shall be liable to make good the wall, floor, ceiling etc. at his own cost.

Conduits shall be so arranged as to facilitate easy drawing of wires through them. Entire conduit layout shall be done in such a way as to avoid additional junction boxes other than light points. The wiring shall be done in a looping manner. All the looping shall be done in either switch boxes or outlet boxes. Joints in junction or pull boxes are strictly not allowed. Where conduits cross building expansion joints, adequate expansion fittings or other approved devices shall be used to take care of any relative movement.

All conduits shall be installed so as to avoid touching of steam and hot water pipes. Conduits shall be installed in such a way that the junction and pull boxes shall always be accessible for repairs and maintenance work. The location of junction/pull boxes shall be marked on the shop drawings and approved by the owner/consultant. A minimum separation of 200mm shall be maintained between electrical conduits and hot water lines in the building. No. run of conduit shall exceed ten meters between adjacent draw-in points nor shall it contain more than two right angle bends, or other deviation from the straight line. Caution shall be exercised in using the PVC conduits in locations where ambient temperature is 50 degree Celsius or above. Use of PVC conduits in places where ambient temperature is more than 60 degree C is prohibited. The entire conduit system including boxes shall be thoroughly cleaned after completion of installations and before drawing of wires. Conduit system shall be erect and straight as far as possible. Traps where water may accumulate from condensation are to be avoided and if unavoidable, suitable provision for draining the water shall be made.

***All jointing methods shall be subject to the approval of the owner/consultant. Separate conduits shall be provided for the following system.***

- Lighting wiring
- 16 Amp power outlets.
- 6 Amp outlets and lighting system.
- 24 Volt supply system.
- Telephone/intercom system,
- Fire Alarm system,
- Computer data cabling system.
- Equipment wiring.

**CONDUIT JOINTS:**

***Conduits shall be joined by means of plain couplers. Where there are long runs of straight conduits, pull/inspection boxes shall be provided at intervals, as approved by the owner/consultant/construction manager. The conduits shall be thoroughly cleaned before making the joints. In case of plain coupler joints, proper jointing material like a vinyl solvent cement (gray in color) or any material as recommended by the manufacturer shall be used.***

**BENDS IN CONDUIT:**

*Wherever necessary, long bends or diversions may be achieved by bending the conduits or by employing normal bends. No bends shall have radius less than 2.5 times outside diameter of the*

*conduit. Heat may be used to soften the PVC conduit for bending, but while applying heat to the conduit, the conduit shall be filled with sand to avoid any damage to the conduit. Kinks in the conduit bends shall not be acceptable.*

## TECHNICAL SPECIFICATIONS OF SWITCH OUTLET & SOCKET OUTLET BOXES

### CONCEALED TYPE OUTLET BOXES

The concealed outlet boxes for switches, sockets, power outlets, telephone outlet, fan regulator etc., shall be of standard factory made and to match the exact requirement of combination of outlets. The boxes shall be fabricated out of heavy gauge CRCA cold rolled carbon alloy sheet steel with zinc plating (G.I). The size of boxes shall match the type of outlet/switch plate to be mounted on the box. Adequate No. and size of knockout holes shall be provided to terminate the conduits in the box. These boxes shall be of standard factory made product and of same make as of switch plates and sockets. Separate screwed earth terminal shall be provided in the box for earthling.

The outlet box shall be of minimum depth of 50mm.Boxes shall be suitable for grid mounting type of accessories. Long screw shall be provided to take care of the extra plaster thickness to mount the switch plates. Provision shall be made in the box and switch plate to have the minor adjustment of alignment of switch plate to plumb level.

### SURFACE TYPE BOXES

The boxes for mounting switches, sockets and other wiring devices shall be either molded plastic or heavy gauge CRCA sheet steel painted to match the colour of wall. The box shall be suitable to terminate the G.I/M.S. Surface conduit into the box. The size and shape of box shall match the exact type and combination of switch plates, receptacles and wiring devices. Deep boxes shall be used to facilitate easy termination of conduit and wires/cables. Separate screwed earth terminal shall be provided in the box for earthling.

### LIGHT OUTLET BOXES:

For concealed PVC conduit installation the light outlet box shall be of PVC round/square with knock-out holes. Conduit projection shall be suitable to terminate the conduit to the box. The box shall be made of heavy gauge PVC and the sample to have the approval of Construction Manager before use. The boxes shall have concealed screwed socket to fix the ceiling rose. The boxes shall be minimum 50mm deep.

For surface conduit installation the light outlet box shall be of G.I/black enameled M.S. boxes. The boxes shall have threaded stub projection having internal threading to terminate the conduits of different sizes. The boxes shall have concealed screwed socket for fixing the ceiling rose. The boxes shall be minimum 50mm deep.

## CEILING FAN HOOK BOXES:

The ceiling fan hook box shall be fabricated of 2mm thick G.I/M.S. With adequately sized M.S. rod/hook to fix the ceiling fan. The hook shall be concealed within the fan hook box. The side extensions of rod shall be sufficiently long to provide adequate anchorage in the concrete. The size of the box shall be such that it should be totally covered by the plastic canopy of the ceiling fan. The box shall have anticorrosive primer coating.

## SWITCHES

Switches shall conform to IS: 3854, and IS: 4615. Switches shall be single pole, single or two way as shown on the drawings. They shall be of the molded type rated for 250V, 5/15A. They shall be provided with insulated dollies and covers.

The switches shall be rocker operated with a quiet operating mechanism with bounce-free, snap acting mechanism in an arc resistant chamber. The switches shall have pure silver and silver cadmium contacts. The switches shall be of approved make as indicated in the `List of Approved Makes'. Switches installed outdoors shall be industrial, metal clad type, and shall be provided in weather-proof enclosure, complete with weather proof gasketed covers.

## COVER PLATES FOR SWITCHES & OUTLETS

Switches/sockets/wiring devices plates shall be of the same make as of switches/sockets/wiring devices. These shall be of best quality. Moulded plastic grid mounting type device plates/frames shall be used and these shall match with the type of switches/sockets and boxes.

## COVER PLATES FOR INSPECTION/JUNCTION/PULL BOXES

The cover plate for PVC boxes shall be with minimum 3mm thick Perspex / formica sheet cover and for the G.I/M.S. boxes, shall be of G.I/black enamelled M.S. Plates. The shape of the plate shall match with that of the box.

## RECEPTACLES

The sockets shall conform to IS 1293.Each socket shall be provided with control switch of appropriate rating. The sockets shall be moulded type rated for 250 volts and of 6 A or 16 A capacity as mentioned on the drawings. The 16 Amps sockets shall be multi pin (6 pin) automatic shutter type suitable for plugging 6 A/16 A plugs. The

shutter shall open when the earth pin of the plug is inserted in the socket. Where called for, the 16 Amp socket shall have indicating lamp. The socket outlets and switches shall be of grid mounting type. Where called for sockets shall be provided with three pin plug top suitable to the socket and of the same make as of socket. The plug shall conform to IS 6538. The socket outlets installed outside the building/open to sky or in damp/wet areas shall of weather-proof, water-tight type.

## TECHNICAL SPECIFICATIONS OF WIRES

### CONDUCTORS:

All FR PVC INSULATED copper conductor wires shall conform in all respects to standards as listed under sub-head 'Regulations and Standards' and shall be of 650/1100V Grade.

### FR WIRES (FOR LIGHT & SMALL POWER WIRING)

The **FR** PVC insulated cables shall conform to IS: 694/1990. For all internal wiring FRLS cables of 650/1100V grade, single core shall be used. The wires shall have the approval of Tariff Advisory Committee.

The conductors shall be plain, circular stranded annealed copper conductors complying with BS : 6360.

The minimum number and diameter of wires for circular stranded conductor shall meet the requirements set out in the relevant British Standards.

The cores of all cables shall be identified by colours in accordance with the following sequence.

| | | |
|---|---|---|
| Single phase | - | Red |
| Three phase | - | Red, Yellow, Blue |
| Neutral | - | Black |
| Earth | - | Green or Green/Yellow. |

A means of identifying the manufacturer shall be provided throughout the length of cable. Unless otherwise specified in the drawings, the sizes of the cables/wires used for internal wiring shall be as follows :

In case of circuit wiring for lights, exhaust fans, ceiling fans, bells, convenience socket outlet points:-

2.5 Sq.mm - For Lights/fans/6A socket wiring from DB's upto the outlet points including control

Wiring where the circuit length from the DB's to 1st outlet is less than 40 m.

In case of power socket outlet circuit.

6.0 Sq.mm - From DB's 20/32 A Industrial type sockets.

4.0 Sq.mm - From DBs to 16 A sockets.

The earth continuity conductor size as indicated in the drawing/BOQ shall be drawn through conduit along with other circuit cables/wires. The size of the earth continuity conductor shall be as follows:-

**UNLESS OTHERWISE SPECIFIED MINIMUM SIZE OF EARTH CONTINUITY CONDUCTOR WIRES NOT FORMING PART OF THE SAME CABLE AS THE ASSOCIATED CIRCUIT CONDUCTOR.**

| Nominal cross sectional area of largest associated copper circuit conductor in sq.mm | Nominal cross sectional area of earth continuity conductor in sq.mm (PVC insulated green colour wire) |
|---|---|
| 1.5 | 2.5 |
| 2.5 | 2.5 |
| 4.0 | 2.5 |
| 6.0 | 4.0 |
| 10.0 | 6.0 |
| 16.0 | 6.0 |
| 25.0 | 10.0 |
| 35.0 | 10.0 |
| 50.0 | 10.0 |

Separate circuits shall run for each water heater, pantry/kitchen equipment, window air conditioner, and similar outlets at locations as shown on drawings.

**WIRING:**

All final branch circuits for lighting and appliances shall be single conductor cables run inside conduits. Branch circuit conductor sizes shall be as shown in the load analysis of drawing and conforming to the requirements of the I.E. Regulations and I.S. Code.

Home runs indicated on the drawings for the final branch circuits shall be kept in a separate conduit upto the panel board via switches wherever called for. No other wiring shall be bunched in the conduit unless the other circuit main of same phase runs in the same conduit.

For each lot of wire supply, Contractor shall supply a certificate issued by the Manufacturer stating its origin, date of manufacture, constitution and standards to which it complies and the test certificates. Looping system of wiring shall be used. Wires shall not be jointed inside the conduit or pull boxes. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of owner/consultant.

Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in galvanized steel boxes. Chromium plated screws shall be used.

Power wiring shall be distinctly separate from lighting wiring.

Each circuit phase wire from the distribution boards should be followed with a separate neutral wire of the same size as the circuit wire.

## BUNCHING OF WIRES:

Wires carrying current shall be bunched so that the outgoing and the return wires are drawn in the same conduit. Wires originating from two different phases shall not run in the same conduit.

## DRAWING CONDUCTORS:

The drawing and jointing of FRLS PVC insulated copper conductor wires and cables shall be executed with due regard to the following precautions. While drawing wires through conduits, care shall be taken to avoid scratches and kinks which cause breakage of conductors. There shall be no sharp bends.

Insulation shall be shaved off like sharpening of a pencil and it shall not be removed by cutting it square.

FR PVC insulated copper conductor wire ends shall be soldered (at least 20 mm length) Strands of wires shall not be cut for connecting terminals. The terminals shall have sufficient cross sectional area to take all strands and shall be soldered. Connecting brass screws shall have flat ends. All looped joints shall be soldered and connected through block/connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. Conductors of all sizes shall always be terminated using cable sockets. At all bolted terminals, brass flat washers of large area and approved steel spring washers shall be used. Brass nuts and bolts shall be used for all connections.

Only certified wiremen and cable jointers shall be employed to do jointing work. All wires and cables shall bear the manufacturer's label and shall be brought to site in original packing. For all internal wiring, PVC insulated wires of 650/1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in loop system and no joints shall be allowed in the length of the conductors. If the use of joint connections is unavoidable due to any specific reason, prior permission, in writing, shall be obtained from the owner/consultant. No wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire, is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of wire. Before the wires are drawn into the conduits, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction by forcing compressed air through the conduits. The minimum size of PVC insulated conductor wires for all sub-circuit wiring for light points shall be 2.5 sq.mm.

## JOINTS:

All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made in conduits and in junction boxes. Conductors shall be continuous from outlet to outlet.

## MAINS AND SUB-MAINS:

Mains and sub-mains cables or wires where called for shall be of the rated capacity and of approved make. Every main and sub-main wire shall be drawn through

an independent adequate size conduit. An independent earth wire of proper rating shall be provided for every single phase sub-main. For every 3-phase sub-main, 2 nos. earth wires of proper rating shall be provided along with the sub- main. The earth wires shall be drawn inside the conduits along with the circuit main. Where mains and sub mains cables are connected to switchgear, sufficient extra lengths of cables shall be provided to facilitate easy connections and maintenance.

## LOAD BALANCING:

Load balancing of circuits in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

## COLOUR CODE OF CONDUCTORS:

Colour code shall be maintained for the entire wiring installation: red, yellow, blue for three phases, black for neutral, green/yellow green for earthling.

The control wire from light control switches to the light/fan points shall be the same colour as that of the phase/circuit wires feeding that particular loop.

## EARTHING

All earthling system shall be in accordance with IS 3043 - 1985 Code of practice for Earthling.

The type and size of earthling wire shall be as specified under the heading of cables.

Each conduit originating from the DB to various outlets shall have one earth wire (PVC insulated green colour wire).

## TESTING OF INSTALLATION

Before a completed installation is put into service, the following tests shall be complied with:

## INSULATION RESISTANCE

The insulation resistance shall be measured by applying 500 Volt megger with all fuses in place, circuit breaker and all switches closed.

The insulation resistance in mega ohms of an installation measured shall not be less than 50 mega ohms divided by the number of points in the circuit.

The insulation resistance shall be measured between

Earth to Phase
Earth to Neutral
Phase to Neutral

## EARTH CONTINUITY PATH

The earth continuity conductors shall be tested for electrical continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit-breaker, measured from the connection, with the earth electrode to any point in the earth continuity conductor in the completed installation and shall not exceed one ohm.

## POLARITY OF SINGLE POLE SWITCHES

A test shall be made to verify that every non-linked, single pole switch is connected to one of the phases of the supply system.

## COMPLETION CERTIFICATES

All the above tests shall be carried out in presence of Construction Manager and the results shall be recorded in prescribed forms. Any default during the testing shall be immediately rectified and that section of the installation shall be retested. The completed test result forms shall be submitted to the owner/consultant.

On completion of an electric installation a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form as required by the local electric supply authority.

## MEASUREMENTS

Mode of measurement is as follows:

For purposes of measurement the point wiring for lights/fans/6A sockets (where 6A sockets are connected to lighting circuit loop) is divided into two parts.

a) Point Wiring
b) Circuit Main

### a) POINT WIRING

The wiring for light/fan/6A socket (where 6A sockets are connected to lighting circuit loop) point starting from first light/switch/fan and looping between switches/ fans/sockets etc., shall be measured either in `Number' or `Set'.

One light/fan point controlled by one switch is measured in Number (No.)

Set of Two or more light points controlled by one switch is measured in `Sets'.

Where set of light points wired and controlled directly from MCB DB shall be measured in `Sets'. The rate for this item shall not include the cost of switch & switch box.

6A socket wiring where connected to the lighting circuit loop is measured in Number (No.)

b) **CIRCUIT MAIN**

The length of circuit main including conduit starting from MCB DB to first switch/light/fan shall be measured separately in `Linear Metres' (Rm). (Further wiring is measured in point wiring).

**CIRCUIT MAIN FOR WIRING 6A SOCKETS, 16A SOCKETS AND POWER OUTLETS SHALL BE MEASURED AS UNDER**

Length of circuit wire including conduit starting from MCB DB to outlets and looping between outlets shall be measured in linear metres (Rm).

The commercial type socket outlet with outlet box and cover plate shall be measured in numbers (No.)

The Industrial type socket outlet including MCB, plug top, outlet box and cover plate shall be measured in numbers (No.)

The plug tops where called for shall be measured in numbers (No.).

**TECHNICAL SPECIFICATIONS LIGHT FITTINGS AND ACCESSORIES:**

**SCOPE**

Scope of work under this section shall include inspection at suppliers/manufacturer's premises, appropriate, receiving at site, safe storage, transportation from point of storage to point of erection and erection of light fittings, fixtures and accessories including all necessary supports, brackets, down rods and painting as required. The contractor shall supply all materials and accessories (other than those supplied by the owner), labour, tools, transportation, scaffolding etc., required for the completion of above work in all respects.

**STANDARDS APPLICABLE:**

The lighting and their associated accessories such as lamps, reflectors, housings, ballasts etc., shall comply with the latest applicable standards, more specifically the following :

| | |
|---|---|
| Electric light fittings General and safety requirement | IS - 1913. |
| Industrial lighting fittings with metal reflectors | IS - 1777 |
| Decorative lighting outposts | IS - 5077 |
| Flood Lights | IS - 1947 |
| Luminaries for street lighting | IS - 2149 |
| Bayonet lamp holders | IS - 1258 |
| Bi-pin lamp holders for tubular fluorescent lamps | IS - 3323 |
| Ballasts for use in fluorescent light fittings | IS - 1534 |
| Starters for fluorescent lamp | IS - 2215 |

| | |
|---|---|
| Ballast for HP MV lamps | IS - 6616 |
| Capacitors for use in fluorescent, HPMV & LP sodium Vapour lamps circuits | IS - 2215 |
| Tubular Fluorescent lamps | IS - 2418 (Part I) |
| High pressure mercury vapour lamps | IS – 2183 |
| Tungsten filament general electric lamps | IS - 418 |
| High pressure sodium vapour lamps | IS - 9974 (Part -I) |

**Light Fittings - General Requirements:**

a) Fittings shall be designed for continuous trouble free operation under atmospheric conditions, reduction in lamp life or without deterioration of materials and internal wiring. Outdoor fittings shall be weather - proof and rain proof.

b) Fittings shall be so designed as to facilitate easy maintenance including cleaning, replacement of lamps/starters etc.

c) All fittings shall be supplied complete with lamps. All mercury vapour and sodium vapour lamp fittings shall be complete with accessories like ballasts, power factor improvement capacitors, starters, etc. Outdoor type fittings shall be provided with weather proof boxes.

d) Fluorescent lamp fittings shall be complete with all accessories like ballasts, power factor improvement capacitors, starters capacitors for correction of stroboscopic effect.

e) Each fitting shall have a terminal block suitable for loop-out connection by 1100 V PVC insulated copper conductor wires upto 4 sq.mm. the internal wiring should be completed by the manufacturer by means of standard copper wire and terminated on the terminal block.

f) All hardware used in the fitting shall be suitably plated or anodised and passivity for use in industrial plants.

g) Earthling of each light fitting shall be provided with an earthling terminal. All metal or metal enclosed parts of the housing shall be bonded and connected to the earth terminal so as to ensure satisfactory earthing continuity throughout the fixture.

h) Painting/Finish All surfaces of the fittings shall be thoroughly cleaned and degreased and the fittings shall be free from scale, rust, sharp-edges, and burrs.

i) The housing shall be stove-enamelled or anodised as required. The surface shall be scratch resistant and shall show no sign of cracking or flaking when bent through 90 deg. over 12 mm dia mandrel.

**DECORATIVE TYPE FITTINGS**

Decorative fluorescent fittings shall be provided with mounting/housing channel cum reflectors of CRCA sheet steel. Stove enamelled diffusers or louvers shall be translucent white polystyrene.

**ACCESSORIES FOR LIGHT FITTINGS REFLECTORS:**

The reflectors shall be made of CRCA sheet steel/aluminium/silvered glass/Chromium plated sheet copper as required. The thickness of reflectors shall be as per relevant standards. Reflectors made of steel shall have stove enamelled/vitreous enamelled/epoxy

coating finish. Aluminium used for reflectors shall be anodised/epoxy stove enamelled/mirror polished. The finish for the reflector shall be as specified. The reflectors shall be free from scratches blisters and shall have a smooth and glossy surface having no premium light reflecting coefficient .Reflectors shall be readily removable from the housing for cleaning and maintenance without use of tools.

**LAMP/STARTERS HOLDERS:**

Lamp holders shall have low contact resistance, shall be resistant to wear.They shall hold lamps in position under normal conditions of shock and vibration prevalent in an industrial atmosphere. Lamp holders for fluorescent lamps shall be of spring loaded BI-pin rotar type. Live parts of the lamp holder shall not be exposed during insertion or removal of the lamp or after the lamp has been taken out.

Lamp holders for incandescent and mercury vapour lamps shall be bayonet type upto 100 W and Edison screw type for higher wattage. Starter holders for fluorescent lamps shall be so designed that they are mechanically robust and shall be capable of withstanding shocks during transit, installation and use.

**BALLASTS:**

The ballasts shall be designed for long life and low power loss. They shall be mounted using self-locking, anti -vibration fixtures and shall be easy to remove without demounting the fittings. The enclosures shall be dust tight and non-combustible. Ballasts shall be inductive, heavy duty type, filled with thermosetting, insulating, moisture repellent polyester compound filled under pressure or vacuum. Ballasts shall be provided with taps to set the voltage. The ballast wiring shall be of copper and they shall be free from dust.

Separate ballast shall be provided in case of multi lamp fittings, except in case of 2 x 20 W fittings. Starters shall have bi-metal electrodes of high mechanical strength. Starters shall be replaceable without disturbing the reflector of lamps and without use of any tool. Starters shall have brass contacts and radio interference suppression capacitor.

**CAPACITORS:**

The Capacitors shall have a constant value of capacitance and shall be connected across the supply of individual lamp circuits. The capacitor shall have a value of capacitance so as to correct the power factor of its corresponding lamp circuit to 0.95 lag or better. Capacitor shall be hermetically sealed preferably in a metal enclosure to prevent seepage of impregnate and ingress of moisture.

**LAMPS:**

Fluorescent lamps shall be "day-light colour" type unless otherwise specified and shall be provided with features to avoid blackening of lamp ends. Mercury vapour lamps shall be of high pressure, colour corrected type. Lamps shall be capable of withstanding vibrations prevalent in an industrial atmosphere, the filament/electrodes shall not break under such circumstances.

**INSTALLATION:**

The light fixtures and fittings shall be assembled and installed in position complete and ready for service, in accordance with details, drawings, manufacturer's instructions and to the satisfaction of the Construction Manager. Pendent fixtures specified with overall stem lengths are subject to change and shall be checked with conditions on the job and installed as directed. All suspended fixtures shall be mounted rigid and fixed in position in accordance with drawings, instructions and the approval of the

Construction Manager. Fixtures shall be suspended true to alignment, plumb, level and capable of resisting all lateral and vertical forces and shall be fixed as required.
All suspended light fixtures, fans etc, shall be provided with concealed suspension arrangement in the concrete slab/roof members. It is the duty of the Contractor to make these provisions at the appropriate stage of construction. Exhaust fans shall be fixed at location shown on drawings. They shall be wired to a plug socket outlet at a convenient location near the fan. All switch and outlet boxes, for fans and light fittings shall be bonded to earth. The recessed type fixtures shall not be supported into the false ceiling frame work. This shall have independent support from the socket of ceiling using G.I.conduit down rods/chromium plated steel chain with provision for adjusting the level of fitting. Wires shall be connected to all fixtures through connector blocks. Wires brought out from junction boxes shall be encased in flexible pipes for connecting to fixtures concealed in suspended ceiling. The flexible pipes shall be check-nut to the junction box with a brass bush and double check nut at the fixture and flexible pipes, wherever used shall be of make and quality approved by the Construction Manager.

**MEASUREMENT**

**MODE OF MEASUREMENT IS AS FOLLOWS:**

Installation of light fittings with all associated works including fixing accessories is measured in numbers (No) Supply and installation of down rods and C.P. Chain with associated works as per BOQ and specifications are measured in linear metre (Rm).

**TECHNICAL SPECIFICATIONS OF EARTHING SYSTEM**

**SCOPE**

This section covers the requirements for providing “Earthling" connection to metal parts of
equipment etc., The contractor shall supply all materials, labour, tools, plant etc., and everything necessary for the complete Earthling installation".

**STANDARDS APPLICABLE**

The following standards shall be applicable:

IS 3043 -Code of practice for earthling.
IEEE - 80:86.
IEEE - 142:92.

**GENERAL**

(i) The electrical distribution system in the Department is with earth neutral (i.e. neutral earthed at the transformer/generator end).In addition to the neutral earthling, provision is made for earthling the metallic body of equipments and noncurrent carrying metallic components in the sub-station, as well as in the internal/external electrical installations.

(ii) Earthling system is also required for lighting protection, computer installations and hospital operation theatres etc. For functional reasons.

(iii) Earthling requirements are laid down in Indian Electricity Rules,1956, as amended from time to time, and in the Regulations of the Electricity Supply Authority Concerned. These shall be complied with.

(iv) Application for Internal Earthing

(a) Every sub-main will have earth continuity conductor to run along with sub-main wiring. In case of 3-phase sub main wiring two earth continuity conductors shall be provided.

(b) Every circuit will have its earth continuity conductor to run alongwith circuit wiring.In case of 3-phase circuit two earth continuity conductors shall be provided.

(c) Looping of earth is allowed only in case of point wiring.

(d) When 2/3 power outlets are looped to one circuit, earth loopingof these outlets is permissible.

## G.I.PIPE EARTH STATION:

Electrodes shall be made of G.I. Pipe of internal diameter of 65mm dia. The pipe electrode shall be as far as practicable embedded below permanent moisture level. The length of the pipe electrode shall not be less than 2.5 m. Except where rock is encountered, pipes shall be driven to a depth of at least 3.0 mtr where rock is encountered at a depth of less than 3.0 mtr. The electrode may be buried inclined to the vertical and the inclinations not more than 30 deg C from the vertical. The pipe electrode shall be made of one piece. Earth leads to the electrode shall be laid in a heavy duty GI pipe and connected to the pipe electrode with brass bolts, nuts and washers. GI pipe shall be terminated in a wire meshed funnel. The funnel shall be enclosed in a masonry chamber of 600mm x 600mm dimensions. The chamber shall be provided with C.I. frame and CI inspection cover. The earth station shall also be provided with a suitable permanent identifications label tag. The earth electrode shall conform to IS: 3043 latest edition. The soil around the earthling electrode shall be treated to reduce the resistivity of the soil by filling the complete depth of electrode with alternative layers of charcoal and salt.

## PLATE EARTH STATION

Plate electrodes shall be made of copper (CU) plate of 3mm thick and 610 x 610mm size. The plate shall be buried vertically in ground at a depth of not less than 2.5 meters to the top of the plate, the plate being encased in charcoal to a thickness of 300mm all round. It is preferable to bury the electrode to a depth where subsoil water is present. Earth leads to the electrode shall be laid in a heavy duty GI pipe and connected to the plate electrode with brass bolts, nuts and washers. A GI pipe of not less than 19mm dia shall be clamped with bolts vertically to the plate and terminated in a wire meshed funnel. The funnel shall be enclosed in a masonry chamber of 610mm x 610mm dimensions. The chamber shall be provided with GI frame and CI inspection cover. The earth station shall also be provided with a suitable permanent identifications label tag. The earth electrode shall conform to IS: 3043.

## EARTHING CONDUCTORS

All earthling conductors shall be of high conductivity copper and shall be protected against mechanical damage and corrosion. The connection of earth

electrodes shall be strong secure and sound and shall be easily accessible. The earth conductors shall be rigidly fixed to the walls, cable trenches, cable tunnel, conduits and cables by using suitable clamps.

Main earth bus shall be taken from the main medium voltage panel to the earth electrodes. The number of electrodes required shall be arrived at taking into consideration the anticipated fault on the medium voltage net work.

Earthling conductors for equipment shall be run from the exposed metal surface of the equipment and connected to a suitable point on the sub main or main earthling bus. All switch boards, distribution boards and isolators disconnect switches shall be connected to the earth, bus. Earthling conductors shall be terminated at the equipment using suitable lugs, bolts, washers and nuts.

All conduits cable armouring etc., shall be connected to the earth all along their run by earthling conductors of suitable cross sectional area. The electrical resistance of earthling conductors shall be low enough to permit the passage of fault current necessary to operate a fuse/protective device or a circuit breaker and shall not exceed 2 ohms.

## PRECAUTIONS

Earthling system shall be mechanically robust and the joints shall be capable of retaining low resistance even after subjection to fault currents.

Joints shall be tinned, soldered and/or double riveted. All the joints shall be mechanically and electrically continuous and effective. Joints shall be protected against corrosion.

## TESTING

On the completion of the entire installation, the following tests shall be conducted:

i) Earth resistance of electrodes
ii) Impedance of earth continuity conductors as per is 3043.
iii) Effectiveness of earthling as per is 3043.

All meters, instruments and labour required for the tests shall be provided by the contractor. The test results shall be submitted in the prescribed tabulated form in triplicate to the consultants for approval.

## MEASUREMENT

Mode of measurement is as follows:
Earth strips (GI/Cu), earth conductor are measured in linear metre (Rm).
Earthling station with all associated works (G.I pipe or copper plate) is measured in number (No).

## LIST OF APPROVED MAKES:-

| | | |
|---|---|---|
| 1 | CURRENT TRANSFORMERS | PRAGATI/ KAPPA / AE |
| 2 | VOLTAGE TRANSFORMERS | PRAGATI/ KAPPA / AE |
| 3 | TRANSFORMER | KIRLOSKAR / VOLT AMP / RPG RAYCAM/SCHNEIDER/SIEMENS |
| 4 | MAIN L.T. PANEL | Electro Allied Product/SCHNEIDER/Legrand / Siemens – SIEPAN 8PU |
| 5 | BATTERY | EXIDE |
| 6 | BATTERY CHARGER | CALDYNE/ HILTON ELECTRONICS |
| 7 | CAPACITORS | EPCOS (SIEMENS) / NEPTUNE/L&T |
| 8 | CONTACTORS & STARTERS | SCHNEIDER / L&T/ABB/ SIEMENS |
| 9 | FUSES & FUSE BASES | SIEMENS/ L& T/ GE |
| 10 | SWITCH FUSE & FUSE SWITCH UNITS | SIEMENS / SCHNEIDER / GE/ L&T/ ABB |
| 11 | SELECTOR SWITCHES & ROTARY SWITCHES | KAYCEE / SALZER |
| 12 | AIR CIRCUIT BREAKERS | SCHNEIDER / SIEMENS / LEGRAND /ABB |
| 13 | MOULDED CASE CIRCUIT BREAKERS | SCHNEIDER / L&T / ABB/LEGRAND/SIEMENS/HAGER |
| 14 | MINIATURE CIRCUIT BREAKERS | LEGRAND / SCHNEIDER/ ABB/ SIEMENS/L&T/HAGER |
| 15 | RESIDUAL CURRENT CIRCUIT BREAKERS (RCCB) | LEGRAND / SCHNEIDER/ ABB/ SIEMENS/L&T/HAGER |
| 16 | PUSH BUTTONS | SIEMENS / VAISHNAV / RISHAB/L&T |
| 17 | RELAYS | ABB / GE/ SIEMENS/ L& T/ALSTOM |
| 18 | TIMERS | LEGRAND / SCHNEIDER / SIEMENS/ ABB/L&T |
| 19 | INDICATING LAMPS | SIEMENS / VAISHNAV / RISHAB |
| 20 | DISTRIBUTION BOARDS | SCHNEIDER/LEGRAND/ SIEMENS/HAGER |
| 21 | DIGITAL MEASURING INSTRUMENTS | ENERCON / L&T/ HPL/ CONVERGE |
| 22 | DIGITAL KILO WATT HOUR METERS | L&T / ENERCON/ HPL/ CONVERGE |
| 23 | LIGHT FIXTURES & LAMPS (INDUSTRIAL, COMMERCIAL & DECORATIVE) | |
| 23.1 | INTERNAL | PHILIPS / WIPRO /BAJAJ/CG/MESCAB |
| 23.2 | EXTERNAL | PHILIPS /BAJAJ/CG |
| 24 | HT & LT CABLES (POWER & CONTROL) | POLYCAB / GLOSTER/FINOLEX/HAVELLS |
| 25 | TELEPHONE CABLES | |
| 25.1 | CAT5E & CAT6 GRADE | LEGRAND/AVAYA(LUSCENT) / AMP/ FINOLEX/POLYCAB |

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|---|---|---|
| 26 | PVC INSULATED COPPER WIRES | FINOLEX (FRLS) /BONTON/ RR KABEL/ LAPP/ POLYCAB/MESCAB/PLAZA/L&T |

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|---|---|---|
| 27 | PVC RIGID CONDUITS | VIP / UNIVERSAL/ AKG/HARSH/ PRECISION |
| 28 | MS CONDUITS | SUPREME / BHARAT/ ECON |
| 29 | CRIMPING TYPE LUGS | DOWELLS / 3D / BRACO |
| 30 | HT CABLE SEALING KITS | REYCHEM |
| 31 | CABLE GLANDS | BRACO/ COMET/ DOWELLS |
| 32 | INDUSTRIAL SOCKETS IN SHEETSTEEL ENCLOSURE WITH MCB | LEGRAND/ CLIPSAL/ HENKEL/CROMPTON |
| 33 | CEILING ROSE | ANCHOR / LISHA |
| 34 | LIGHTING & POWER CONTROL SWITCHES, RECEPTACLES | LEGRAND /MK (WRAPAROUND) / CRABTREE/ ABB/ SIEMENS/ PHILIPS |
| 35 | CEILING FANS & EXHAUST FANS | CROMPTON / BAJAJ/ EPC/ HAVELLS |
| 36 | TERMINALS | ELMEX / CONNECTWELL / WAGO |
| 37 | CHANGE OVER SWITCHES | HAVELLS/ HPL/ C& S/ GE |
| 38 | PUBLIC ADDRESS SYSTEM & SPEAKERS | PHILIPS / AHUJA / SONODYNE / ONKYO |
| 39 | TELEPHONE SYSTEM & EXCHANGE | TATA TELECOM / SIEMENS / LUCENT |
| 40 | CABLE TRAYS | LOCAL MAKE/ CITY STEELEDGE |
| 41 | SYNTHETIC PVC MATS | SUNTEX ENTERPRISES |
| 42 | AVIATION LIGHT | BAJAJ |

## Technical Specification of
### ELECTRIC CREMATORIUM FURNACE SYSTEM

Supply, installation, testing and commission including obtaining NOC from the W.B. Pollution Control Board of 2 nos. of Electric Crematorium Furnace System as per the following specification with 12 months' guarantee for manufacturing defects after commissioning.

### TECHNICAL SPECIFICATION

1 Primary Combustion Chamber with inbuilt Secondary cum ash chamber .
2. Emission Treatment Systems

### Emission Treatment Systems

Secondary Chamber
Hot duct with finned inserts
Gravity Settler with Filters
Ventury Wet Scrubber
Mist eliminator
Filter chamber with Filters
Dilution System
Negative Pressure creation System

**Function of the above emission treatment system**

**Secondary Combustion Chamber**

For the re incineration of emissions – Conversion of gaseous products to soluble form under an atmosphere of excess air. This removes the foul odor from the emissions

**Hot Duct with Finned Inserts**

To remove carried over carbonaceous materials from the emissions by allowing the emissions to move to the next chamber after coming in contact with the hot fins of heat resistant metallic fins and also to achieve a good residence time for emissions in secondary chamber

**Gravity Settler with Filters**

To remove heavier particulates from emissions and also filters the semi fine particulates from emissions

**.Ventury Wet Scrubber**

To remove soluble emissions as well as to remove carried over particulates

**Mist Eliminator**

Incorporated in the wet scrubber to remove aerosols (Mist) from the treated emissions

**Filter Chamber with Filters**

The Filter Chamber will have Charcoal/ Activated Carbon & Activated Alumina Pack to remove any carried over foul odor

**Negative Pressure Creation System**

The whole Furnace system will work on a negative pressure which is created by an Induced Draft Fan driven by a powerful motor

**Dilution System**

The treated Emissions are diluted with excess air to bring down the concentration of detrimental emissions prior to letting out to atmosphere through a stack of 30 Meters height. This system will control the opacity of the let out emissions.

**Additional Features**

1. This System ensures a gas residence time of minimum 2 seconds in Secondary Combustion Chamber the temperature of which is maintained at 1050 degree centigrade.

2. Ensures a combustion Efficiency will be 99%

3. No entrapment of fluids in the ash

4. **ENERGY SAVING DEVICE- The system is designed to work in a power rating**

of 63 KW instead of 75KW thus saving 12 KW per hour

5. **The Crematorium Furnace System will conform to the Pollution Control Board Norms.**

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1. Scope : Design, supply, Erection and Commissioning of twin chamber Crematorium Furnace with common Emission Treatment systems.

**Technical Details of each chamber**

| | |
|---|---|
| Primary incineration Chamber with built .in Secondary incineration Chamber - Size | : 2400 x 1100 x 1350mm (height) mm |
| Temperature of Primary Chamber | : 620 to 800 degree centigrade |
| Temperature of Secondary Chamber | : 900 to 1000 degree centigrade |
| Power requirement | : 400/440V, 50C/s- 3Phase, 4 Wire System |
| Power rating - Primary &Secondary Chamber -Total | : 54KW |
| Power rating of Duct | : 9 KW |
| Hearth of Primary & Secondary Cum Ash chamber | Solid heat resistant material |
| Thermal insulation | : High alumina Refractory backed up with ceramic Fibres of Various grades |
| Heating element | : Kanthal APM- Powder Metallurgy Product |
| Temperature control & indication. | : Digital type solid state indicating controller<br>: 0 to 1200 degree centigrade |
| Safety to control Activity | : Solid state non- indicating controller. |
| Temperature sensor | : Cr/A1 Thermocouples. |
| Supply of combustion | : By means of powerful blower Air |
| Creative of negative | : By means of powerful blowe |

Pressure : capacity -7.5 HP

Loading of body : Using trolley moving on rails with lowering and lifting mechanism / Stretcher with rollers for the body pushing inside the chamber

Ash removal : From the ash cum secondary chamber provided beneath the Primary combustion chamber

Furnace casing : Sturdy mild steel structure outer with glazed tiles

Door to Primary Chamber : Vertical sliding type counter weight balanced-Electrically operated

Door of Ash cum secondary chamber – Hinged type

Control Panel : A floor mounting control panel of mild steel sheet construction with metallic stiffeners' housing indicating lamps, contractors, HRC fuses, controllers, ammeter with selector switch, volt meter with selector switch etc. The control panel will b neatly wired and ferruled as per standard

Chimney : Self standing chimney of mild steel pipes up to a height of 30 meter from ground level. Chimney will have necessary sampling pockets, ladder up to platform for sampling, aviation obstruction lamp lightning arrestor and day and night marking as per

**Painting:**

The control panel and other metal parts except Furnace outer will be painted with attractive enamel finish/ heat resistant aluminium paint after surface treatment. The Furnace outer will be lined with glazed tiles: ICAO norms

**Common emission treatment systems**

Systems as explained above

26. Safety Measures.

a) Safety controller : To take care of control activities in case of failure of main controller.

b) Interlocking between : To cut power supply at the time of opening the door and the heating: the door element

c) Earthing : Proper earthing as per Electricity Board rules

**Effluent Treatment**: The water circulation tank will be provided with Filters, aeration for treating the effluent. The treated effluent will be discharged to sewers after treating with hypochlorite

## Specific Priced Schedule of probable items with approximate quantities for the work of "Construction of Electric Crematorium at Tarapith in the District of Birbhum, West Bengal"

### (7) Electric Crematorium Furnace System including Electric Burners (2 nos.) & Pollution Control arrangement as well as all other Electrical works

| Sl No | Description | Quantity | Unit | Rate | Amount (Rs.) |
|---|---|---|---|---|---|
| | **Group A ( Electrical Items)** | | | | |
| 1 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of PCC CUM MCC CUM Instrument panel for Furnace and Pollution Control system complite with all necessary switchgears, Instruments, Lamps , Push bottom etc. Brief Specification of Control panel has been given below.<br><br>a) The panel should be floor mounted , self supporting indoor type conforming to IP-54 standured.<br>b) The panel to be fabricated from 2.5 mm thkd CRC Sheet and the bus bar inside the panel should be of Copper and with suitable arrangement.<br>c) The Colour of the panel should be Siemens Gray<br>d)The panel should be fitted with 2 nos. suitable rated Panel AC. With timmer and necessary arrangement for changing over after every 2 hrs.<br>e)The panel should have following feeder.<br>i) Suitable Microprocessor based MCCB at the incoming of the panel.<br><br>ii)1 no. 96 x 96 size Digital Volt meter with selector switch<br><br>iii) 1 no. 96 x 96 size Digital Ammeter with selector switch.<br>iv) 1 no. 3ph Digital Energy meter.<br>v) Necessary Plug and Panel lamp.<br>vi) 54 Kw Feeder for Heating Element of Primary Chamber The feeder consist of suitable rated Fuses, Contactor. Provision to be made to run the heater in Star Delta and Off mode.<br>vii) 27 Kw Feeder for Heating element of Secondary Chamber. Provision to be made to run the heater in Star, Delta and Off mode.<br>viii) 0.5 KW DOL Feeder for Door Motor with forward and reverse. The circuit should consist of Suitablke rated MPCB, Contactor etc.<br>ix) 2 KW DOL Feeder for Fresh air injection Motor. The circuit should consist of Suitablke rated MPCB, Contactor etc.<br>x) 7.5 KW star delta Feeder for ID fan Motor. The circuit should consist of Suitable rated MPCB, Contactor etc.<br><br>xi) 3 HPDOL Feeder for Scrubber Pump Motor. The circuit should consist of Suitable rated MPCB, Contactor etc.<br>xii) 2 hp DOL Feeder for After cooler Motor. The circuit should consist of Suitable rated MPCB, Contactor etc.<br>f) Two position Digital type microprocessor based on / off type Temperature controller 96 x 96 size with two set point and 2 nos relay output<br>g) Digital type microprocessor based on off type Over Temperature controller 96 x 96 size with two set point and 2 nos relay output<br>h) 2 nos feeder for 220 V servo motror.<br>i) 2 nos 48 x 48 size controller with 4 - 20 mA out put with position feed back arrangement.<br>j) Necessary Push bottom<br>k) Necessary lamps.<br>l) The pannel should be neatly wired with suitable ferrule marking and sockets suitably creamped. | 2 | Nos. | 350,000.00 | 700000.00 |

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| | m) 3 sets of Electrical circuit drawing, test certicicate, and test certificate of all the components to be provided along with the control panel. Prior to the building of panel successful contractor should get the drawing approved.<br>n)Necessary arrangement along with timmer to control the stsrt and stop of the aviation lamp. | | | | |
| 2 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Prove out of 200 amp Bus Bar Box for giving connection to the heater of primary chamber | 2 | Nos. | 4,500.00 | 9000.00 |
| 3 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Prove out of 100 amp Bus Bar Box for giving connection to the heater of secondary chamber | 2 | Nos. | 4,000.00 | 8000.00 |
| 4 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of servo motor fitted with suitable butterfly valve for controlled injection of fresh air. | 4 | Set | 75,000.00 | 300000.00 |
| 5 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of Pipe line, ducting support system, Forced Draft fan etc | 2 | Set | 90,321.00 | 180642.00 |
| 6 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of thermocouple and compensating cables of following specification<br>a) 2 Nos. K type thermocouple 600 mm lg with SS-310 tube for primary chamber<br>b) 1 No K type thermocouple 600 mm lg with Ceramic tube for secondary chamber | 2 | set | 22,000.00 | 44000.00 |
| 7 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of heating element of capacity 4.5 Kw for primary chamber made from 8 SWG N-80 wire win coil form. The Lid out rod to be suitably designed ane of material AISI-310. The coil to be inserted into groove of coil brichs and ceramic tubes. | 24 | Nos. | 25,000.00 | 600000.00 |
| 8 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of heating element of capacity 4.5 Kw for secondary chamber made from 8 SWG N-80 wire win coil form. The Lid out rod to be suitably designed ane of material AISI-310. The coil to be inserted into groove of coil brichs and ceramic tubes. | 12 | Nos. | 25,000.00 | 300000.00 |
| 9 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of Copper Lugs and Coper wire and ceramic insulators of suitable design for the interconnection of heater of primary and secondary chamber | 2 | set | 4,999.50 | 9999.00 |
| | **Group B ( Structural Items )** | | | | |
| 10 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of complete structural work for primary and secondary chamber of furnace made out of M.S Angle , M.S Channel etc and 4 mm thk M.S plate , Rear and Bottom side plate of adequate thickness and welded or bolted in propper manner. Furnace door should be suitable counter balanced so that minimum power is required to lift the door. Door should be electrically operated with option of manual override in case of power failure. To make the door of light weight, the same should be lined with ceramic fiber blanket. To hold the blanket suitable designed stainless rod to be used of grade AISI-310. | 2 | set | 380,000.00 | 760000.00 |

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| 11 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection, Commissioning and Proveout of 2 nos. cast door with suitable hinge and locking arrangement. The door to be insulated with suitable insulating castable. These doors are to be used for poking and removing of bones and ashes. | 2 | set | 55,000.00 | 110000.00 |
| 12 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of counterweight and its arrangement. The counter weight te made from cast iron. | 2 | set | 55,000.00 | 110000.00 |
| 13 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of manifold with provision of three outlet , complete set of flue damper set, door guider and side rail sets and flue damper sets | 2 | set | 40,000.00 | 80000.00 |
| | **Group C ( Mechanical Items)** | | | | |
| 14 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of two position cantilever type spring loaded body Charging trolley with suitable handle. The trollu to be made of suitable Mild Steel chequered plate for latforms complete with rollers, bearings etc.Before fabrication the drawing of trolley to be approved bt EIC. | 2 | set | 290,000.00 | 580000.00 |
| 15 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Prove out of main door driving shaft with sprocket and bearing assembly . 1 set handle assembly for manual driven door with 50 and 30 dia pulmer block and bearing assembly (2 set each) 1" pitch roller chain of suitable length with link and 1" pitch roller chain of suitable length with chain link. | 2 | set | 155,000.00 | 310000.00 |
| | **Group D (Refractories and Insulation)** | | | | |
| 16 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of Refractory and insulation system comprises of the following.<br>a) 1020 Nos. IS - 8 bricks<br>b) 2000 nos Hot face Insulation bricks conforming to IS-type II<br>c) 2000 nos.Cold face Insulation Bricks conforming to IS-type -III<br>d) 1 set Refractories slab for construction of flue duct passage in the basement as required.<br>e) 40 bag Heat resistance fire clay<br>f)1 set Mill Board<br>g)1 set Ceramic Rope<br>h)1 set Various Special Shape bricks as required to complite the job<br>i) 1 set Vermaculite insulating powder<br>j) 1 set Ordinary Building Brick<br>k) 1 set Necessary Cement<br>l) 1 set Necessary sand<br>k) 1 set Decorative Glazed Tiles<br><u>Note :</u><br>a) Complite lining & assembling of entire cremation chamber accourding to standured size with proper of arrangement of accomodation of heating element , resting of dead body with sufficient opening for falling of ashes to the ash chamber and sufficient ventilation for fresh air spraying.<br>b) Complete lining & assemblying of entire cremation chamber accourding to standured size with provision of drawing out ashes from the rear side and sufficient ventillation for fresh air injection. | 2 | set | 820,000.00 | 1640000.00 |

c) Complete lining and assembling of entire cremation chamber accourding to the standured size with provision of air inlet supplying of fresh air blower and arrangement of multi ventilation path for Fresh air injection to the ash chamber and cremation chamber.

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| | **Group E (Pollution control System)** | | | | |
| 17 | Design, Engineering, Manufacturing, Testing Supply, Delivery at site Erection , Commissioning and Proveout of pollution control system to meet the specific stsndured of CPCB. The system should be strickly as per the guide line of CPCB. The pollution control system consists of the following equipments.<br>a)1 no. Air cooled after Cooler made from AISI- 304 with 2 hp blower for purging cold / atmospheric air.<br>b) 1 no. Ventury packed wet scrubber mad from AISI- 304 material along with 3 hp centrifugal pump<br>c) 1 no. Mist Elimator with chevron plate for eleminating the water particles.<br>d) 1 no. Induced Draft fan fitted with 10 hp , 3ph, 1440 rpm motor. The casing and impeller of the fan is made from AISI-304 material.<br>e) 1 set Decessary Ductings and accessories along with damper etc made from AISI-304 material.<br>f) 1 set Foundation bolt for the chimney<br>g) Approval of thr pollution system from respective authority. | 2 | set | 1,400,000.00 | 2800000.00 |
| 18 | 30 mts self supported chimney as per IS standured. The chimney should be capable of handeling the flue gas of both the furnace at same time. The chimney should have at least 3 nos platform at various height and ladder with sampling point at various level. The top dia of the chimney should be 800 mm min and the base dia 2400 mm. the base plate should be 20 mm min . First two shell should be 12 mm minimum, next two shell should be 10 mm minimum rest with 8 mm plate. The height of single shell should be minimum 2.5 mts. The following should be provided with chimney.<br><br>a) Aveation lamp<br>b) Lightening arrestor<br>c) Earthing strip with porceline insulator.<br><u>Note</u>: Before Construction the drawing should be approbed by EIC along with all calculation and annalysis report. | 1 | set | 1,650,000.00 | 1650000.00 |
| | **Groupe - F (Cables and Accessories.)** | | | | |
| 19 | Design, Engineering, procurement, Testing Supply, Delivery at site Erection , Commissioning and Proveout of The following Cables and accessories are required and have to be supplied by the contractor<br>a) 70 mm2 X 3Core 1.1 KV grade P.V.C insulated Al armoured cable from Control panel to Bus bar box of primary chamber. This cable is for carrying the power to primary chamber heating element.<br>b) 50 mm2 X 3Core 1.1 KV grade P.V.C insulated Al armoured cable from Control panel to Bus bar box of secondary chamber. This cable is for carrying the power to secondary chamber heating element.<br>c)1.5 mm2 3Core 1.1 KV Cu armoured cable from Control panel to Door Motor<br>d)1.5 mm2 3Core 1.1 KV Cu armoured cable from Control panel to Fresh Air Motor<br>e)4 mm2 3Core 1.1 KV Cu armoured cable from Control panel to ID fan Motor<br>f)2.5 mm2 3Core 1.1 KV Cu armoured cable from Control panel to pump Motor<br>g)1.5 mm2 3Core 1.1 KV Cu armoured cable from Control panel to After Cooler Motor<br>h)1.5 mm2 3Core 1.1 KV Cu armoured flexible cable from Control panel to servo Motor<br>i) 1.5 mm2 2 Core 1.1 Kv Cu armoured flexible cable from Control panel to aveation lamp.<br><u>Note</u>: All necessary accessories required to fix the cables such as Lug, cable tray, cable tie, metallic cable gland etc. | 2 | set | 230,000.00 | 460000.00 |

**Group G ( Miss)**

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| 20 | Supply and installation of two number copper earthling plate size 600 mm x 600 mm x 3 mm thk and G.I strip 15 mm x 3 mm size shall be connected to furnace control panel and to all equipments of furnace and other equipment as per Indian Electricity Act and Regulation in approved manner. | 2 | set | 26,000.00 | 52000.00 |
| 21 | ERECTION, TESTING & COMMISSIONING OF 11 KV 3PANEL HT PANEL (WBSEB HT PANEL) | | | | |
| | (i) VCB<br>1 Incomers. 1 Outgoings, 1 Bus PT<br>Nominal rating of VCB-800Amp.,26.3kA/1 Sec.<br>Spring charging of motor Aux.supply 230V AC<br>Closing Coil (CC) Aux.supply 110V DC<br>Triping Coil (TC) Aux.supply 110V DC<br>2nd Trip Coil Aux.Supply (if applicable)<br>Aux. Contacts + No.of Pins-6NO+6NC<br>Encapsulated Contact Arm No-1 | | | | |
| | (ii) PROTECTIVE RELAYS (CT Sec- 5A, 110V DC)<br>Relay 1, Numerical 3-Over Current & 1-Earth Fault Protection Relay with High Set Inst Unit & In-Buit Trip Circuit Supervision Feature. No-1<br>Relay 2, Master Trip Relay No-1<br>Relay 3, Auxuliary Relay No-2<br>Relay 4, Under Voltage Relay No-1<br>Relay 5, Anti Pumping Relay No-1 | | | | |
| | (iii) CTs<br>CT;TYPE( WINDOW/WOUND)<br>Set 1, CT Ratio, VA,CLASS-100-50/5-5A, 15VA, CL=1.0,<br><br>15VA, 5P10. Nos.-3 | | | | |
| | (iv) PTs<br>(BUS) PT Primary -11Kv/√3 No.-1<br>Set 1 PT Secondary<br>Core (VA,CLASS) Three Phase-200VA,CL.-1.0 | | | | |
| | (v) Meters (96 sq mm)<br>Ammeter (Digital) with Selector Switch Flush Mounted No-1<br>Voltmeter (Digital) with Selector Switch Flush Mounted No.-1<br>KWH-Meter No.-1 | | | | |
| | (vi) Control Switch<br>Breaker Control Switch No.-1 | | | | |
| | (vii) Indication LED Type<br>Red CB"OFF" 110V DC No.-1<br>Green CB"ON" 110V DC No.-1<br>Amber "AUTO TRIP" 110V DC No.-1<br>White"TRIP CKT.HEALTHY" 110V DC No.-1<br>Blue "Spring Charged" 110V DC No.-1<br>RYB PT Indication 110V AC Nos.-3 | | | | |
| | (viii) Push Buttons<br>Breaker EM Stop (Mushroom Head - Spring Return Type) No.-1<br>Push Button for Buzzer Accept No-1 | | | | |
| | (ix) Fuse/MCB<br>PT ckt. Fuse - 10A No-7<br>Spring charging ckt. Fuse - 6A/10A No-2<br>Closing ckt. Fuse - 6A/10A 2 2<br>Tripping ckt. Fuse - 6A/10A No.- 2<br>Indication ckt. Fuse - 4A/6A No.-2<br>Main DC ckt DC MCB - 16A DP No.-1<br>Main AC ckt No.-2 | | | | |
| | (x) Terminal Type<br>Control/PT<br>CT | | | | |

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|---|---|---|---|---|---|
| (xi) Panel Illumination lamp,AC-60W, 240V AC No-1<br>(xii) Power Pack I/P : 110V AC, O/P : 110V DC No-1<br>(xiii) Auxuliary Contractor No.-1<br>(xiv) Buzzar No.-1<br>(xv) Cable/ Busduct Entry-Bottom<br>Control Cable -Type FRLS<br>DC control Size & Colour 1.5sq.mm. / grey<br>CT Size & Colour 2.5 sq.mm./ R,Y,B<br>PT Size & Colour 1.5 sq.mm./ R,Y,B<br>AC Control ckt. Size & Colour 1.5 sq.mm./ grey<br>Interpanel Wiring Size & Colour 1.5 sq.mm./ grey<br>(xvi) Three pin 6Asocket +6A switch No.-1<br>(xvii) Anti condentation space heater/Thermostat (230V,100 Watt) No-1<br>(xviii) Busbar, Earthing[40x10 Sqmm.-Al], Wiring, Overhead,Misc, Fabrication | 1 | No. | 650000 | 650000.00 |
| 22 ERECTION, TESTING & COMMISSIONING OF 11 KV 3PANEL HT PANEL (CLIENT'S HT PANEL)<br>(i) VCB<br>1 Incomers & 2 Outgoings<br>Nominal rating of VCB-800Amp.,26.3kA/1 Sec.<br>Spring charging of motor Aux.supply 230V AC<br>Closing Coil (CC) Aux.supply 110V DC<br>Triping Coil (TC) Aux.supply 110V DC<br>2nd Trip Coil Aux.Supply (if applicable)<br>Aux. Contacts + No.of Pins-6NO+6NC<br>Encapsulated Contact Arm No-1<br>(ii) PROTECTIVE RELAYS (CT Sec- 5A, 110V DC)<br>Relay 1, Numerical 3-Over Current & 1-Earth Fault Protection Relay with High Set Inst Unit & In-Buit Trip Circuit Supervision Feature. No-1<br>Relay 2, Master Trip Relay No-1<br>Relay 3, Auxuliary Relay No-2<br>Relay 4, Under Voltage Relay No-1<br>Relay 5, Anti Pumping Relay No-1<br>(iii) CTs<br>CT;TYPE( WINDOW/WOUND)<br>Set 1, CT Ratio ,VA,CLASS-100-50/5-5A, 15VA, CL=1.0,<br><br>15VA, 5P10. Nos.-3<br>(iv) PTs<br>(Line) PT Primary -11Kv/√3 No.-1<br>Set 1 PT Secondary<br>Core (VA,CLASS) Three Phase-200VA,CL.-1.0<br>(v) Meters (96 sq mm)<br>Ammeter (Digital) with Selector Switch Flush Mounted No-1<br>Voltmeter (Digital) with Selector Switch Flush Mounted No.-1<br>KWH-Meter No.-1<br>(vi) Control Switch<br>Breaker Control Switch No.-1<br>(vii) Indication LED Type<br>Red CB"OFF" 110V DC No.-1<br>Green CB"ON" 110V DC No.-1<br>Amber "AUTO TRIP" 110V DC No.-1<br>White"TRIP CKT.HEALTHY" 110V DC No.-1<br>Blue "Spring Charged" 110V DC No.-1<br>RYB PT Indication 110V AC Nos.-3<br>(viii) Push Buttons<br>Breaker EM Stop (Mushroom Head - Spring Return Type) No.-1<br>Push Button for Buzzer Accept No-1 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | (ix) Fuse/MCB<br>PT ckt. Fuse - 10A No-7<br>Spring charging ckt. Fuse - 6A/10A No-2<br>Closing ckt. Fuse - 6A/10A 2 2<br>Tripping ckt. Fuse - 6A/10A No.- 2<br>Indication ckt. Fuse - 4A/6A No.-2<br>Main DC ckt DC MCB - 16A DP No.-1<br>Main AC ckt No.-2<br>(x) Terminal Type<br>Control/PT<br>CT<br>(xi) Panel Illumination lamp,AC-60W, 240V AC No-1<br>(xii) Power Pack I/P : 110V AC, O/P : 110V DC No-1<br>(xiii) Auxuliary Contractor No.-1<br>(xiv) Buzzar No.-1<br>(xv) Cable/ Busduct Entry-Bottom<br>(xvi) Control Cable -Type FRLS<br>DC control Size & Colour 1.5sq.mm. / grey<br>CT Size & Colour 2.5 sq.mm./ R,Y,B<br>PT Size & Colour 1.5 sq.mm./ R,Y,B<br>AC Control ckt. Size & Colour 1.5 sq.mm./ grey<br>Interpanel Wiring Size & Colour 1.5 sq.mm./ grey<br>(xvii) Three pin 6Asocket +6A switch No.-1<br>(xviii) Anti condentation space heater/Thermostat (230V,100 Watt) No-1<br>(xix) Busbar, Earthing[40x10 Sqmm.-Al], Wiring, Overhead,Misc, Fabrication | 1 | No. | 650000 | 650000.00 |
| 23 | Erection, Supply ,Testing and Commissioning of 315 KVA, 3 Phase , 50 Hz, 1KV/433V Dry type distribution transformer as per specification below :<br>Design, fabrication, supply, installation, testing and commissioning of indoor type 315 kVA, 11kV/433V 3 Ph, 50 Hz, dry type, vector group DYN -11 Transformer, copper wound, Class F insulation, indoor distribution Transformer with IP23 enclosure. The transformer shall connected Delta on HV side and Star on LV side with Off Load Tapp Changer in steps of + 5% to -10% in steps of 2.5. The transformer shall have neutral CT with suitable enclosure on earthed star point with connector for connection to low set earth fault relay, REF relay provided in HT panel, winding temperature alarm and trip, HV cable box suitable for termination of HT XLPE cable and LV chamber suitable for termination of cable and complete with all standard fittings and accessories etc including necessary louvers with cooling fan/duct as required complete and as per specifications attached in all respects as required and necessary control cabling for alarm, tripping & indication as required. The rate shall be inclusive of all materials, lead, lift, necessary civil works for transformer foundation etc. complete.<br><br>Voltage Ratio: 11/0.433 kV<br>Type of Winding: Copper<br>Fittings: Standard fittings as per IS:2026/77. | 1 | No. | 750000 | 750000.00 |
| 24 | H.T.CABLE<br>Supplying 3C X 300 Sq.mm, 11kV GRADE(E) XLPE aluminium conductor steel armoured cables & Laying of Cable in ground including excavation,sand cushing,protective covering and refilling the trench etc. as required. | 40 | Rm | 3100 | 124000.00 |

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| 25 | H.T.CABLE TERMINATION (Heat shrinkable type) | | | | |
| | (i) Supply and making terminal joints for 1R-(3 x 300 sq.mm), 11kV cross linked polyethylene (XLPE) insulated aluminium conductor cable gland, indoor type cable sealing kits, insulation tape, approved sealing epoxy compound, effecting gland etc. | 6 | Nos. | 9364 | 56184.00 |
| | (ii) Supply and fixing in position the best quality danger boards of approved shape and size as specified by the local electrical authorities written in English, Hindi and Local Language. | 2 | Nos | 270 | 540.00 |
| | (iii) The professional charges for liason work and departmental procedures required for the above said work . | 1 | Lot | 150000 | 150000.00 |
| | Note: The work shall include the following:<br>* Complete liasoning with WBSEDCL and electrical inspectorate.<br>* Obtaining the feasibility report and spot inspection, etc.<br><br>*Obtaining saction of H.T. connection of 2nos.315 KVA Dry type Transformer<br>* Preparation and submission of all statutory drawings to WBSEDCL and electrical inspectorate.<br>* Obtaining necessary approvals and submitting to the clients.<br>* Arranging for the service from the WBSEDCL<br>* Any other works related to WBSEDCL and Electrical inspectorate. | | | | |
| 26 | EARTHING SYSTEM FOR SUBSTATION EQUIPMENT | | | | |
| | (i) Earthing with 65 mm dia GI pipe (TATA-Medium)x 3.0 Mts. long and 1 No. 50 mm x 6 mm galvanized (Hot Dip) steel strip (4 Mts. long), 20 mm dia x 125 mm long galvanized bolt,double nuts, double washers including finishing both ends by making holes etc. and S & F 65 mm dia GI pipe (ISI-Medium) protection (3 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level to an average depth of 3.65 Mts | 8 | Nos. | 3453 | 27624.00 |
| | (ii) Earthing with Copper plate (610x610x3mm size) having weight of 9.84 Kg and 1 No. 25x5mm Copper strip (3.20 mt long) & 1no. 6 sqmm PVC insulated stranded Copper wire (4 Mt long) incl. S & F 15 mm dia GI pipe (ISI-Medium) protection (4 mt. long) to be fillied with bitumen, partly under the ground level & partly above ground level to an average depth of 3.65 Mts.below the ground level and restoring the surface duly rammed incl. providing 3.0 mt long, 25 mm dia GI pipe (ISI-Medium) for periodic treatment, incl. providing masonery enclosure on the top of the earth electrode of overall size 86.36x86.36x46cm deep (below Ground level) complete with cemented brick work (1:6) of 25 cm width, duly plastered with cement morter (inside) CI hinged inspection cover of size 36.56x35.56cm with locking arrangement, GI reducer and treatment of soil by using salt & charcoal or coke for plate electrode | 4 | Nos. | 11479 | 45916.00 |
| | (iii) Providing and laying earthing conductors of GI strip/wire including necessary accessories, clamping to walls, cables etc. as required and interconnection between lengths as per specifications and as per good installation practice.<br><br>50x 6 mm G.I strip. | 40 | Rm | 217 | 8680.00 |
| | (iv) Providing and laying earthing conductors of copper strip/wire including necessary accessories,clamping to walls,cables etc. as required and interconnection between lengths as per specifications and as per good installation practice.<br>50 x 6mm Cu strip | 30 | Rm | 3221 | 96630.00 |

27 M.V.DISTRIBUTION BOARDS

Supply, installation, testing and commissioning of M.V.Distribution Boards suitable for 415V, 3 phase, 4 wire, 50Hz distribution system & The panel shall be free standing, floor mounting, sheet metal enclosed, flush front with Aluminium busbars.Supply of the following cubical type panels made of 14 guage CRCA structure, base channel, complete with, ACB,moulded case circuit breakers, indicating lamps, current transformer etc. Complete in all respects, insulated bus bars with heat shrinkable PVC sleeve in suitable bus chambers, interconnection, small wiring, name plate, danger Plate, earth bus etc. & comprising of compartments with hinged door for each feeder & its accesories, cable alley with hinged doors, bus chamber with bolted door etc. The panel being of dust & vermin proof construction with rubber gasket attractively powder coating etc. The panel shall be free standing type/ wall mounted type as per relavant drawing and comprising with the following:

The panel shall be fabricated only after the approval of fabrication drawings by the consultant.
Two (1+1) - EB INCOMER FEEDERS consisting of
One (1) - 630A,50KA,TPN, EDO Type ACB with microprocessor releases and also with Earth fault, Over voltage, Undervoltage, Over Current & Short Circuit protection.
Three(3)– 600/5A , 15VA , CL 1.0, CT for Metering.
One (1) - Digital multi data meter capable of reading, Voltage, Current, Power Factor, Frequency, kilowatt hours, Cl. 1.0, flush mounting with RS 485 communication port.

One (1)- Auto/Manual Selector Switch
LED Type R,Y,B Phase Indicating Lamps - 1 Set
LED Type ON,OFF & TRIP Indicating Lamps - 1 Set
6A, SP, MCB's For Control Circuit -1Set
Two EB INCOMING FEEDERS ARE MECHANICALLY INTERLOCKED WITH EACH OTHER BY CASTLE KEY

One (1) - Set 3 Phase, 4Wire, 50Hz, 415V, 1000A, 50kA Aluminium busbars
OUTGOING FEEDERS:-
Two (1+1) - Outgoing Feeder each having
One (1) - 250A,TPN, 50 KA,MCCB with O/L,S/C Thermal Mag.Release
One (1) - Outgoing Feeder each having
One (1) - 80A,TPN, 35 KA,MCCB with O/L,S/C Thermal Mag.Release
One (1) - Outgoing Feeder each having
One (1) - 125A,TPN, 35 KA,MCCB with O/L,S/C Thermal Mag.Release
Two (1+1) - Outgoing Feeder each having
One (1) - 20A,DP, 10 KA,MCB
One (1) - Outgoing Feeder each having
One (1) - 40A,TPN, 10 KA,MCB
One (1) - Outgoing Feeder each having (For Spare)
One (1) - 160A,TPN, 35KA,MCCB with O/L,S/C Thermal Mag.Release
Three (3) - Outgoing Feeder each having (For Pump)
One (1) - 25A,DP, 10 KA,MCB
One (1) - Outgoing Feeder each having (For Spare)
One (1) - 63A,TPN, 10 KA,MCB
One (1) - Outgoing Feeder each having (For Spare)
One (1) - 63A,TPN, 10 KA,MCB
One (1) - Outgoing Feeder each having (For Spare)
One (1) - 63A,TPN, 10 KA,MCB
PANEL as above

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| 1 | No | 1200000 | 1200000.00 |

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| 28 | ERECTION, TESTING & COMMISSIONING OF FURNACE CONTROL PANEL<br>One(1) - Incoming feeder having<br>One(1)-250A,TPN,35KA, MCCB with O/L,S/C Thermal Mag.Release<br>One (1) set of - 250/5A, 15VA, Cl 1.0, CTs<br>One (1)- set of Voltage Frequency Meter<br>One (1) lot indicating lamps and push buttons for ON / OFF control / indication of the capacitors and three phase indicating lamps.<br>One(1)- 3Phase-4Wire,50 Hz 415 V,600A,36 KA, Al. Bus Bar.<br>OUTGOING FEEDERS<br>One (1) - Outgoing Feeder each having<br>One (1) - 200A,TPN, 36 KA,MCCB with O/L,S/C Thermal Mag.Release<br>One (1) - Outgoing Feeder each having<br>One (1) - 25A,TPN, 10 KA,MCB<br>One (1) - Outgoing Feeder each having<br>One (1) - 16A,SP, 10 KA,MCB<br>One (1) - Outgoing Feeder each having<br>One (1) - 16A,SP, 10 KA,MCB<br>One (1) - Outgoing Feeder each having (For Spare)<br>One (1) - 63A,TPN, 10 KA,MCB<br>One (1) - Outgoing Feeder each having (For Spare)<br>One (1) - 63A,TPN, 10 KA,MCB<br>One (1) - Outgoing Feeder each having (For Spare)<br>One (1) - 25A,DP, 10 KA,MCB<br>PANEL AS ABOVE | 2 | No | 90000 | 180000.00 |
| 29 | AIR POLLUTION CONTROL DEVICE AREA DB (8 way TPN DB)<br>One(1) - Incoming feeder having<br>One (1) - 80A,TPN, 35 KA,MCCB with O/L,S/C Thermal Mag.Release (Schneider Make)<br>One(1)- 3Phase-4Wire,50 Hz 415 V,100A,10 KA, Cu. Bus Bar.<br>OUTGOING FEEDERS<br>Four (4) - Outgoing Feeder each having<br>One (1) - 10A,SP, 10 KA,MCB<br>Eight (8) - Outgoing Feeder each having<br>One (1) - 16A,SP, 10 KA,MCB<br>One (1) - Outgoing Feeder each having for Metal Plug & Socket DB's<br>One (1) - 63A,4P, 10 KA,MCB<br>One (1) - 40A,TPN, 10 KA,MCB<br>Two (1+1) - Outgoing Feeder each having (For Spare)<br>One (1) - 16A,SP, 10 KA,MCB<br>DB AS ABOVE | 1 | No | 12000 | 12000.00 |
| 30 | EXTERNAL TOILET AREA DB (8 way SPN DB)<br>One(1) - Incoming feeder having<br>One(1)-20A,DP,10KA, MCB<br>One(1)- 1Phase-2Wire,50 Hz 240 V,100A,10 KA, Cu. Bus Bar.<br>OUTGOING FEEDERS<br>Five (5) - Outgoing Feeder each having<br>One (1) - 10A,SP, 10 KA,MCB<br>One (1) - Outgoing Feeder each having (For Spare)<br>One (1) - 10A,SP, 10 KA,MCB<br>DB AS ABOVE | 2 | No | 3298 | 6596.00 |

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| 31 | EXTERNAL SUBSTATION AREA DB (12 way SPN DB)<br><br>One(1) - Incoming feeder having<br>One(1)-32A,DP,10KA, MCB<br>One(1)- 1Phase-2Wire,50 Hz 240 V,100A,10 KA, Cu. Bus Bar.<br>OUTGOING FEEDERS<br>Seven (7) - Outgoing Feeder each having<br>One (1) - 10A,SP, 10 KA,MCB<br>Two (2) - Outgoing Feeder each having<br>One (1) - 16A,SP, 10 KA,MCB<br>One (1) - Outgoing Feeder each having (For Spare)<br>One (1) - 16A,SP, 10 KA,MCB<br>DB AS ABOVE | 1 | No | 4367 | 4367.00 |
| 32 | EXTERNAL LIGHTING DB-1 (4 way TPN DB)<br>One(1) - Incoming feeder having<br>One(1)-40A,TPN,10KA, MCB<br>One(1)- 3Phase-4Wire,50 Hz 415 V,100A,10 KA, Cu. Bus Bar.<br>OUTGOING FEEDERS<br>Nine (9) - Outgoing Feeder each having<br>One (1) - 10A,SP, 10 KA,MCB<br>Three (3) - Outgoing Feeder each having (For Spare)<br>One (1) - 10A,SP, 10 KA,MCB<br>DB AS ABOVE | 1 | No | 7090 | 7090.00 |
| 33 | PANEL @WAITING LOBBY AREA<br>One(1) - Incoming feeder having<br>One(1)-125A,TPN,36KA, MCCB with O/L,S/C Thermal Mag.Release<br>One (1) set of - 125/5A, 15VA, Cl 1.0, CTs<br>One (1)- set of Voltage Frequency Meter<br>One (1) lot indicating lamps and push buttons for ON / OFF control / indication of the capacitors and three phase indicating lamps.<br>One(1)- 3Phase-4Wire,50 Hz 415 V,250A,36 KA, Al. Bus Bar.<br>OUTGOING FEEDERS<br>One (1) - Outgoing Feeder each having<br>One (1) - 32A,TPN, 10 KA,MCB<br>Two (1+1) - Outgoing Feeder each having<br>One (1) - 40A,TPN, 10 KA,MCB<br>Seven (7) - Outgoing Feeder each having<br>One (1) - 10A,SP, 10 KA,MCB<br>Five (5) - Outgoing Feeder each having<br>One (1) - 16A,SP, 10 KA,MCB<br>Three (3) - Outgoing Feeder each having (For Spare)<br>One (1) - 16A,SP, 10 KA,MCB<br>One (1) - Outgoing Feeder each having (For Spare)<br>One (1) - 63A,TPN, 10 KA,MCB<br>PANEL AS ABOVE | 1 | No | 20000 | 20000.00 |
| 34 | OFFICE AREA DB @ Ground Floor (6 way TPN DB)<br>One(1) - Incoming feeder having<br>One (1) - 32A,TPN, 10 KA,MCB<br>One(1)- 3Phase-4Wire,50 Hz 415 V,100A,10 KA, Cu. Bus Bar.<br>OUTGOING FEEDERS<br>Eight (8) - Outgoing Feeder each having<br>One (1) - 16A,SP, 10 KA,MCB<br>Five (5) - Outgoing Feeder each having<br>One (1) - 10A,SP, 10 KA,MCB<br>Three (3) - Outgoing Feeder each having (For Spare)<br>One (1) - 16A,SP, 10 KA,MCB<br>DB AS ABOVE | 1 | No | 8089 | 8089.00 |

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| 35 | LOBBY AREA DB FOR TOILET+EXTERNAL LIGHT (6 way TPN DB)<br>One(1) - Incoming feeder having<br>One (1) - 40A,TPN, 10 KA,MCB<br>One(1)- 3Phase-4Wire,50 Hz 415 V,100A,10 KA, Cu. Bus Bar.<br>OUTGOING FEEDERS<br>Nine (9) - Outgoing Feeder each having<br>One (1) - 10A,SP, 10 KA,MCB<br>Three (3) - Outgoing Feeder each having (For Spare)<br>One (1) - 10A,SP, 10 KA,MCB<br>Three (3) - Outgoing Feeder each having (For Spare)<br>One (1) - 16A,SP, 10 KA,MCB<br>DB AS ABOVE | 1 | No | 8313 | 8313.00 |
| 36 | ROOM AREA+TERRACE LIGHT DB @ FIRST Floor (8 way TPN DB)<br>One(1) - Incoming feeder having<br>One (1) - 40A,TPN, 10 KA,MCB<br>One(1)- 3Phase-4Wire,50 Hz 415 V,100A,10 KA, Cu. Bus Bar.<br>OUTGOING FEEDERS<br>Ten (10) - Outgoing Feeder each having<br>One (1) - 16A,SP, 10 KA,MCB<br>Twelve (12) - Outgoing Feeder each having<br>One (1) - 10A,SP, 10 KA,MCB<br>Two (2) - Outgoing Feeder each having (For Spare)<br>One (1) - 16A,SP, 10 KA,MCB<br>DB AS ABOVE | 1 | No | 10750 | 10750.00 |
| 37 | MV CABLE DESCRIPTIONS:-<br>Supplying, testing and commissioning of 1100V grade XLPE cable for mains and sub mains as per specifications. | | | | |
| | (i) 3.5C x 300 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 65 | Rm | 2194 | 142610.00 |
| | (ii) 3.5C x 185 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 90 | Rm | 1420 | 127800.00 |
| | (iii) 3.5C x 70 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 70 | Rm | 620 | 43400.00 |
| | (iv) 3.5C x 50 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 65 | Rm | 457 | 29705.00 |
| | (v) 4C x 10 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 10 | Rm | 206 | 2060.00 |
| | (vi) 3C x 6 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 600 | Rm | 145 | 87000.00 |
| | (vii) 2C x 6 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 75 | Rm | 123 | 9225.00 |
| 38 | Supplying and Drawing 1.1 KV single core stranded 'FR' PVC insulated & unsheathed single core stranded copper wire (Brand approved by EIC) of the following sizes in the PVC Rigid Conduit and by the prelaid GI fish wire and making necy. Connection as required. | | | | |
| | (i) 2X2.5+1X1.5 Sq.mm. "FR" Cu. Wire | 300 | Rm | 76 | 22800.00 |
| | (ii) 2X4.0+1X2.5 Sq.mm. "FRLS" Cu. Wire | 250 | Rm | 111 | 27750.00 |
| | (iii) 2X6.0+1X4.0 Sq.mm. "FRLS" Cu. Wire | 50 | Rm | 163 | 8150.00 |
| | (iv) 4X10.0+2X6.0 Sq.mm. "FRLS" Cu. Wire | 40 | Rm | 580 | 23200.00 |
| | (v) 4X16.0+2X10.0 Sq.mm. "FRLS" Cu. Wire | 30 | Rm | 937 | 28110.00 |
| 39 | Laying of two cables above 185 sqmm in an underground trench in single tier formation (horizontal), the trench size : 680 mm x 760 mm average depth, with brick protection on the top of each cable 8 (eight) Nos. bricks per Mtr. and 4 (four) Nos. bricks per Mtr. as separator between the bricks and cables and also trench to be filled up with shifted soil, levelling up and restoring surface duly rammed | | | | |
| | (i) 3.5C x 300 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 30 | Rm | 355 | 10650.00 |

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| 40 | Laying of three cables above 35 sqmm upto 185 sqmm. in an underground trench the trench size : 460 mm x 760 mm average depth with brick protection on the top of each cable with 8 nos. bricks per Mtr. including filling the space between the the bricks and cables and also the trench with shifted soil, levelling up and restoring surface duly rammed | | | | |
| (i) | 3.5C x 185 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 60 | Rm | 180 | 10800.00 |
| (ii) | 3.5C x 70 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 50 | Rm | 180 | 9000.00 |
| (iii) | 3.5C x 50 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 65 | Rm | 180 | 11700.00 |
| 41 | Laying of three cables upto 35 sqmm. in an underground trench the trench size : 460 mm x 760 mm average depth with brick protection on the top of each cable with 8 nos. bricks per Mtr. including filling the space between the the bricks and cables and also the trench with shifted soil, levelling up and restoring surface duly rammed | | | | |
| | 2C x 6 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 55 | Rm | 170 | 9350.00 |
| 42 | Laying on Wall / surface with Saddles / clamps<br>Laying of cable upto 3/4 core 25 sqmm on wall/surface incl. S & F MS saddles with earthing attachment in 10 SWG GI (Hot Dip) Wire, making holes etc. as necy. mending good damages and painting | | | | |
| | 4C x 10 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 10 | Rm | 62 | 620.00 |
| 43 | Laying of one number XLPE insulated and XLPE power cable of 1.1 KV grade of following size direct in ground including excavation and refilling the trench etc. as required, but excluding sand cushioning and protective covering. | | | | |
| | 3C x 6 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 600 | Rm | 87 | 52200.00 |
| 44 | Supplying and fixing compression type gland complete with brass gland, brass ring & rubber ring for dust & moisture-proof entry of XLPE/PVC armoured cables as below : | | | | |
| (i) | 3.5C x 300 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 8 | Nos. | 568 | 4544.00 |
| (ii) | 3.5C x 185 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 4 | Nos. | 430 | 1720.00 |
| (iii) | 3.5C x 70 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 2 | Nos. | 229 | 458.00 |
| (iv) | 3.5C x 50 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 2 | Nos. | 211 | 422.00 |
| (v) | 4C x 10 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 2 | Nos. | 141 | 282.00 |
| (vi) | 3C x 6 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 44 | Nos. | 121 | 5324.00 |
| (vii) | 2C x 6 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 4 | Nos. | 74 | 296.00 |
| 45 | Finishing the end of following XLPE/PVC armoured cables by crimping method incl. supplying and fixing solderless socket (Dowels make), tapes, anticorrosive paste & jointing materials | | | | |
| (i) | 3.5C x 300 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 8 | Nos. | 992 | 7936.00 |
| (ii) | 3.5C x 185 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 4 | Nos. | 603 | 2412.00 |
| (iii) | 3.5C x 70 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 2 | Nos. | 282 | 564.00 |
| (iv) | 3.5C x 50 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 2 | Nos. | 222 | 444.00 |
| (v) | 4C x 10 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 2 | Nos. | 72 | 144.00 |

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| (vi) 3C x 6 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 44 | Nos. | 66 | 2904.00 |
| (vii) 2C x 6 sqmm 1.1 KV AL,Arm., XLPE Multi stranded Cable | 4 | Nos. | 34 | 136.00 |

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| 46 | Providing & laying of 2mm thick MS sheet fabricated perforated cable tray of following sizes,including support,coupler,bend Tee etc as required. | | | | |
| (i) | 300 mm. (W) X 2 mm (THK) X 62.5 mm. (D) G.I. SCHEDULE OF PERFORATED CABLE TRAYS | 100 | Rm | 878 | 87800.00 |
| 47 | Supplying and fixing PVC Rigid Conduit 'FR' [Precision Make] on wall, ceiling with saddles or Concealed and other accessories as required and mending good damages to building works. | | | | |
| (i) | 20 mm Dia | 3000 | Rm | 57 | 171000.00 |
| (ii) | 25 mm Dia | 1500 | Rm | 70 | 105000.00 |
| 48 | Earthing with 65 mm dia GI pipe (TATA-Medium)x 3.0 Mts. long and 1 No. 50 mm x 6 mm galvanized (Hot Dip) steel strip (4 Mts. long), 20 mm dia x 125 mm long galvanized bolt,double nuts, double washers including finishing both ends by making holes etc. and S & F 65 mm dia GI pipe (ISI-Medium) protection (3 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level to an average depth of 3.65 Mts | 5 | Nos. | 3453 | 17265.00 |
| 49 | Providing and laying earthing conductors of GI strip/wire including necessary accessories, clamping to walls, cables etc. as required and interconnection between lengths as per specifications and as per good installation practice. | | | | |
| (i) | 50 x 5mm G.I strip. | 80 | Rm | 217 | 17360.00 |
| (ii) | 6 SWG G.I. WIRE | 65 | Rm | 14 | 910.00 |
| (iii) | S & F Lightning Conductor Air Terminal made of 20 mm dia 1000 mm long GI pipe (ISI Medium) having five discharge prongs of 4SWG GI (Hot Dip) wire at top duly soldered with 7/16 stranded GI (Hot Dip) wire and 85 mm dia 6 mm thick GI base plate at bottom incl. necessary holes etc. complete duly grouted on the parapet etc. in CC mortar ( 4:2:1) | 1 | No. | 462 | 462.00 |
| (iv) | Providing and Fixing G.I. tape 20mmX3mm thick on parapet or surface of wall for lighting conductor complete as required (For Vertical run) | 75 | Rm | 98 | 7350.00 |
| 50 | Distribution wiring in 2 x 22/0.3 (1.5 sqmm) single core stranded 'FR' PVC insulated & unsheathed copper wire (Brand approved by EIC) in 20mm size PVC rigid conduit 'FR' (Precision make), with 1x22/0.3 (1.5 sqmm) single core stranded 'FR' PVC insulated & unsheathed copper wire for ECC, to light/fan/call bell points with Modular type switch (Brand approved by EIC) fixed on Modular GI switch board with top cover plate and 2 no. suitable size “Ph & N” copper bar & earthing attachment fixed on wall incl. mending good damages to original finish. | | | | |
| (i) | Average run 12Mtr ( One Light Contrlled by one switch) | 100 | Point | 1505 | 150500.00 |
| (ii) | Average run 12Mtr ( Two Light Point Controlled by One switch) | 22 | Point | 1505 | 33110.00 |
| (iii) | Average run 12Mtr ( Three Light Point Controlled by One switch) | 2 | Point | 1505 | 3010.00 |
| 51 | Distribution wiring in 1.1 KV grade 22/0.3 (1.5 sqmm) single core stranded 'FR' PVC insulated & unsheathed copper wire (Brand approved by EIC) in 20mm size PVC rigid conduit 'FR' (Precision make), with 1.1 KV grade 1 x 22/0.3 (1.5 sqmm) single core stranded 'FR' PVC insulated & unsheathed copper wire as ECC, to 6A 3 pin Modular type plug socket & switch (Brand approved by EIC) on 4 Module GI switch board with 3/4 Module top cover plate on wall incl. necy. Connection making earthing attachment, painting and mending good damages to building works. | 16 | Point | 249 | 3984.00 |

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| 52 | Supply & Fixing 240 V 6 A Modular type switch (Brand approved by EIC) on existing GI Modular type switch board having top cover plate and making necessary connections as required | 16 | Point | 94 | 1504.00 |
| 53 | Supply & Fixing 240 V, 6A, 5 pin Modular type plug socket (Brand approved by EIC), without switch & plug top, on existing GI Modular type switch board with top cover plate and making necy. connections with PVC Cu wire and earth continuity wire etc. | 6 | Point | 139 | 834.00 |
| 54 | Supplying & Fixing GI Modular Switch Board of the following sizes complete with three no. suitable size Copper bar with holes (for Ph, N & E) fixed on bakelite/Hard Rubber insulator over the MS welded chairs incl. top cover flushed in wall for housing the board after cutting the brick wall incl. making earthing attachment, painting and mending good damages to building works | | | | |
| | (i) 4 Module | 3 | Point | 297 | 891.00 |
| | (ii) 6 Module | 15 | Point | 381 | 5715.00 |
| | (iii) 8 Module | 15 | Point | 466 | 6990.00 |
| | (iv) 12 Module | 9 | Point | 603 | 5427.00 |
| 55 | Supply & Fixing 240 V, 6 A, 3 pin Modular type plug socket (Brand approved by EIC) with 6A Modular type switch, without plug top on 4 Module GI Modular type switch board with 3 Module top cover plate flushed in wall incl. S&F switch board and cover plate and making necy. connections with PVC Cu wire and earth continuity wire etc. | 35 | Nos. | 433 | 15155.00 |
| 56 | Supply & Fixing 240 V, 16 A, 3 pin Modular type plug socket (Brand approved by EIC) with 16A Modular type switch, without plug top on 4 Module GI Modular type switch board with top cover plate flushed in wall incl. S&F switch board and cover plate and making necy. connections with PVC Cu wire and earth continuity wire etc. | 20 | Nos. | 527 | 10540.00 |
| 57 | Supply & Fixing of 1200 mm Dia Havells Make (Model No - Pacer Colour White/Brown/Ivory/Matt Brown) Ceiling fan or Equivalent Make. | 23 | Set | 2200 | 50600.00 |
| 58 | Fixing only ceiling fan complete with blades, canopy, and fork, rubber bush etc. incl. S&F connecting wire for down rod upto 30 cm incl. painting the rod with approved paint and making necessary connection as required by 2x1.5 sqmm flexible copper wire. | 23 | Set | 68 | 1564.00 |
| | (a) Extra for supplying additional wire for down rod & painting the rod exceeding 30 cm by 2x1.5 sqmm flexible copper wire. | 60 | Rm | 44 | 2640.00 |
| 59 | Supply & Fixing 240V, Modular Socket (2 Module) type fan regulator (Step type) (Brand approved by EIC) on existing Modular GI switch board with top cover plate incl. making necy. connections etc. | 23 | Nos. | 455 | 10465.00 |
| 60 | 300 mm Sweep 240V Exhaust fan 900 RPM Havells or Equivalent Make. | 25 | Nos. | 2500 | 62500.00 |
| 61 | Fixing only exhaust fan after making hole in wall and making good damages and smooth cement finish etc. as practicable as possible and providing necy. length of PVC insulated wire and making connection for exhaust of following diameter: | | | | |
| | i) 300 mm (12") | 25 | Nos. | 117 | 2925.00 |
| | ii) 450 mm Sweep 240V Exhaust fan 900 RPM Havells or Equivalent Make. | 4 | Nos. | 2800 | 11200.00 |
| 62 | Fixing only exhaust fan after making hole in wall and making good damages and smooth cement finish etc. as practicable as possible and providing necy. length of PVC insulated wire and making connection for exhaust of following diameter: | | | | |
| | 45 cm (18") | 4 | Nos. | 518 | 2072.00 |
| 63 | Surface Mounted (PHILIPS MAKE FCS518 2XPL-L 18 Watt with 2XPL-L 18 Watt Lamp)or equivalent make. | 15 | Nos. | 1900 | 28500.00 |

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| 64 | Surface/Wall Mounted (CROMPTON GRAVES MAKE DJB1224EB 2X36/40Watt FTL)or equivalent. | 30 | Nos. | 1800 | 54000.00 |

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| 65 | Surface/Wall Mounted (CROMPTON GRAVES MAKE DJB1214EB 1X36/40Watt FTL) or equivalent. | 35 | Nos. | 1200 | 42000.00 |
| 66 | Wall Mounted (BAJAJ MAKE BJC111 1X11 Watt 'S' type CFL) or equivalent make. | 20 | Nos. | 1000 | 20000.00 |
| 67 | External Light (PHILIPS MAKE SGP401 1XCDMTT-150W with 1XCDMTT150 Watt Lamp)or equivalent. | 6 | Nos. | 6840 | 41040.00 |
| 68 | Supply and installation of BAJAJ make Hot dip galavanised iron pole (7 mtr. Height) weatherproof reinforced door opening with junction box mounting arrangement but exclusive of Bakelite sheet with one 6A SP MCB and 16 sq.mm. stud type connector, 20 dia threaded made to J shape 750 mm long steel grade EN8 foundation bolts - 4 nos with nuts, templates and all complete. | 6 | Nos. | 13000 | 78000.00 |
| 69 | Fixing outdoor type fluorescent/SV/MV light fitting on pole including S&F 40 mm dia x 1.68 mts. long GI Pipe (ISI-Medium)bracket with 40 mmx10 mm thick, MS clamp etc. and providing wiring with 2x1/1.40 PVC insulated and sheathed wire (single core) from loop box at the base of pole to light fiting through pole & bracket (without control switch) including making connections & painting | 6 | Nos. | 1525 | 9150.00 |
| 70 | Fixing only outdoor / street light type fluorescent light fitting or MV light fitting complete with all accessories to be fixed /projected from the wall of the building incl. making holes/providing clamping arrangement & necy. GI reducer as required. S&F 40 mm GI pipe (ISI-Medium) quality 1.5 mts. average length having suitable bend S&F necy. length of 1.5 sqmm PVC insulated single core stranded annealed copper wire and making connections as required and mending good damages to wall incl. painting etc. | 3 | Nos. | 915 | 2745.00 |
| 71 | External Light (PHILIPS MAKE SGP401 1XCDMTT-150W with 1XCDMTT150 Watt Lamp) or equivalent. | 3 | Nos. | 6840 | 20520.00 |
| 72 | Post Top Light (CROMPTON GRAVES MAKE CFPT218EB/ECO 2X18Watt CFL) or equivalent. | 3 | Nos. | 2575 | 7725.00 |
| 73 | Bulk Head Light (PHILIPS MAKE NXC 1XA60-60W-CL B22 GR with 1xGLS 60Watt) for equivalent. | 10 | Nos. | 900 | 9000.00 |
| 74 | Aviation Light (Bajaj MAKE BGAV 302 LED) for equivalent. | 2 | Nos. | 6000 | 12000.00 |
| 75 | Direct on Line Starter | 3 | Nos. | 7500 | 22500.00 |
| | | | | **Total** | **16540089.00** |

(Rupees One Crore Sixty Five Lakhs Forty Thousand and Eighty Nine Only)