

SECTION – I

NOTICE INVITING TENDER

Construction of Building For Rural at Nalbari Self-Employment Training Institute (RSETI) at Nalbari.

Sealed tender are invited in duplicate on behalf of the Zonal Manager, UCO Bank Zonal Office, Guwahati for the following work :-

- | | | |
|---|---|--|
| 1) Name of work | : | Construction of Building For Rural Self Employment Training Institute (RSETI) |
| 2) Location of work | : | Sariahtali, Nalbari, Assam. |
| 3) Estimated cost | : | Rs. 1.40 Cr.
(Rupees One Crore forty lakh only) |
| 4) Time of completion of the work | : | 9 (nine) Calendar months from the date of acceptance of tender. |
| 5) Earnest Money | : | Rs. 2.80,000.00
(Rupees Two Lakh Eighty thousand Only) in the shape of BankDraft / Pay Order / Bank Guarantee /Banker's Cheque drawn in favour of UCObank and payable at Guwahati Tenderwithout Earnest Money in proper form willbe rejected. |
| 6)Cost of tender document | : | Rs. 5000.00 (Rupees Five Thousand only) per set of tender document (original &duplicate) in the form of Bank Draft drawnin favor of UCO Bank, and payable atGuwahati (Non-refundable). Both original &duplicate documents are to be submitted. |
| 7) Availability of tender documents | : | Tender documents will be available UCO Bank's website www.ucobank.co.in from 5th August 2017 |
| 8) Pre-bid meeting – Venue, Date & Time | : | Pre-bid meeting to be held at UCO Bank, Zonal Office, UCO Bank, Zonal Office, Guwahati on 17 th August 2017 at 14:00 Hrs.

In case any contractor does not attend the pre-bid meeting, the decision of the prebid meeting will be binding to the firm |
| 9) Last Date of submission of tender | : | Up to 14:00 Hrs on 28th August ,2017 |

- 10) Place of submission : At the Zonal Office, UCO Bank, Guwahati, Maniram Dewan Road, Silpukhuri, Guwahati – 781003.
- 11) Procedure for submission of tender : Tenders in duplicate will have to be submitted in two parts viz. Part-I & Part-II separately sealed and super scribed with the name of the work as described in detail under para 6 of Section – II (General Rules & Instructions for the Guidance of Tenderers).
- 12) Tender to be addressed to : Zonal Manager, UCO Bank, Zonal Office, Guwahati.
- 13) Time & Date of Opening of Tender : **I. Part-I on 28th August 2017 at 14.30 Hrs.**
II. Part-II – Time and date will be notified after opening of Part-II.
- 14) Place for Opening of Tender : At UCO Bank, Zonal Office, Guwahati.
- 15) Inspection of drawings other than Enclosed ones and clarifications, if Any. : At UCO Bank, Zonal Office, Guwahati. during working hours on all working days up to **17 th August 2017**
- 16) Validity of tenders : Calendar Months from the stipulated last date of submission of tender.
- 17) Delay in submission : Delay in submission arising out of postal or any other irregularities will not be considered. The Bank in any case will not be responsible for any damage in transit in case of postal delivery.
- 18) Sales Tax or any other Tax on materials or finished work like Work Contract Tax, Turnover Tax, etc. in respect of this contract whether in vogue or may be imposed in future shall be payable by the contractor and the Bank will not entertain any claim whatsoever in this respect. However, any benefit due to reduction of taxes etc. shall be passed to the Employer. Service Tax shall be payable by Bank as per applicable rate.
- 19) The Bank does not bind itself to accept the lowest tender and reserves to itself the right to reject any or all others tenders received without assigning any reason/s thereof. The notification of award of contract will be made to the successful tenderer in writing by the Bank.

Yours faithfully,

For UCO Bank, Zonal Office,

SECTION – II

General Instruction for Guidance of Tenderers in respect to Part-I of Tender document.

1. Applications should be submitted in Bank's prescribed format only (asper Annexure-I). Application in any other form will not be considered.
2. Applicants should have at least seven year's experiences in execution of similar works i.e., construction of Office / Residential Buildings, Training College with Hostel, Hotels Shopping Malls etc in Banks /Govt./Public Sector / reputed private sector organizations.
3. A) Project cost above Rs. 5.00 Crore
 - a. Three similar completed works costing not less than the amount equal to 40% of the estimated cost within seven years ending last day of the month previous to the one in which applications are invited in execution of similar works,
 - or,
 - b. Two similar completed works costing not less than the amount equal to 50% of the estimated cost within seven years ending last day of the month previous to the one in which applications are invited in execution of similar works,
 - or,
 - c. One similar completed work costing not less than the amount equal to 80% of the estimated cost within seven years ending last day of the month previous to the one in which applications are invited in execution of similar works.
- B) **Project cost below Rs. 5.00 Crore**

Tenderers should have successfully executed at least two similar works of at least up to 75% of the estimated cost during last seven years ending last day of the month previous to the one in which applications are invited in execution of similar works.
4. Average financial turnover during the last three years, ending 31st March of the previous financial year, should be at least 30% of the estimated cost.
5. The Tenderers should have their Office / Establishment in Assam.
6. The Bank reserves the right to visit the establishment / workshop of Tenderers before finalization of tender.
7. **The contractor should engage Electrical Contractor with valid Electrical Contractor's Licenses as issued by the State/Central Government, who should have sufficient experience in similar type of works. The contractor should submit the Photostat copy of the valid Electrical License along with similar work completion certificate from the client. However, the entire responsibility of the work shall be borne by the Tenderer.**
8. The Bank reserves the right to accept or reject any application without assigning any reason and **WITHOUT COST OR COMPENSATION THEREFOR.**
9. Additional sheet of papers may be used for submitting the applications, wherever space in the format is found inadequate.

10. Bank reserves the right to call for report from the existing clients of the applicant if required.
11. Following documents / papers are to be submitted.
- The list of similar work executed in last three years in Bank's / Govt. Departments / Public Sector Organizations / Reputed private Sector Organizations along with Completion Certificates & Work Order mentioning therein the details of work value & date of completion. (as per Annexure – II & III).
 - Copies of PAN card, VAT Registration Certificate, Service Tax Registration Certificate, Trade Licence and any other registration certificates/licences, as may be necessary, as per Rules of local Statutory Authorities.
 - Audited Account and Balance Sheet for last three years.
 - Name and Address of Bankers with solvency certificate.
 - Key personnel permanently employed (as per Annexure – IV).
 - Work force & workshop facilities (as per Annexure – V & VI).

11. Rejection Criterion

Tender will be summarily rejected on account of followings:-

1. Tenderers not submitting the cost of tender document along with Part –1 tender as stipulated in NIT,
2. Tenderers not submitting the Earnest Money along with Part-1 tender as stipulated in NIT,
3. Tenderers not submitting the Part – 1 & Part – 2 tender in separate sealed cover duly super scribed as mentioned in NIT,
4. Non-fulfilment of any criterion as specified under this Section – II.

Signature of Bank Officials with Seal.

SECTION – III

GENERAL RULES AND INSTRUCTION FOR THE GUIDANCE OF TENDERER

1. Tenders are hereby invited on behalf of UCO Bank, Zonal Office, Guwahati for General Building, Sanitary & Plumbing, Electrical works and Area Development work for construction of Bank's Building at Nalbari.
Estimated cost of the work is **Rs. 1.40 Crore**
2. Tender documents consisting of the following may be downloaded from UCO Bank's website www.ucobank.co.in
 - i. Notice Inviting Tender,
 - ii. General Instructions for Guidance of Tenderers in respect to Part– I of Tender Document,
 - iii. General Rules and Instructions for the guidance of Tenderer,
 - iv. Form of Tender,
 - v. Articles of Agreement,
 - vi. General Conditions of Contract with Appendices,
 - vii. Special Conditions,
 - viii. Safety Code,
 - ix. Model Rules for the protection of health and sanitary arrangements of Workers,
 - x. Technical Specifications and mode of Measurements,
 - xi. Schedule of Quantities,
 - xii. Drawings, Construction Schedule.
3. It is proposed to hold a pre-bid meeting with the intending tenderers on **2017 at 14:00 hrs.** at UCO Bank, Zonal Office, Guwahati to clarify any point that the intending tenderers may have regarding the drawings, technical specifications, schedule of quantities and clauses of conditions of contract. Based on the pre-bid meeting, the Bank may modify some terms & conditions, a set of which will be published in UCO Bank's website www.ucobank.co.in. This will also form a part of the contract document. The object of pre-bid meeting is to obtain a substantially responsive bid from the tenderers conforming to all the terms, conditions and specifications of the tender document inclusive of modified conditions/s furnished without any material deviation or reservation affecting the competitiveness of other tenders submitting substantially responsive bid. Conditional tenders are liable for rejection
4. The site of work is available.
5. Tenders only in downloaded printed form should be placed in a sealed cover and address to the Zonal Manager, UCO Bank, Guwahati. The name of the project shall be super scribed on the envelop and the same shall be received at UCO Bank, Zonal Office, Guwahati up to **14:00 hrs on 2017.**
6. The sealed cover, as mentioned in para 5 above, shall contain two separate sealed covers marked Part – I and Part – II containing the documents as under :-

Part – I : Covering Letter, Earnest Money of Rs.
(Rupees only),
Cost of Tender Booklet of Rs. 5000/-
(Rupees Five Thousand Only) and others as per Annexure I to Annexure– VI.

Part – II : Bill of Quantities, duly priced and Drawings. No conditions shall be stipulated in the Part – II. Conditional Rebate, if any, given in Part – II shall be treated as unconditional.

7. Part – I will be opened on **2017 at 14:30 hrs**. The tenderers may depute their authorized representative to be present at the time of opening. The date and time of opening of Part – II will be intimated to the tenderers after opening of Part – I. In order to expedite the process, the representatives deputed by the tenderers at the time of tender opening should be authorized to take the decision on behalf of the tenderers. Part – II of tenders will not be opened and will be treated as cancelled in case submissions in Part – I are found to be not in order.
8. The time allowed for carrying out the work will be 9(Nine) months either from the fourteenth day after the date of written orders to commence work or day on which the contractor is instructed to take possession of site, whichever is later.
9. The tenderers should quote in figures as well as in words the rates and amount tendered by them. The language for filling tender documents shall be in English. The amount of each item should be worked out and requisite total given. All corrections shall be attested by the initials of the tenderers with the seal of the firm. In case any discrepancy / difference is found on checking between rates quoted by the Contractor in words and figures or in the amount worked out by him, the following procedure shall be followed :-
 - a) When there is difference between the rates in figure and in words, the rate which corresponds to the amount worked out by the Contractor, shall be taken as correct.
 - b) When the amount of any item is not worked out by the Contractor it does not correspond with the rate written either in figures or in words, then the rate quoted by the Contractor in words shall be taken as correct.
 - c) When the rate quoted by the Contractor in figures and in words tally but the amount is not worked out correctly, rate quoted by the Contractor shall be taken as correct and not the amount.
 - d) Amendments as mentioned above shall be based on tender marked "original" only.
10. Tenderer has to ensure that the rates of terms of similar nature or analogous in specifications are consistent throughout the tender.
In case inconsistent rates are observed for terms of same description in the different sections of the schedule of quantities, the lowest of such rates shall be considered as the rate applicable for all such items.
11. All rates shall be quoted on the proper form of the tender alone. Special care should be taken to write the rates in figures as well as in words and the amount in figures only, in such a way that interpolation is not possible. The total amount should be written both in figures and in words. In case of figures, the words Rs. Should be written before the figures of rupees and words "P" after the decimal figures e. G. Rs. 2.15P and in case of words, the words "Rupees" should precede and the word Paise should be written at the end. Unless the rate is in whole rupees and followed by the words "only" it should be invariably up to two decimal places. While quoting the rate in schedule of quantities, the word "only" should be written clearly following the amount and it should not be written in the next line.
12. The contractor, whose tender is accepted, will be required to furnish by way of security deposit for the due fulfilment of his contract, such sum as detailed in clause No. 17 of the General Conditions of Contract.

The Earnest Money Deposit of the Contractor whose tender is accepted is liable to be forfeited in full at the discretion of the Employer in case he does not remit the Initial Security Deposit (ISD) within the stipulated period and / or does not start the work by the stipulated date mentioned in the tender of award / work order.

13. The acceptance of a tender will rest with the UCO Bank, Zonal Office, Guwahati who does not bind itself to accept the lowest or any tender and reserves to itself the authority to reject any or all the tenders received without assigning any reason whatsoever. All tenders in which any of the prescribed conditions are not fulfilled are incomplete in any respect and are liable to be rejected. The Employer reserves the right to accept the tender in full or in part and the tenderer shall have no claim for revision of rates or other conditions if his tender is accepted in parts.
14. Canvassing in connection with tenders is strictly prohibited and tenders submitted by the Contractors who resort to canvassing will be liable to rejection.
15. An item rate tender containing percentage below / above will be summarily rejected.
16. On acceptance of the tender, the name of the accredited representatives of the Contractor who would be responsible taking instructions from the Employer / Consultant shall be communicated to the Employer / Consultant.
17. Sales Tax, Work Contract Tax, Turn Over Tax, or any other tax on materials or on finished work in respect of this contract whether in vogue or likely to be imposed in future, shall be payable by the Contractor and the Employer will not entertain any claim whatsoever in this respect at any time. Rates should include all these taxes, Service Tax will be payable by Bank as per applicable rate.
18. The Contractor shall give a list of his relatives working with the Employer along with their designations and address.
19. No Employee of the Employer is allowed to work as a contractor for a period of two years of his retirement from Employer's service, without the previous permission of the Employer. The contract is liable to be cancelled if either the Contractor or any of his employees is found at any time to be such a person who had not obtained the permission of the Employer as aforesaid before submission of the tender or engagement in the Contractor's service.
20. The tender for the work shall remain open for acceptance for a period of **4 (Four)** calendar months from the stipulated last date for submission of tenders. If any tenderer withdraws his tender before the said period, or make any modification in the terms and conditions of the tender which are not acceptable to the Employer, then the Employer without prejudice to any other right or remedy shall be at liberty to forfeit the Earnest Money paid along with the tender.
21. The tender for the work shall not be witnessed by a Contractor or Contractors who himself / themselves has / have tendered or who may have / have tendered for the same work. Failure to observe this condition would render tenders of the Contractors tendering as well as witnessing the tender liable to summary rejection.
22. It will be obligatory on the part of the tenderer to tender and sign the tender documents for all the component parts and the work order will be issued / awarded to the selected bidder only after receipt of signed tender documents and acceptance of our letter of intent by the selected bidder for executing the articles of agreement available with the bank thereafter.
23. The tenderer, apart from being a competent Contractor, must associate himself with agencies of the appropriate class who are eligible to tender for (i) Ante Termite Treatment, (ii) Waterproofing work and (iii) Sanitary & Water Supply Installation work etc.

Signature of Bank Official with Seal.

SECTION – IV FORM OF TENDER

The General Manager,
UCO Bank,
Zonal Office, Guwahati

Date

Dear Sir(s),

Re : General Building, Sanitary & Plumbing and Area Development work for construction of Bank's Building at -----.

1. I / we refer to the tender notice issued by UCO Bank, Zonal Office, Guwahati in connection with the captioned work that the work for which tender is submitted falls within the scope and ambit of our business.
2. I / we do hereby offer to perform, provide, execute, complete and maintain the work in conformity with drawings, conditions of contract, specifications, schedule of quantities etc. at the respective rates quoted in the schedule of quantities.
3. I / We have satisfied myself / ourselves as to the site conditions, examined the drawings and all aspects of the tender conditions. Subject to above, I / We do hereby agree, should this tender be accepted in whole or in part, to :
 - a: Abide by and fulfil all the terms and provisions of the said conditions annexed hereto :
 - b: Complete the work within ----- (-----) calendar months, as stipulated by working in two or three shifts, if considered necessary by the Consultants, at no extra cost to the Employer.
4. I / We have deposited Earnest Money of Rs. ----- (Rupees ----- Only) in the form of Demand Draft / Pay Order / Banker's Cheque which, I / We note, will not bear any interest and is subject to forfeiture solely at Bank's discretion if :
 - a. Not abide by and fulfil all the terms and provisions of the said conditions annexed hereto.
 - b. Not completed the work within ----- (-----) calendar months, as stipulated by working in two or three shifts, if considered necessary by the Consultants, at no extra cost to the Employer.
5. I / We have deposited Earnest Money of Rs. ----- (Rupees ----- Only) in the form of Demand Draft / Pay Order / Banker's Cheque which, I / We note, will not bear any interest and is subject to forfeiture solely at Bank's discretion if :
 - i) The work is not commenced by me / us either within 14 (Fourteen) days from the date of issue of formal work order or the day on which I / We will be instructed to take possession of the site, whichever is later Or,
 - ii) The offer is withdrawn within the validity period of acceptance Or,
 - iii) The Initial Security Deposit (ISD) is not deposited within 14 (fourteen) days from the

date of acceptance of tender Or,

iv) The agreement of the contract is not executed within 15 days from award of contract.

6. I / We understand that you are not bound to accept the lowest or any tender you receive and for that the accepting authority is not bound to assign any reason for the same.
7. The acceptance of this tender shall constitute a binding contract and any failure as mentioned in item 4. above shall constitute a breach of contract by us and the tender accepting authority shall be entitled to have the work executed at our risk and cost and to claim extra cost / expenditure incurred by them from us.
8. Our Bankers are :
- 1.
 - 2.
 - 3.
9. Name of partners / directors of our firm :
- i)
 - ii)
 - iii)
 - iv)

Yours faithfully,

For -----

Signature -----

Name.....

Designation

Name of Partner / Director of the Firm authorized to sign or name of person having power of attorney to sign the contract. (Certified true copy of power of attorney should be attached)

Signature and address of witnesses:

a. Signature

Name:.....

Address

b. Signature

Name:

Address

SECTION – V

GENERAL CONDITIONS OF CONTRACT

Except where provided for in the description of the individual items in the schedule of quantities and in the specifications and conditions laid down hereinafter and in the Drawings, the work shall be carried out as per standard specifications and under the direction of the Employer/Consultant.

1: **INTERPRETATION**

In construing these conditions the specifications, the schedule of quantities, tender and Agreement, the following words shall have the meaning herein assigned to them except where the subject context otherwise requires :

- i: **Employer** : The term Employer shall denote “UCO Bank, a body corporate, constituted under the Banking Companies (Acquisition & Transfer of Undertakings) Act, 1970 as amended from time to time having its Head Office at No.10, BTM Sarani, Kolkata-700001 and a Zonal Office amongst other placed at Guwahati or any of its employees / representative authorized on their behalf
- ii: **Consultant** : The term Consultant shall mean M/s. Architects Collaborative, M. R. Dewan Road, P.O. : Silpukhuri, Chandmari, Guwahati – 781 003 or in the event of their ceasing to be the Consultant for the purpose of this contract such other persons as the Employer shall nominate for the purpose.
- iii: **Contractor**: The term contractor shall mean the individual or firm or company whether incorporated or not, undertaking the work and shall include legal representative(s) of such individual or persons composing such firm or company or successors of such firm or company as the case may be and permitted assigns of such individual or firm or company.
- iv: **Site**: The site shall mean the site where the work are to be executed as shown within the boundary in red borders on the site plan including any building and erections thereon
- v: **Site Engineer/Project Management Consultant (PMC)** : The Site Engineer shall be appointed by the Employer. The Employer may also appoint Project Management Consultant (PMC).
- vi: **Drawing** : The work is to be carried out in accordance with drawings, specifications, the schedule of quantities and any further drawings which may be supplied or any other instruction, which may be given by the Employer/Consultant during the execution of the work.

All drawings relating to work given to the Contractor together with a copy of schedule of quantities are to be kept at site and the Employer/Consultant shall be given access to such drawings or schedule of quantities whenever necessary.

In case any detailed drawings are necessary the contractor shall prepare such detailed drawings and/or dimensional sketches therefore and have it confirmed by the Employer/Consultant prior to taking up such work.

The contractor shall ask in writing for all clarifications on matters occurring anywhere in drawings, specifications and schedule of quantities or to additional instructions at least 20 days ahead from the time when it is required for implementation so that the Employer / Consultant may be able to give decision thereon.

- vii: **"The Work"** shall mean the work to be executed or done under this contract.

- viii: "Act of Insolvency" shall mean any act as such as defined by the Presidency Towns Insolvency Act or in Provincial Insolvency Act or any amending statutes.
- ix: "The Schedule of Quantities" shall mean the schedule of quantities as specified and forming part of this contract.
- x: "Priced Schedule of Quantities" shall mean the schedule of quantities duly priced with the accepted quoted rates of the Contractor.

2: SCOPE

The work consists of General Building, Sanitary & Plumbing and Area development in connection with construction of Bank's Building at Nalbari, Assam. UCO Bank in accordance with the drawings and "Schedule of items and quantities". It includes furnishing all materials, labour, tools and equipment and management necessary for and incidental to the construction and completion of the work. All work, during its progress and soon completion, shall conform to the lines, elevations and grades as shown on the drawings furnished by the Employer/ Consultant. Should any detail, essential for efficient completion of the work be omitted from the drawings and specifications it shall be the responsibility of the Contractor to inform the Employer/Consultant and to furnish and install such detail with Employers / Consultant's concurrence, so that upon completion of the proposed work the same will be acceptable and ready for use.

Employer/Consultant may in their absolute discretion issue further drawings and/or written instructions, details, directions and explanations, which are, here after collectively referred to as 'The Employer's /Consultant's instructions in regard to :

- a. The variation or modification of the design, quality or quantity of work or the addition or omission or substitution of any work.
- b. Any discrepancy in the drawings or between the schedule of quantities and/or drawings and/or specification.
- c. The removal from the site of any defective material brought thereon by the Contractor and the substitution of any other material thereof.
- d) The demolition removal and or execution for any work executed by the contractors.
- e) The dismissal from the work of any persons employed thereupon.
- f) The opening up for inspection of any work covered up.
- g) The rectification and making good of any defects under clauses hereinafter mentioned and those arising during the Defect Liability Period.

The Contractor shall forthwith comply with and duly execute any work comprised in such Employers / Consultant's instructions, provided always that verbal instructions, directions and explanations given to the Contractor or his representative upon the work by the Employer / Consultant shall if involving a variation be confirmed in writing to the Contractor within seven days. No work, for which rates are not specifically mentioned in the priced schedule of quantities, shall be taken up without written permission of the Employer / Consultant. Rates of items not mentioned in the priced schedule of quantities shall be fixed by the Employer in consultation with the Consultant as provided in Clause "variation".

The contractor shall set up at his own cost a field laboratory with necessary equipments for day to day testing of materials like grading of coarse and fine aggregates, silt content and bulkage of sand etc. Regarding all factory made products for which ISI marked products are available, products bearing ISI marking shall be used in the work.

3 DETAILED DRAWINGS AND INSTRUCTIONS

The Employer through its Consultant shall furnish with reasonable promptness additional instructions by means of drawings or otherwise necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the Contract Documents, true developments thereof, and reasonably inferable therefrom.

The work shall be executed in conformity therewith and the Contractor shall not work without proper drawings and instructions.

4. COPIES FURNISHED

The Contractor on signing of the agreement shall be furnished by the Employer through its Consultant free of charge with a copy of the price schedule of quantities rates, two copies of each of the said drawings and one copy of specifications and two copies of all further drawings issued during the progress of the work. Any further copies of such drawings required by the Contractor shall be supplied on payment of the charges thereof by the contractor.

5. OWNERSHIP OF DRAWING

All drawings, specifications and copies thereof furnished by the Consultant are the property of the Employer. They are not to be used on other work and with the exception of the signed contract set, are to be returned to the Employer on request at the completion of the work.

6. FAILURE BY CONTRACTORS TO COMPLY WITH EMPLOYER'S / CONSULTANTS INSTRUCTION

If the contractor after receipt of written notice from the Employer or the Consultant requiring compliance of any instruction within ten days fails to comply with such further drawings, Employer's/Consultant's instructions, the Employer through the Consultant or other person, may employ other person to execute any such work whatsoever that may be necessary to give effect here and pay all cost incurred in connection therewith and same shall be recoverable from the contractor by the Employer on the certificate of the Consultant as a debt or shall have right to deduct same from all moneys due or to become due to the contractor.

7. TENDERER SHALL VISIT THE SITE

Intending tenderer shall visit the site and make himself thoroughly acquainted with the local site condition, nature and requirements of the work, facilities of transport condition, effective labour and materials, access and storage for materials and removal of rubbish. The tenderer shall provide in their tender for cost of carriage, freight and other charges including all taxes etc. as also for any special difficulties and including police restriction for transport etc for proper execution of work as indicated in the drawings. The successful tenderer will not be entitled to any claim of compensation for difficulties faced or losses incurred on account of any site condition which existed before the commencement of the work or which in the opinion of the Employer / Consultant might be deemed to have reasonably been inferred to be so existing before commencement of work.

8. TENDERS

The entire set of tender paper Issued to the tenderer should be submitted fully priced and also signed on the last page together with initials on every page. Initial/signature will indicate the acceptance of the tender papers by the tenderer :

The schedule of quantities shall be filled in as follows:

- i: The "Rate" column to be legibly filled in ink in both English figures and English words.
- ii: Amount column to be filled in for each item and the amount for each subhead as detailed in the "Schedule of Quantities".

- iii: All corrections / overwriting are to be initialed with the seal of the Firm.
- iv: The "Rate Column" for alternative items if any shall be filled up.
- v: The "Amount" for alternative items if any of which the quantities are not mentioned shall not be filled up.
- vi: In case of way errors / omissions in the quoted rates, the rates given in the tender marked original shall be taken as correct rates.

No modifications, writings or corrections can be made in the tender papers by the tenderer. The Employer reserves the right to reject the lowest or any tender and also to discharge any or all of the tenders for each section or to split up any item of work to any specialist firm or firms, without assigning any reason.

The tenderers should note that the tender is strictly on the item rate basis and their attention is drawn to the fact that the rates for each and every item should be correct, workable and self-supporting. If called upon by the Employer / Consultant detailed analysis of any or all the rates shall be submitted. The Employer / Consultant shall not be bound to recognize the Contractor's analysis.

The work will be paid for as "measured work" on the basis of actual work done and not as "lump sum" contract.

All items of work described in the schedule of quantities are to be deemed and paid as complete work in all respects and details including preparatory and finishing work involved, directly, related to and reasonably detectable from the drawings, specifications and schedule of quantities and no further extra charges will be allowed in this connection. In the case of lump sum charges in the tender in respect of any item of work, the payment of such item of work will be made for the actual work done on the basis of lump sum charges as will be assessed to be payable by the Employer / Consultant.

The Employer has power to add to, omit from any work as shown in drawings or described in specifications or included in schedule of quantities and intimate the same in writing but no addition, omission or variation shall be made by the Contractor without authorization from the Employer. Such variation done by the Employer shall not vitiate the contract.

9. AGREEMENT

The successful Contractor shall sign the agreement as per draft agreement annexed within 15 days from the date of issue of Letter of Intent and he shall pay for all stamps and legal expenses, incidental thereto. However, the written acceptance of the tender by the Employer / Consultant on behalf of Employer will constitute a binding contract between the Employer and the person so tendering whether such formal agreement is or is not subsequently executed.

THE SELECTED BIDDER IS REQUIRED TO EXECUTE THE ARTICLES OF AGREEMENT BEFORE AWARING/ISSUANCE OF THE WORK ORDER TO HIM AND THE SAID DRAFT ARTICLES OF AGREEMENT WILL BE AVAILABLE FROM THE OFFICE OF THE EMPLOYER.

10. ROYALTIES & PATENTS

The contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Employer harmless from loss on account thereof.

11. PERMITS AND LICENCES

Permits and licenses for release of materials which are under government control will be arranged by the contractor. The Employer will render necessary assistance, sign any forms or applications that may be necessary.

The Employer/Consultant shall be indemnified against all Government or legal actions arising out of theft or misuse of Government controlled materials in the custody of the contractor.

12. GOVERNMENT AND LOCAL RULES

The Contractor shall conform to the provisions of all local Bylaws and Acts relating to the work and to the Regulations etc. of the Government and Local Authorities and of any company with whose system the structure is proposed to be connected. The Contractor shall give all notices required by the said Act, Rules, Regulations and Bylaws etc and pay all fees payable to such authority/authorities for execution of the work involved. The cost, if any, shall be deemed to have been included in his quoted rates, taking into account all liabilities for licenses, fees for footpath encroachment and restorations etc. and shall indemnify the Employer against such liabilities and shall defend all actions arising from such claims or liabilities.

13. TAXES AND DUTIES

The tenderness must include in their tender prices quoted for all duties, royalties, cess, excise, sales tax, work contract sales tax, VAT or any other taxes or local charges If applicable. No extra claim on this account will in any case be entertained. However, Service Tax as applicable will be payable by the Bank.

14. PROVISIONAL SUMS (P.S.)

All provisional sum described in the schedule of quantities as P.S. shall be exclusively allotted to the purchase of materials & not for any handling & fixing to be done by the contractor. Such costs of handling & fixing with profit (or transportation charges, if required) shall be separately included in the contract price as described in the schedule of quantities. The disposal of the amounts covered under this head will be absolutely at the discretion of the Employer. Contractor is to make payments for these materials to the suppliers on certificate or order issued by the Employer / Consultant & realizes them through his bills from the Employer.

15. QUANTITY OF WORK TO BE EXECUTED

The Quantities shown in the Schedule of Quantities are intended to cover the entire new structure indicated in the drawings but the Employer reserves the right to execute only a part or the whole or any excess thereof without assigning any reason therefore. If at any time after the commencement of the work, the Employer / Consultant shall for any reason whatsoever not require the whole work thereof as specified in the tender to be carried out, the Consultant / Employer shall give notice in writing of the fact to the contractor who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full, but which he did not derive in consequence of the full amount of the work not having been carried out; neither shall he have any claim for compensation by reason of any alterations having been made in the original specification, drawing, designs and instructions which shall involve any curtailment of the work as originally contemplated.

16. OTHER AGENCY OR PERSONS ENGAGED BY THE EMPLOYER

The Employer reserves the right to execute any part of the work included in this contract or any work which is not included in this contract by other Agency or persons and the Contractor shall allow all reasonable facilities and use of his scaffolding for the execution of such work. The General building Contractor shall extend all co-operation in this regard.

17. EARNEST MONEY, SECURITY DEPOSIT & RETENTION MONEY

The tenderer will have to deposit an amount of Rs. Lakhs (Rupees only) in the form of Demand Bank Draft/Pay Order/Banker's Cheque drawn in favour of UCO Bank and payable at Guwahati at the time of submission of tender as Earnest Money. The Employer is not liable to pay any interest on the Earnest Money. The Earnest Money of the unsuccessful tenderers will be refunded without any interest soon after the decision to award the work is taken or after the expiry of the validity period of the tender.

The successful tenderer to whom the contract is awarded will have to deposit as "Initial Security Deposit" (ISD) a further sum to make up 2% (Two Percent) of the value of the accepted tender including the Earnest Money. ISD may be submitted in the form of Bank Draft/Pay Order/Banker's Cheque or Bank Guarantee (as per Annexure-XII herein below). The Bank Guarantee shall be from any nationalized Bank other than UCO Bank. The initial Security Deposit will have to be made within 14 days from the date of acceptance of tender, failing which the Employer at his discretion may revoke the Letter of Acceptance and forfeit the Earnest Money deposit furnished along with the tender.

Apart from the initial security deposit made as above, Retention Money shall be deducted from progressive running bills @ 8% of the gross value of each running bill until security deposit, i.e. the Initial Security Deposit plus the Retention Money equal to:

- (a) 10% on the first Rupees one Lac of the cost of work;
- (b) 7.5% on the next Rupees one Lac of the cost of work;
- (c) 5% on the next amount up to Rs. 2 Crores of the cost of work.
- (d) 2% for the amount in excess of 2 Crores of the cost of work subject to ceiling on the total security of Rs. 25,00,000/-.

However, the retention money will not be deducted from progressive running bills till the amount of Initial Security Deposit including the earnest money is covered.

Also, the Retention Money will not be deducted from the contractor's running bills if Bank Guarantee from a Nationalized Bank other than UCO Bank covering the retention money calculated as above, is submitted by the contractor.

After realization of the total Retention Money by deduction from the bills of the contractor as specified above, 50% of the total Retention Amount will be refunded to the contractor on completion of work subject to the following :-

- 1) Issue of the Virtual Competition Certificate by the Consultants / Bank.
- 2) Contractor's removal of his material, equipment, labour force, temporary sheds/stores etc. from the site excepting for small presence required if any, for the defect liability period and approved by the Bank.

The balance 50% will be released to the Contractor within a reasonable period after the end of "Defect Liability Period" provided he has satisfactorily carried out all the work, submitted all documents including all as-built drawings etc. contractually called for and attended to all defects in accordance with the conditions of the contract. No interest is allowed on Retention Money and Earnest Money Deposit.

Further, if some dues to the Employer from the Contractor(s) have still to be recovered, the Employer reserves the right to withhold payment of so much of the Retention Money as in his opinion, represents the cost of the same.

18. PERFORMANCE SECURITY:

Within 30 days of receipt of the letter of award the successful tenderer shall furnish to the UCO Bank Performance Security (as per Annexure-XIII hereinbelow) for an amount of 5% (seven percent) of the contract price in the shape of Demand Draft or Pay Order or Bank Guarantee from a Nationalized (other than UCO Bank) or Foreign Bank acceptable to the employer. After due performance or completion of the work in all respects the Performance Security will be returned to the Contractor without any interest. Failure of the successful tenderer to furnish the Performance Security shall constitute sufficient grounds for the annulment of the award and forfeiture of Initial Security Deposit. In this event the employer may make the award to other tenderer according to the position prevailing at the appropriate time.

10% of the job value pertaining to waterproofing & anti-termite works will be kept in FD a/c for 4 (Four) years after the end of Defect Liability Period for which the contractor is to execute guarantee bond for waterproofing treatment work (as per Annexure-X herein below) and guarantee bond for anti-termite treatment (as per Annexure-IX herein below) which shall be refunded after 4 years from the end of Defect Liability Period & will carry interest AT PREVAILING RATE provided he has satisfactorily carried out all the work and attended to all defects in accordance with the conditions of the contract.

No interest is allowed on retention money for defect liability period of one year.

19. CONTRACTOR TO PROVIDE EVERYTHING NECESSARY.

The Contractor shall provide everything necessary for the proper execution of the work according to the intent and meaning of the drawings, schedule / of quantities and specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can reasonably be inferred there from and if the Contractor finds any discrepancies therein he shall immediately and in writing refer the same to the Employer / Consultant whose decision shall be final and binding. The contractor shall provide himself for fresh and tested water for carrying out the work at his own cost. The Employer shall on no account be responsible for the expenses incurred by the Contractor for hired ground or fresh water obtained from elsewhere.

The rates quoted against individual items will be inclusive of everything necessary to complete the said items of work within the contemplation of the contract, and beyond the unit price no extra payment will be allowed for incidental or contingent work, labour and or materials inclusive of all taxes and duties whatsoever except for specific items, if any stipulated in the tender documents.

The Contractor shall supply, fix and maintain at his own cost, for the execution of any work, all tools, tackles, machineries and equipment's and all the necessary centering, scaffolding, staging, planking, timbering, strutting, shoring, pumping, fencing, boarding, watching and lighting by night as well as by day required not only for the proper execution and protection of the said work but also for the protection of the public and safety of any adjacent roads, streets, walls, houses, buildings, all other erections, matters and things and the Contractor shall take down and remove any or all such centering, scaffolding, planking, timbering, strutting, shoring, etc., as occasion requires or when ordered so to do, and shall fully reinstate and make good all matters and things disturbed during the execution of work to the satisfaction of the Employer / Consultant.

The Contractor shall also provide such temporary road on site as may be necessary for the proper performance of the contract and for his own convenience but not otherwise. Upon completion, such road shall be broken up and leveled where so required by the drawings unless the Employer shall otherwise direct.

The Contractor shall at all times give access to workers employed by the Employer or any men employed on the buildings and to provide such parties with proper sufficient and if required, special scaffolding, hoists and ladders and provide them with water and lighting and leave or make

any holes, grooves etc. in any work, where directed by the Employer as may be required to enable such workmen to lay or fix pipes, electrical and telephone conduit, special fittings, etc. The quoted rates of the tenderers shall accordingly include all these above mentioned contingent work.

20. TIME OF COMPLETION, EXTENSION OF TIME AND PROGRESS CHART

a) Time of Completion:

The entire work is to be completed in all respects within the stipulated period of 09 (Nine) calendar months. The work shall be deemed to be commenced within 14 (fourteen) days from the date of issue of formal work order or the date on which the Contractor is instructed to take possession of the site, whichever is later. Time is the essence of the contract and shall be strictly adhered to by the Contractor.

The work shall not be considered as complete until the Employer/Consultant have certified in writing that this has been completed and the Defects Liability Period shall commence from the date of such certificate.

b) Extension of Time:

If in the opinion of the Employer / Consultant the work be delayed (a) by reason of any exceptionally inclement weather or (b) by reason of instructions from the Employer / Consultant in consequence of proceeding taken or threatened by or disputes, with adjoining or neighbors or owners or

(c) by the work, or delay of other contractors or tradesmen engaged or nominated by the Employer / Consultant and not referred to in the specification or (d) by reason of authorized extra and additions or (e) by reason of any combination of workmen or strike or lockout affecting any of the building trades or (f) from other causes which the Employer / Consultant may consider are beyond the control of the Contractor, the Employer / Consultant before the completion of the time allowed for the contract shall make fair and reasonable extension of time for completion in respect therefore. In the event at the Employer failing to give possession of the site upon the day specified above the time of completion shall be extended suitably.

In case of such strikes or lock-outs, as are referred to above, the Contractor shall immediately give the Employer / Consultant written notice thereof.

Nevertheless, the Contractor shall use his best endeavors to prevent delay, and shall do that may be reasonably required, to the satisfaction of the Employer / Consultant to proceed with the work and on his doing so that it will be ground of consideration by the Employer / Consultant for an extension of time as above provided. The decision of the Employer as to the period to be allowed for an extension at time for completion hereunder (which decision shall be final and binding on the Contractor) shall be promulgated at the conclusion of such strike or lock-out and the Employer shall then in the event of extension being granted, determine and declare the final completion date. The provision in Clause 20 with respect to payment of liquidated damages shall in such case, be read and construed as if the extended date fixed by the Employer were substituted for and the damage shall be deducted accordingly.

Hindrance Register in the approved format as per Annexure – XIII, Table – XII, shall be maintained and proper record of hindrances arisen and solved with the dates to be recorded in the register by the Employer's Site Engineer / Consultant's Site Engineer and Contractor's authorized representative so that extension of time to be granted can be derived from the register and recommended by the Consultant and approved by the Employer's Competent Authority.

c) Progress of Work/ Work Program :

During the period of construction the Contractor shall maintain proportionate progress on the basis of the Programmed Chart submitted by the Contractor immediately before commencement of work and agreed to by the Employer/ Consultant. Contractor should also include planning for

procurement for scarce material well in advance and reflect the same in the Programme Chart so that there is no delay in completion of the project.

21. LIQUIDATED DAMAGES (LD)

Should the work be not completed to the satisfaction of the Employer / Consultant within the stipulated period, the contractor shall be bound to pay to the employer a sum calculated as under by way of liquidated damage and not as penalty during which the work remains un-commenced or unfinished after the expiry of the completion date :-

a)	For contracts having time for completion 6 months and less	1.00% of the estimated amount shown in the tender per week subject to a ceiling of 10% of the accepted contracted sum.
b)	For contracts having time for completion exceeding 6 months but not exceeding 2 years (24 months)	0.50% of the estimated amount shown in the tender per week subject to a ceiling of 7.5% of the accepted contracted sum but not exceeding the total S. D. of the contract.
c)	For contracts having time for completion in excess of 2 years	0.25% of the estimated amount shown in the tender per week subject to a ceiling of 5% of the accepted contracted sum but not exceeding the total S. D. of the contract.

22. ACTION WHEN WHOLE OF SECURITY DEPOSIT IS FORFEITED

In any case in which under any clause or clauses of this contract, the contractor shall have rendered himself liable to pay liquidated damages amounting to the whole of his Security Deposit (whether paid in one sum or deducted by installments) the Employer / Consultant shall have power to adopt any of the following courses as they may deem best suited to the interest of the Employer:

a) To rescind the contract (of which rescission notice in writing to the contractor under hand of the Employer shall be conclusive evidence), and in which case the Security Deposit of the contractor shall stand forfeited and be absolutely at the disposal of the Employer.

b) To employ labour by the Employer and to supply materials to carry out the work, or any part of the work, debiting the contractor with the cost of the labour and price of material (of the amount of which cost and price of a certificate of the Consultant shall be final and conclusive against the contractor) and crediting him with the value of the work done, in all respects in the same manner and at the same rates as if it had been carried out by the contractor under the terms of this contract and the certificate of the Employer as to the value of the work done, shall be final and conclusive against the contractor.

c) To measure up the work of the contractor, and to take such part thereof as shall be unexecuted, out of his hands, and to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (of the amount of which excess the certificate in writing of the Consultant shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any money due to him by the Employer under the contract or otherwise, or from his security Deposit or the proceeds of sale thereof, or a sufficient part thereof.

In the event of any of the above courses being adopted by the Employer / Consultant the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagements or make any advances on account of, or with a view to the execution of the work or the performance of the contract. And in case the contract shall be rescinded under the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereto for actually performed under this contract unless and until the Employer / Consultant will have certified in writing the

performance of such work and the value payable in respect thereof, and he shall only be entitled to be paid the value so certified.

23. TOOLS, STORAGE OF MATERIALS, PROTECTIVE WORKS AND SITE OFFICE REQUIREMENTS

The Contractor shall provide, fix up and maintain in an approved position proper office accommodation of the contractor representative and staff which shall be open at all reasonable hours to receive instruction notices or communications and clear away on completion of the work and make good all work disturbed.

All drawings maintained on the site are to be carefully mounted on boards of appropriate size. They are to be protected from ravages of termites, ants, and other insects. The Contractor shall provide at his own cost all artificial light required for the work and to enable other contractors and sub-contractors to complete the work within the specified time.

The Contractor shall provide a suitable temporary hut for the watchman and clear away the same when no longer required and to provide all necessary attendance, lights etc, required.

The Contractor shall arrange for temporary latrines for the use of workers and field staff and keep the same in a clean and sanitary condition to the satisfaction of the Public Health Authorities and shall cause such latrines and soil to be cleared away whenever necessary and shall make good all the work disturbed by these conveniences.

Every precaution shall be taken by the contractor to prevent the breeding of mosquitoes on the work during the construction and all receptacles, cisterns, water tanks etc used for storage of water must be suitably protected against breeding of mosquitoes. The Contractor shall indemnify the Employer against any breach of rules in respect of anti-malarial measures. The Contractor shall not fix or place any placards or advertisement of any description or permit the same to be fixed or placed in or upon any boarding gantry, building structure other than those approved by the Employer.

Protective Measures

The Contractor from the time of being placed in possession of the site must make suitable arrangements for watching, lighting and protecting the work, the site and surrounding property by day, by night, on Sundays and other holidays.

The Contractor shall indemnify the Employer against any possible damage to the building, roads, or member of the public in course of execution of the work.

The Contractor shall provide necessary temporary enclosures, gates, entrances etc. for the protection of the work and materials and for altering and adopting the same as may be required and removing on completion of the work and making good all work disturbed.

Storage of materials

The Contractor shall provide and maintain proper sheds for the proper storage and adequate protection of the materials etc and other work that may be executed on the site including the tools and materials of subcontractors and remove same on completion. Sheds for storage of cement are to have pucca floor raised above the ground. Cement godown shall be constructed for storing about six weeks requirements of cement stored as per norms with a stack or 10 bags each, two feet opening all around with two feet passage between each stack. Structure shall be waterproof from all the sides and top. Cement should be stored one ft. above the ground level and the floor of the godown shall consist of wooden planks resting on base prepared of dry bricks. So also reinforcement bars are to be stored above the ground level to prevent the same from getting rusted.

Tools

All tools, equipments and instruments as instructed by the Employer /Consultant and considered necessary for the work shall be provided by the Contractor for the due performance of this contract.

All measuring tapes shall be of steel and suitable scaffolding and ladders that may be required for taking measurement shall be supplied by the Contractor.

The mistries and the supervisors on the work shall carry with them always one meter or two meter steel tape and a measuring tape of 30 meters, a spirit level, a plumb bob and a square and shall check the work to see that the work is being done according to the drawing and specifications.

The Site Engineer will use any or all measuring instruments or tools belonging to the contractors as he chooses for checking the work executed or being executed on the contract.

The Contractor should cover in his rates for making provisions for all reasonable facilities for the use of his erected scaffolding, and/or tools and plant etc by sub-contractors for their work or for work to be carried out by other agencies employed by the Employer / Consultant.

24. NOTICE AND PATENTS OF APPROPRIATE AUTHORITY AND OWNERS

The Contractor shall conform to the provisions of any Act of the Legislature relating to the work and to the Regulations and Bylaws of any authorities, and/or any water, lighting and other companies, and/or authorities with whose systems the structures were proposed to have connection and shall before making any variations from the drawings or specification that may be associated to so conform, give the Employer / Consultant written notices specifying the variations proposed to be made and the reasons for making them and apply for instruction thereon. The Employer / Consultant on receipt of such intimation, shall give a decision within a reasonable time. The Contractor/s shall arrange to give all notices required for by the said Acts, Regulations or Bylaws to be given to any authority and to pay such authority or to any public office all fees that may be properly chargeable in respect of the work and lodge the receipts with the Employer. The Contractor shall indemnify the Employer against all claims in respect of patent rights, royalties damages to buildings, roads or member of public in course of execution of work and shall defend all actions arising from such claims and shall keep the Employer saved harmless and indemnified in all respects from such actions, costs and expenses.

25. CLEARING SITE AND SETTING OUT WORKS

The site shown on the plan shall be cleared of all obstructions, trees, bushes, shrubs, loose stone, and rubbish materials of all kinds. All holes or hollows whether originally existing or produced by removal of loose stone or material shall be carefully filled with earth well rammed and leveled off as directed at his own cost.

The Contractor shall set out the work and shall be responsible of the true and perfect setting out of the work and for the correctness of the positions, levels, dimensions and alignment of all parts thereof. If at any time, any error shall appear during the progress of any part of the work, the Contractor shall at his own expenses rectify such error, if called upon to the satisfaction of the Employer / Consultant. The Contractor shall further set out the work to the alternative positions at the site until one is finally approved and the rates quoted in his tender should include for this and no extra on this account will be entertained.

26. DATUM

The 'datum' will be furnished by the Consultant / Employer in conformity with regulations of appropriate Authority. The contractor shall make arrangements for preserving the above datum till completion of the work. All levels shown in the drawings are to be strictly adhered to.

27. BENCHES

The Contractor is to construct and maintain proper benches of all the mainwalls, in order that the lines and levels may be accurately checked at all times.

These benches will consist of timber posts of adequate length and minimum diameter 75mm to be driven in the ground at suitable distance as directed and encased with brick work. The wire nails will be driven on the top of wooden post on the center line at columns, walls, inside and outside faces of foundation trenches. Center line of walls, columns etc may be clearly indicated so that checking may be done at any time, if it is so required.

28. CONTRACTOR IMMEDIATELY TO REMOVE ALL OFFENSIVE MATTERS

All soil, filth or other matters of any offensive nature taken out of any trench, sewer, drain, cesspool or other place shall not be deposited on the surface but shall be at once carted away by the Contractor to a safe place as per rules of the appropriate authorities / instruction of the Employer / Consultant.

The Contractor shall keep the foundations and work free from water and shall provide and maintain at his own expenses, electrically or other power driven pumps and other plant to the satisfaction of the Employer for the purpose, until the building is handed over to the Employer. The Contractor shall arrange for the disposal of the water so accumulated to the satisfaction of the employer and the local authority and no claims will be entertained afterwards if he does not include in his rates for the purpose.

29. ACCESS

Any authorized representative of the Employer / Consultant shall at all reasonable times have free access to the work and/or to the workshops, factories other places where materials are being prepared or constructed for the work and at any place where the materials are lying or from where they are being obtained, and the Contractor shall give every facility to the Employer or their representatives necessary for inspection and examination and test of the materials and workmanship. Except the representatives of the Employer and Consultant no person shall be allowed at any time without the written permission of the Employer.

30. MATERIALS, WORKMANSHIP, SAMPLES, TESTING OF MATERIALS

All the work specified and provided for in the specifications or which may be required to be done in order to perform and complete any part thereof shall be executed in the best and most workmanlike manner with materials of the approved quality of the respective kinds in accordance with the particulars contained in and implied by the specifications and as represented by the drawings or according to such other additional particulars, and instructions as may from time to time be given by the Employer / Consultant during the execution of the work and to his entire satisfaction.

A list of Mandatory Tests is annexed as per Annexure – XIV, which is only indicative and not exhaustive. The contractor will have to carry out the tests at his own cost in any approved testing laboratory to prove that the materials under test conform to the specifications stipulated in relevant I. S. Code / Tender. The necessary charges for preparation of mould (in case of concrete cube), transporting, testing etc shall have to be borne by the contractor. Any other tests, special or routine, on any material or workmanship, if advised to be done by the Employer/ Consultant for any reason whatsoever, shall be carried out by the Contractor for which no additional payment will be made.

A list of materials of approved make and brand is annexed in the "Technical Specifications". Materials are to be used from the annexed approved materials list. Out of the approved brands

one with ISI mark shall be given preference over the others. In case of non-availability of materials of specified makes, alternative products of equivalent quality may be used with prior permission from the Employer / Consultant.

All the materials (except where otherwise described) stores and equipment required for the full performance of the work under the contract must be provided through normal channels and must include charges for all duties, sales tax, octroi and other charges legally payable and must be the best of their kind available and the contractors must be entirely responsible for the proper and efficient carrying out of the work. The work must be done in the best workman like manner. Samples of all materials to be used must be submitted to the Employer / Consultant when so directed by the Employer / Consultant and written approval from Employer / Consultant must be obtained prior to placement of order.

During the inclement weather the Contractor shall suspend concreting and plastering for such time as the Employer / Consultant may direct and shall protect from injury all work during its course of execution. Any damage (during construction) to any part of the work for any reasons due to rain, storm or neglect of Contractor shall be rectified by the Contractor in an approved manner at no extra cost. Should the work be suspended by reason of rain, strike, lock-outs or any other cause, the Contractor shall take all precautions necessary for the protection of work and at his own expenses shall make good any damage arising from any of these causes. The Contractor shall cover up and protect from damage from any cause, all new work and supply all temporary doors, protection to windows, and all other requisite protection for the execution of the work whether by himself or special tradesmen or sub-Contractor and any damage caused must be made good by the Contractor at his own expenses.

31. REMOVAL OF IMPROPER WORK

The Employer / Consultant shall during the progress of the work have power to order in writing from time to time the removal from the work within such reasonable time or times as may be specified in the order of any materials which in the opinion of the Employer / Consultant are not in accordance with specifications or instructions, the substitutions or proper re-execution of any work executed with materials or workmanships not in accordance with the drawings and specifications or instructions. In case the Contractor refuses to complete with the order, the Employer / Consultant shall have the power to employ and pay other agencies to carry out the work and all expenses consequent thereon or incidental thereto as certified by the Employer/Consultant shall be borne by the Contractor or may be deducted from any money due to or that may become due to the Contractor. No certificate which may be given by the Consultant shall relieve the Contractor from his liability in respect of unsound work or bad materials.

32. SITE ENGINEER/PROJECT MANAGEMENT CONSULTANTS (PMC)

The term "Site Engineer / Project Management Consultants (PMC)" shall mean the person/firm appointed and paid by the Employer to superintend the work. The Contractor shall afford the Site Engineer / PMC every facility and assistance for examining the work and for checking and measuring work and Materials. The Site Engineer/PMC shall have no power to revoke, alter, enlarge or relax any requirements of the contract or to sanction any day work, additions, alterations, deviations or omission or any extra work whatever, except in so far as such authority may be specially conferred by a written order of the Employer.

The Site Engineer/PMC shall have power to give notice to the contractor or to his foreman, of non approval of any work or materials and such work shall be suspended or the use of such materials shall be discontinued until the decision of the Employer / Consultant is obtained. The work will from time to time be examined by the Consultant, Engineer of the Employer and the Site Engineer/PMC. But such examination shall not in any way exonerate the contractor from the obligations to remedy any defects which may be found to exist at any stage of the work or after the

same is complete. Subject to the limitation of this clause the Contractor shall take instruction only from the Employer / Consultant.

33. OFFICE ACCOMMODATION FOR THE SITE ENGINEER / PMC

The Contractor shall provide, erect and maintain at his cost a separate simple watertight office accommodation for the Site Engineer/PMC in case it is not already available at site. This accommodation shall be well lighted and ventilated and provided with windows, door with a lock. The Site Engineer's/PMC's office shall be a minimum of 14 Sqm. (150 Sqft.) and the Contractor shall provide a desk, chairs, drawers for keeping drawings, a cupboard having proper lock, telephone connection and a tack board for displaying drawings, lights and fans. Charges for the telephone bill, electricity bill, etc. shall be borne by the contractor. The accommodation shall be demolished when directed.

34. CONTRACTOR'S EMPLOYEES

The Contractor shall employ technically qualified and competent supervisors for the work who shall be available (by turn) throughout the working hours to receive and comply with instruction of the Employer/Consultant. The Contractor shall engage at least one experienced Engineer as Site-in-charge

for execution of the work. The Contractor shall employ in connection with the work persons having the appropriate skill or ability to perform their job efficiently.

The Contractor shall employ local laborers on the work as far as possible.

No labourer below the age of sixteen years and who is not an Indian National shall be employed on the work. Any labourer supplied by the Contractor to be engaged on the work on day-work basis either wholly or partly under the direct order or control of the Employer or his representative shall be deemed to be a person employed by the Contractor.

The Contractor shall comply with the provisions of all labour legislation including the requirements of :-

- a) The Payment of Wages Act
- b) Employer's Liability Act
- c) Workmen's compensation Act
- d) Contract Labour (Regulation and Abolition) Act, 1970 and Central Rules 1971
- e) Apprentices Act 1961
- f) Any other Act or enactment relating thereto and rules framed thereunder from time to time.

The Contractor shall keep the Employer saved harmless against claims of any of the workmen and all costs and expenses as may be incurred by the Employer in connection with any claim that may be made by any workmen.

The contractor shall comply at his cost with the order or requirement of any Health Officer of the State or any local authority or of the Employer regarding the maintenance of proper environmental sanitation of the area where the contractor's labourers are housed or accommodated for the prevention of small pox, cholera, plague, typhoid, malaria and other contagious diseases.

The Contractor shall provide, maintain and keep in good sanitary condition adequate sanitary accommodation and provide facilities for pure drinking water at all times for the use of men & women engaged on the work and shall remove and clear away the same on completion of the work.

Adequate precautions shall be taken by the contractor to prevent nuisance of any kind of work or the lands adjoining the same.

The Contractor shall arrange to provide, first aid treatment to the labourers engaged on the work. He shall within 24 hours of the occurrence of any accident at or about the site or in connection with execution of the work, report such accident to the Consultant / Employer and also to the

competent authority where such report is required by law.

35. DISMISSAL OF WORKMEN

The Contractor shall on the request of the Employer / Consultant immediately dismiss from work any person employed thereon by him, who may in the opinion of the Employer / Consultant be unsuitable or incompetent or who may misconduct himself. Such discharge shall not be the basis of any claim for compensation or damages against the Employer / Consultant or any of their officer or employee.

36. ASSIGNMENT

The whole of the work Included In the contract shall be executed by the Contractor and the Contractor shall not directly or indirectly transfer, assign or underlet the contract or any part, share or interest therein nor, shall take a new partner, without written consent of the Employer and no subletting shall relieve the Contractor from the full and entire responsibility of the contract or from active superintendence of the work during their progress.

37. NOMINATED SUB-CONTRACTOR

All specialists, Merchants, Tradesmen and others executing any work or supplying and fixing any goods for which prime cost prices or provisional sums are included in the Schedule of Quantities/Rates and/or specifications and who may be nominated or selected by the Employer are hereby declared to be sub-contractors employed by the contractor and are herein referred to as nominated sub-contractors.

No nominated sub-contractor shall be employed on or in connection with the work against whom the contractor shall make reasonable objection or save where the Employer and contractor shall otherwise agree who will not enter into a contract provided:

a) That the nominated sub-contractor shall indemnify the contractor against the same obligations in respect of the sub contract as the contractor is under in respect of this contract.

b) That the nominated Sub-contractor shall indemnify the contractor against claims in respect of any negligence by the sub-contractor, his servants or agents or any misuse by him or them of any scaffolding or other plants the property of the contractor or under any Workman's compensation Act in force.

c) Payment shall be made to the nominated sub-contractor by the contractor within fourteen days of his receipt of the Consultant's certificate provided that before any certificate is issued the contractor shall upon request furnish to the Consultant proof that all nominated sub-contractor's accounts included in previous certification have been duly discharged, in default whereof the Employer may pay the same upon a certificate of the Consultant and deduct the amount thereof from any sums due to the contractor. The exercise of this power shall not create privity of contract between the Employer and the subcontractor.

38. DAMAGE TO PERSONS AND PROPERTY, INSURANCE, ETC

The Contractor shall be responsible for all injury to the work or workmen to persons, animals or things and for all damages to the structural and/or decorative part of property which may arise from the operations or neglect of himself or of any sub-Contractor or of any of his or a sub-Contractor's employees, whether such injury or damage arise from carelessness, accident or any other cause whatsoever in any way connected with the carrying out of this contract. The clause shall be held to include inter-alia, any damage to buildings whether immediately adjacent or otherwise and any damage to roads, streets, foot-paths or pathways as well as damage caused to the buildings and the work forming the subject of this contract by rain, wind or other inclemency of the weather. The Contractor shall indemnify and hold harmless the Employer in respect of all and

any expenses arising from any such injury or damages to persons or property as aforesaid and also in respect of any claim made in respect of injury or damage under any acts of compensation or damage consequent upon such claim.

The Contractor shall reinstate all damage of every sort mentioned in this clause, so as to deliver the whole of the contract work complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damages to the property or third parties. The contractor shall effect the insurance necessary and indemnify the employer entirely from all responsibility in this respect. The insurance must be placed with a company approved by the Employer and must be effected jointly in the name of the contractor and the Employer and the policy lodged with the latter. The scope of insurance is to include damage or loss to the contract itself till this is made over in a complete state. The Contractor shall also be responsible for anything which may be excluded from damage to any property arising out of incidents, negligence or defective carrying out of the contract. The Employer shall be at liberty and is hereby empowered to deduct the amount of any damages, compensations, costs, charges and expenses arising or accruing from or in respect of any such claim or damages from any sums due or to become due to the contractor.

39. INSURANCES

Unless otherwise instructed the Contractor shall insure the work and keep them insured until handing over of the work against loss or damage by fire and / or earthquake, flood or damages from whatever cause by an "All Risk Insurance Policy" for the full value of the contract. The contractor shall also take insurance for third party liability. The limit of coverage for third party liability shall be 1% of the accepted contract sum at any time of the contract period. The insurance is to be at his own cost and must be placed with a company approved by the Employer, in the joint names of the Employer and the Contractor of such amount and for any further sum if called upon to do so by the Employer, the premium of such further sum being allowed to the Contractor as an authorized extra.

Moreover, the contractor will be required to obtain "Workman's Compensation Insurance" from an approved insurance company at his own cost.

Insurance is compulsory and the Contractor shall effect Insurance before undertaking construction work and deposit the policy and receipt for premiums paid with the Employer within 21 (twenty one) days from the date of issue of work order unless otherwise instructed. In default of the Contractor insuring as provided above, the Employer on his behalf may so insure and may deduct the premiums paid from any money due, or which may become due to the contractor. The Contractor shall as soon as the claim under the policy is settled or the work reinstated by the Insurance Company should they elect to do so, proceed with due diligence with the completion of work in the same manner as though the fire / earthquake / flood has not occurred and in all respects under the conditions of the contract. The Contractor in case of rebuilding or reinstatement after fire/earthquake/flood shall be entitled to extension of time for completion as the Employer may deem fit.

40. ACCOUNTS RECEIPTS AND VOUCHERS

The Contractor shall, upon the request of the Employer / Consultant furnish them with all the invoices, accounts, receipts and other vouchers that they may require in connection with the work under this contract.

If the Contractor shall use materials less than what he is required under the contract, the value of the difference in the quantity of the materials he was required to use and that he actually used shall be deducted from his dues.

The decision of the Employer shall be final and binding on the Contractor as to the amount of materials the Contractor is required to use for any work under this contract.

41. MEASUREMENT OF WORK

The contractor will record the measurements in the approved printed measurement books available in the Consultant's office on payment, and submit measurements verification and endorsement of Project Management Consultant/Site Engineer and site representative of the Consultant, if any. The contractor should submit the bill to the Consultant with such endorsement.

The Consultant shall upon receipt of the bill intimate to the contractor that here requires the work to be measured, and the contractor shall forthwith attend or send a Qualified Agent to assist the Consultant or the Consultant's representation / Employer's Representatives In taking such measurements and calculations and to furnish all particulars or to give all assistance required by either of them.

Should the contractor not attend or neglect or omit to send such Agent then the measurement taken by the Consultant or a representative approved by him shall be taken to be the correct measurement of the work.

The contractor or his Agents may at the time of measurement take such notes and measurements as he may require. All authorized extra work, omissions and all variations made without the Consultant's knowledge, if subsequently sanctioned by him in writing, with the approval of the Employer shall be included in such measurements. The final measurement should be done within three months from the date of completion of work jointly by the Consultant and/or his representative. If the contractor fails to comply, the measurements taken by the Consultant will be final.

42. METHOD OF MEASUREMENT

Unless otherwise mentioned elsewhere in the tender document, measurements will be on the net quantities of work produced in accordance with up to date rules laid down by the Indian Standard Institution. In the event of any dispute with regard to the measurement of the work executed, the decision of the Consultant / Employer shall be final and binding on the contractor.

43. ACTION WHERE NO SPECIFICATION

In the case of any class of work for which there is no such specification in Technical Specification, such work shall be carried out in accordance with the I.S specification, and in the event of there being no I.S. specification, then in such case the work shall be carried out in all respects in accordance with the instructions and requirements of the Consultant / Employer.

44. CONTRACTOR NOT TO DEPOSIT MATERIALS IN A MANNER THAT MAY CAUSE INCONVENIENCE TO THE PUBLIC

The contractors shall not deposit materials on any site which will cause inconvenience to the public. The Employer / Consultant may require the contractor to remove any materials, which are considered by him to be a danger or inconvenience to the public or cause them to be removed at the contractor's cost.

45. PAYMENTS

a) All bills shall be prepared by the Contractor in the form prescribed by the Employer / Consultant as per format marked Annexure – VIII. Normally one interim bill shall be prepared each month subject to minimum value for interim certificate as stated in APPENDIX. The bills in proper forms must be duly accompanied by detailed measurements recorded in the approved measurement book available from the consultants office, on payment, duly endorsed by the Site Engineer/PMC/Consultant representative as defined in Clause 42 above in support of quantities of work done and must show deductions for all previous payments, retention money, etc.

Advance / adhoc payment for work actually executed will not be normally made. However adhoc payment may be made at the discretion of Consultant/Employer in case of exigency. The Consultant / Employer shall issue a certificate after due scrutiny of the Contractor's bill stating the amount due to the Contractor from the Employer and the Contractor shall be entitled to payment thereof, by the Employer within the period of honoring certificates mentioned in the APPENDIX.

The amount stated in an interim certificate shall be the total value of work properly executed and secured advances not exceeding 75% of invoiced assessed value of material brought to site for permanent incorporation into the work up to the date of the bill provided that secured advance is payable against them as per tender condition less the amount to be retained by the Employer as retention money vide Clause 17 of these conditions and less installments previously paid under these conditions. The materials against which secured advance will be considered are cement, steel & stone chips/gravels; manufactured items of steel / cement, bricks, door frames & shutters, window frames & shutters, flooring materials, paints, G.I. & C.I. pipes & fittings, sanitary fixtures & fittings etc.

The materials to be considered for secured advance shall only include the value of the said material and goods as and from such time as they are reasonably, properly and not prematurely brought to or placed adjacent to the work and then only if adequately protected against weather or other casualties, provided also materials are considered acceptable by the Site Engineer/PMC/Consultant. An indemnity bond on stamp paper is to be submitted by the contractor in the annexed format (as per Annexure-XIV herein below) whenever Secured Advance against materials are prayed for.

If the Employer has supplied any materials or goods to the Contractor, the cost of any such materials or goods will be progressively deducted from the amount due to the Contractor in accordance with the quantities consumed in the work.

All the interim payments shall be regarded as payments by way of advance against the final payment only and not as payments for work actually done and completed, and shall not preclude the requiring of bad, unsound, and imperfect or unskilled work to be removed and taken away and reconstructed, or re-erected or be considered as an admission of the due performance of the contract, or any part thereof in any respect or the accruing of any claim, nor shall, it conclude determine or affect in anyway the powers of the Employer under these conditions or any of them as to the final settlement and adjustment of the accounts or otherwise or in any other way vary or affect the contract. The final bill shall be submitted by the Contractor to the Consultant within three months of the date fixed for completion of the work or of the date of certificate of completion furnished by the Consultant and payment shall be made by the Employer within three months from the date of receipt of the final bill duly verified & certified by the Consultant. The Employer / Consultant reserves the right to withhold in part or full payment of bills in case of non-compliance/violation of any terms and conditions stipulated in the agreement. The contractor shall neither suspend the work nor claim for extension of time for non-payment / withholding of payment on this account and no interest is also payable on the payment withheld/due.

b) FINAL PAYMENT

The final bill shall be accompanied by a certificate of completion from the Consultants. Payments of final bill shall be made after deduction of Retention Money as specified in Clause 17 of these conditions, which sum shall be refunded in the manner stated in Clause 17. The acceptance of payment of the final bill by the Contractor would indicate that he will have no further claim in respect of the work executed.

46. VARIATION / DEVIATION

The Contractor may when authorized and shall, when directed in writing by the Consultant / Employer add and / or omit, or vary the work shown in the drawings or described in the specifications or included in the priced schedule of quantities. The Contractor on his own accord shall make no addition, omission or variation without such authorization or direction. A verbal authorization or direction by the Consultant / Employer shall when confirmed by the Contractor in writing within 3 days shall be deemed to have been given in writing. The price of all such additional/non-tendered items will be worked out on the basis of rates quoted for similar items in the contract wherever existing or on engineering rate analysis based on prevalent fair price of

labour, materials at site of work including wastage and other components as required plus 15% towards contractor's profit, supervision, overhead etc. Works Contract Sales Tax, if applicable will be considered over and above 15%. The tendered rates shall hold good for any increase or decrease in tender quantities.

No claim for an extra shall be allowed unless it shall have been executed by the authorization of Employer / Consultant. No variation i. e. additions, omissions or substitutions shall vitiate the contract.

47. SUBSTITUTION.

Should the Contractor desire to substitute any materials and workmanship, he/they must obtain the approval of the Employer / Consultant in writing for any such substitution well in advance. For materials designated in this specification indefinitely by such term as "Equal" or "Other approved" etc. specific approval of the Employer / Consultant has to be obtained in writing prior to execution.

48. PREPARATION OF BUILDING WORKS FOR OCCUPATION AND USE ON COMPLETION.

The whole of the work will be thoroughly inspected by the Contractor and deficiencies and defects put right. On completion of such inspection, he shall inform the Consultant that he has completed the work and it is ready for inspection. On completion, the Contractor shall clean all windows & doors including cleaning and oiling, if necessary, of all hardware, inside & outside, all floors, staircases and every part of the building. He will leave the entire building neat and clean and ready for immediate occupation and to the satisfaction of the Employer / Consultant. Contractor shall obtain necessary completion / occupation certificate from municipal authorities. Employer as well as Consultants may assist if required.

49. CLEARING SITE ON COMPLETION

On completion of the work the contractor shall clear away and remove from the site all constructional plant, surplus materials, rubbish and temporary work of every kind and leave the whole of the site and the work clean and in a workman like condition to the satisfaction of the Employer / consultant.

50. DEFECTS AFTER COMPLETION

The Contractor shall make good at his own cost and to the satisfaction of the Employer / Consultant all defects, shrinkage, settlements or other faults which may appear within 12 months after completion of the work and considered as the "Defect Liability Period". In default the Employer may employ, and pay other persons to amend and make good such damages, losses and expenses consequent thereon or incidental thereto shall be made good and borne by the contractor and such damages, loss and expenses shall be recoverable from him by the Employer or may be deducted by the Employer, in lieu of such amending and making good by the Contractor, deduct from any money due to the Contractor a sum equivalent to the cost of amending such work and in the event of the amount retained being insufficient recover that balance from the Contractor from the amount retained under clause No 17 together with any expenses the Employer may have incurred in connection therewith.

51. CONCEALED WORK

The Contractor shall give due notice to the Employer / Consultant whenever any work is to be buried in the earth, concrete or in the bodies of walls or otherwise becoming inaccessible later on in order that the work may be inspected and correct dimensions taken before such burial, in default whereof the same shall, at the option of the Employer / Consultant be either opened up for measurement at the Contractor's expense or no payment be made for such materials. Should any dispute or difference arise after the execution of any work as to measurements etc or other

matters which cannot be conveniently tested or checked, the notes of the Employer /Consultant be accepted as correct and binding on the Contractor.

52. PRICE VARIATION.

The rates quoted shall be firm for first six months the tenure of the contract (including extension of time, if any, granted) and will not be subject to any fluctuation due to increase in cost of materials, sales tax, octroi, etc. Thereafter, price variation adjustment clause as per specimen Price variation adjustment clause as given in Section VI clause 2 of these tender documents, will be applicable.

53. IDLE LABOUR

Whatever the reasons may be, no claim for idle labour, additional establishment cost of hire and labour charges of tools and plants would be entertained under any circumstances.

54. SUSPENSION

If the contractor except on account of any legal restraint upon the Employer preventing the continuance of the work or in the opinion of the Employer shall neglect or fail to proceed with due diligence in the performance of his part of the contract or if he shall more than once make default the Employer shall have the power to give notice in writing to the Contractor requiring the work be proceeded within a reasonable manner and with reasonable despatch, such notices purport to be a notice under this Clause.

After such notice shall have been given, the Contractor shall not be at liberty to remove from the site of the work or from any ground contiguous thereto, any plant or materials to subsist from the date of such notice being given until the notice shall have been complied with.

If the Contractor shall fail for 7 (seven) days after such notice has been given to proceed with the work as therein prescribed, the Employer may proceed as provided in this Clause 55 (Termination of Contract by the Employer).

55. TERMINATION OF CONTRACT BY EMPLOYER

The Employer shall have the right to terminate the contract at any time at its own convenience by serving a prior written notice of 30 days to the contractor without assigning any reason and without cost or compensation therefore.

However, the Employer may also terminate the contract in any of the following cases upon prior notice of 30 days to the contractor:

(a) If the Contractor being a company go into liquidation whether voluntary or compulsory or being a firm shall be dissolved or being an individual shall be adjudicated insolvent or

(b) shall make an assignment or a composition for the benefit of the greater part, in number or amount of his creditors or

(c) shall enter into a Deed or arrangement with his creditors, or

(d) if the Official Assignee in insolvency, or the Receiver of the Contractor in insolvency, shall repudiate the contract, or

(e) if a Receiver of the Contractor's firm appointed by the Court shall be unable, within fourteen days after notice to him requiring him to do so to show to the reasonable satisfaction of the Employer that he is able to carry out and fulfill the contract and if so required by the Employer to give reasonable security therefore,

Or

(f) if the Contractor shall suffer execution to be issued, or shall suffer any payment under this contract to be attached by or on behalf of the creditors of Contractors, or

(g) shall assign, charge or encumber this contract or any payments due or which may become due to the Contractor, there under,

or

(h) shall neglect or fail to observe and perform all or any of the acts matters of things by this contract, to be observed and performed by the Contractor within three clear days after the notice shall have been given to the Contractor in manner hereinafter mentioned requiring the Contractor to observe or perform the same or

(i) shall use improper materials or workmanship In carrying on the work, or

(j) shall in the opinion of the Employer not exercise such due diligence and make such due progress as would enable the work to be completed within due time agreed upon, and shall fail to proceed to the satisfaction of the Employer after three clear days notice requiring the Contractor so to do shall have been given to the Contractor as hereinafter mentioned, or

(k) Shall abandon the contract, then and in any of the said cases.

56. EFFECTS OF TERMINATION:

Further, on termination of the agreement as aforesaid, the Employer or his agent, or servants, may enter upon and take possession of the work and also materials lying upon premises or the adjoining lands or roads if any advance payment has been made by the Bank against those materials and completing the work by employing any other contractor or other persons or person to complete the work, and the Contractor shall not in any way interrupt or do any act, matter or thing to prevent or hinder such other contractors Employer may give notice in writing to the Contractor to remove his surplus materials, plants, machinery, tools, scaffolding etc and should the Contractor fail to do so within a period of 14 days after receipt by him the Employer may sell the same by Public Auction and shall give credit to the Contractor for the amount so realized after adjusting dues from the contractor if any.

Any expenses or losses incurred by the Employer in getting the work carried out by other contractors shall be adjusted against the amount payable to the Contractor by way of selling his tools and plants or due on account of work carried out by the Contractor prior to engaging other contract or against the Security Deposit.

The Employer at its sole discretion shall invoke the Performance Guarantee, Security Deposit and the Indemnity furnished for performance of contract in the event of breach of terms and conditions of the contract by the Contractor, without prejudice to its rights and conditions available under the Law for the time being in force.

57. ARBITRATION

The Contractor and the Employer shall endeavor their best to amicably settle all disputes arising out of or in connection with the Contract in the following manner:

a. The Party raising a dispute shall address to the other Party a notice requesting an amicable settlement of the dispute within seven (7) days of receipt of the notice.

b. The matter will be referred for negotiation between Employer and the Contractor. The matter shall then be resolved between them and the agreed course of action documented within a further period of 15 days.

c. In case any dispute between the Parties, does not settle by negotiation in the manner as mentioned above, all disputes or differences of any kind whatsoever which shall at any time arise between the parties hereto touching or concerning the work or the execution or maintenance thereof of this contract shall be referred to and the same may be resolved exclusively by arbitration by a Sole Arbitrator to be selected by the employer and approved by the contractor and such dispute may be submitted by either party for arbitration within 20 days of the failure of negotiations. Arbitration shall be held at THE CIRCLE OFFICE OF THE UCO BANK AT ----- and conducted in accordance with the provisions of Arbitration and Conciliation Act, 1996 or any statutory modification or reenactment thereof.

d. The "Arbitration Notice" should accurately set out the disputes between the parties, the intention of the aggrieved party to refer such disputes to arbitration as provided herein and the Arbitrator is to be appointed within 45 days from receipt of the notice. All notices by one party to the other in connection with the arbitration shall be in writing.

e. The arbitrator shall hold the sittings at the CIRCLE OFFICE OF THE UCO BANK AT ----- . The arbitration proceedings shall be conducted in English language. The arbitration award shall be final, conclusive and binding upon the Parties and judgment may be entered thereon, upon the application of either party to a court of competent jurisdiction. Each Party shall bear the cost of preparing and presenting its case, and the cost of arbitration, including fees and expenses of the arbitrators, shall be shared equally by the Parties unless the award otherwise provides.

f. The contractor shall not be entitled to suspend the work or the completion of the work, pending resolution of any dispute between the Parties and shall continue with the work in accordance with the provisions of the Contract/Agreement notwithstanding the existence of any dispute between the Parties or the subsistence of any arbitration or other proceedings.

g. It is also a term of the contract that if Contractor(s) do/does not make any demand for arbitration in respect of any claim (s) within 90 days of receiving intimation from Employer/Consultant that the bill after due verification is passed for payment of a lesser amount, or he has accepted the payment as per clause 45 whichever is earlier or otherwise, the Contractor's right under this agreement to refer to arbitration shall be deemed to have been forfeited and Employer/Consultant shall be relieved and discharged of their liability under this agreement in respect of such claims. Further, it is agreed that for the purpose of this clause, such notice is deemed to have been received by the Contractor(s) within 2 days of posting of the letter by Employer / Consultant or when delivered by hand immediately after receipt thereof by the Contractor(s), whichever is earlier. Further, a letter signed by the officials of Employer / Consultant that the letter so posted to the Contractor(s) shall be conclusive.

h. For the purpose of appointing the sole Arbitrator referred to above the CIRCLE HEAD UCO BANK CIRCLE OFFICE ----- AS Appointing Authority will send within thirty days of receipt by him of the written notice as aforesaid to the Contractor, a panel of three names of persons who shall be presently unconnected with the organization for which the work is executed from the following categories of Arbitrators.

i) Retired High Court I Supreme Court Judges, who have experience in handling Arbitration cases.

ii) Members of the Council of Arbitration.

iii) Fellow of the Institution of Indian Institute of Architects.

iv) Eminent retired Chief Engineers from State/Central PWD/Public Sector Undertakings of good reputations and integrity.

(i) The contractor shall on receipt by him names as aforesaid select any one of the persons named to be appointed as a sole Arbitrator and communicate his name to the Appointing Authority within thirty days of receipt by him of the names. The Appointing Authority shall thereupon without any delay appoint the said person as the sole Arbitrator. If the Contractor fails within the period specified, the Appointing Authority shall make the selection and appoint the selected person as the Sole Arbitrator.

(j) If the Appointing Authority fails to send to the Contractor, the panel of three names as aforesaid within the period specified, the Contractor shall send to the Appointing Authority a Panel of three names of persons out of the above mentioned four categories of Arbitrators who shall all be unconnected with either party. The appointing Authority shall on receipt by him of the names as aforesaid select anyone of the person named and appoint him as the sole Arbitrator. If the Appointing Authority fails to select the person and appoint him as the sole Arbitrator within 30 days of receipt by him of the panel and inform the Contractor accordingly, the Contractor shall be entitled to appoint one of the persons from the panel as the sole Arbitrator and communicate his name to the Appointing Authority.

(k) If the Arbitrator so appointed is unable or unwilling to act or resign his appointment or vacates his office due to any reason whatsoever another sole Arbitrator shall be appointed as aforesaid.

(l) The work under the Contract shall, however, continue during the arbitrations proceedings and no payment due or payable to the Contractor shall be withheld on account of such proceedings.

(m) The Arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties fixing the date of the first hearing.

(n) The Arbitrator may from time to time, with the consent of the parties, extend the time for making and publishing the award.

(o) The Arbitrator shall give a separate award in respect of each dispute or difference referred to him. The Arbitrator shall decide each dispute in accordance with the terms of the contract. The venue of arbitration shall be such place as may be fixed by the Arbitrator in his sole discretion.

(p) In all cases, where the amount of claim in dispute is Rs. 50,000/- (Rupees Fifty thousand) and above, the Arbitrator shall give reasons for the award.

(q) The fees, if any, of the Arbitrator shall, if required to be paid before the award is made and published, be paid half and half by each of the parties. The cost of the reference and of the award including the fees if any, of the Arbitrator who may direct to and by whom and in what manner, such costs or any part thereof shall be paid and may fix or settle the amount of costs to be so paid.

(r) The award of the Arbitrator shall be final and binding on both the parties

AND THE PARTIES AGREE TO BE BOUND THEREBY AND TO ACT ACCORDINGLY.

(s) Subject to aforesaid the provisions of the Arbitration and Conciliation Act, 1996 or any statutory modification or re-enactment thereof and the rules made there under, and for the time being in force, shall apply to the Arbitration proceeding under this clause.

58. JURISDICTION

All the dispute(s) / difference(s) arising out of the said agreement shall be subject to the jurisdiction of Courts of Law at only and shall be governed by the Laws in force in India.

59. Excepted Matters:

If the disputes or differences pertain to the under noted matters (called excepted matters), the decision in writing of the officer of UCO Bank designated in and signing the contract documents shall be final, conclusive and binding on the parties. No arbitration shall arise in such matters except either by mutual agreement or under the directions of a competent Court:

i) Instruction

ii) Transactions with local authorities

iii) Proof of quality of materials

iv) Assigning or under letting of the contract

- v) Certificate as to the causes of delay on the part of the contractor and justifying extension of time.
- vi) Rectification of defects pointed out during the defects liability period.
- vii) Notice to the contractor to the effect that he is not proceeding with due diligence.
- viii) Certificate that the contractor has abandoned the contract.
- ix) Notice of determination of the contract by the Employer.

60. SECURITY ARRANGEMENTS

Proper arrangements shall be made to keep all records under lock and key. It shall be ensured that the contractor provides for adequate fences, Watch and Ward and security of basic materials such as cement and steel etc.

Movement of material, stores and plant, especially of those which the Bank has got financial interest or those which influence progress of work, shall be strictly controlled. Checks shall be exercised at gate (entrance and exit shall be preferably through one gate only). When the work is completed and handed over to the user, the responsibility of proper security arrangements shall rest with the users.

61. WORKING HOURS

Site office working hours shall normally be fixed as may be prevailing in the locality.

Normally no construction work of important structural nature shall be carried out on Sundays, Holidays and during nights. In exceptional circumstances, however, the work may be carried out with prior approval of the Site

Engineer who shall depute supervising staff to be present on the occasion.

62. BOND

The Contractor should execute an Indemnity Bond in the proforma provided (as per Annexure-XIV herein below) to keep the Bank harmless and indemnified against any extra costs, damages and/or bear extra burden and also for their acts of omission and commission or misdeeds.

APPENDIX

1	Name of Work	Plumbing and Area Development work for construction of Bank Building for UCO Bank at Nalbari, Assam.
2	Location	Sariahtali, Nalbari, Assam
3	Scope of work	As in Clause 2 of Section : V and as further detailed in Tender Notice, Instruction to Tenderer
4	Defect Liability Period (Cl. 50)	12 (Twelve) Months
5	Date of Commencement (Cl. 20)	14th day from the date of issue of work order or the date on which the contractor is instructed to take possession of site, whichever is later.
6	Date / Time of Completion (Cl. 20)	Nine Calendar Months
7	Liquidated Damages (Cl. 21)	As per Clause 21, Page ---, under the Head "General Conditions of Contract" (Section – V)
8(a)	Earnest Money (Cl. 17)	Rs. 2,80,000.00 (Rupees Two lakh eighty thousand Only).
8(b)	Initial Security Deposit (Cl. 17)	2% of the accepted contract sum including EMD.
8(c)	Retention Percentage (Cl. 17)	As mentioned in Clause No. 17.
9	Installment after completion certificate (Cl. 17)	50% of the total retention amount.
10	Period of Honoring Certificate (Cl. 45)	3 weeks from the date of receipt of Certificate from the Consultant.
11	Minimum value of work for interim certificate (Cl. 44)	Rs. 30.00 Lakh (Rupees Thirty lakh only).

NOTE : Clauses (CL) refer to General Conditions of Contract

SECTION –VI

SPECIAL CONDITIONS WITH PROFORMA OF TEST RESULTS

1: TECHNICAL EXAMINATIONS

The proposed work covered under this tender during its progress subject to inspection by the Chief Technical Examiner / Technical Examiner, Central Vigilance Commission, Govt. of India or by an Officer of the Vigilance Cell of the Employer. The Contractor will be required to extend all assistance and facilities for such inspections

2: GENERAL PRICE VARIATION ADJUSTMENT (PVA) CLAUSES FOR ALL MATERIALS (Including Cement & Steel) AND LABOUR

PVA will not be applicable. Rate quoted by the tenderer shall be firm throughout the contract period. No claim will be entertained for any variation in cost of material and labour.

3. GUARANTEE

Whenever the tender provides for submission of a specific guarantee to keep any specialized work efficient and trouble free for a specific period and shall be submitted from the specialized agency along with a counter guarantee by the main Contractor engaged for the work. The specialized agency and the main contractor shall furnish the guarantee as mentioned above on non-judicial stamp papers of appropriate values. If the Contractor is required to submit guarantee/ guarantees for any item/items for a period of more than 12 months, the guarantee / guarantees in case of those items shall remain valid even after expiry of the defect liability period of 12 months as stipulated in the contract.

10% of the job value pertaining to waterproofing & anti-termite works will be kept in an FD a/c after the end of defects liability period for a period of 4 years & will be refunded thereafter to the contractor with accrued interest at PREVAILING RATE provided he has satisfactorily carried out all the work and attended to all defects in accordance with the conditions of the contract. No interest is allowed on retention money for defect liability period of one year.

4. POSSESSION PRIOR TO COMPLETION

The Employer shall have the right to take possession of or use any completed or partially completed part of the work. Such possession or use shall not be an acceptance of any work not completed in accordance with the contract agreement.

5. INCOME TAX/ GST ON WORKS CONTRACT / OTHER TAXES

Statutory deductions on account of Income Tax/ GST on works contract and other taxes legally payable by the contractor shall be made from all interim and final payments as per extant statute. However, Service Tax will be payable by Bank as per applicable rate.

6. TREASURE TROVE ETC.

Any treasure trove, coin or object of antiquity which may be found on the site of construction shall be the property of the Employer and shall be handed over to him.

7. LAND FOR CONTRACTORS' ESTABLISHMENT

For the purpose of construction of Contractors store yard, godowns, siteoffice, etc. the Contractor may utilize with the permission of the Employer Consultant, portion of the land belonging to the Employer if available at such location as would not interfere with the execution of the work. The Contractor shall for this purpose submit to the Employer I Consultant for his approval a plan or plans of the proposed layouts for the site facilities. The Employer /Consultant reserves the right to modify the contractors' proposals as he may deem fit

8. WATER

The rates quoted by the Contractor shall include all expenditure for providing all the water for the full contract period required for the work, including that for the work people and all staff on the site. He shall make his own arrangement for the supply of approved quality water suitable for use in the work and the work people. If municipal/urban water supply is available, the contractor shall make arrangements to obtain the same. All expenses including running charges shall be borne by the contractor. If municipal water is not available or inadequate, he shall make other arrangements like sinking tube wells or making bore wells or transport from outside by tanker or any other suitable means entirely at his cost and no separate payment for the same will be made. He shall arrange for testing water at an approved laboratory at his own cost and shall provide all tubes, tanks, fittings and temporary plumbing work required for the work and on completion of work shall remove all temporary appliances and make good any work disturbed for making such arrangements to the satisfaction of the Employer/Consultant for which no extra payment will be made.

9. POWER

The contractor shall at his own cost arrange for necessary power required for construction and lighting for the entire period of contract. If, however, separable power available in the premises, the Contractor shall make his own arrangement to obtain necessary connections, maintain an efficient service of electric lights and power and shall pay for all the requisite charges for the same. The Employer, as well as the Consultant shall give all the recommendations necessary to obtain power and water connections from the concerned authorities, but the responsibility for obtaining the same shall rest with the Contractor.

The contractor shall pay all fees and charges for obtaining power from the concerned authorities and include the same in his tendered rates and hold the Employer free from all such costs. If any other Contractor, appointed by the Employer, is required to use water and power, he shall be allowed to use the same and make temporary connections from the supply arranged by the main Contractor at rates and terms that may be mutually agreed upon by both, failing which, at rates, terms and conditions that may be decided by the Employer/consultant.

10. FIRST -AID FACILITIES

The Contractor shall at his own expense arrange to ensure availability of medical attendance promptly when necessary. He shall provide properly equipped first aid station, in -charge of qualified persons at suitable location within easy reach of the workmen and staff. The Contractor shall also provide for transport of serious cases to the nearest Hospital. The Contractor shall be responsible for availability which may be excluded from the insurance policies referred in Clause 38 of General Conditions of Contract and also for all other damages to any person, animal or property arising out of or incidental to the negligence or defective carrying out of this contract. He shall also indemnify the Employer in respect of any cost, charges or expenses arising out of or any claims or proceedings and also in respect of any award of compensations and damages arising there from. The Employer shall with the concurrence of the Consultant be entitled to deduct the amount of any damage, compensation, cost charges and expenses arising from or occurring from,

or in respect of, any such claims or damages from any or all sums due or become due to the Contractor without prejudice to the Employer's other rights in respect thereof.

11. FIRE FIGHTING ARRANGEMENTS

The contractor shall at his own expenses provide at suitable, prominent, and easily accessible places requisite number of fire extinguishers and buckets some filled with sand and some with water.

12. REPORTS AND RETURNS

Contractor shall maintain at site daily records of progress with regard to the work carried out, labour engaged and construction equipment deployed. These daily records shall be made available / accessible to the Employer's Site Engineer / Consultant as and when required by him. Enlarged progress photographs are also submitted by the Contractors with each running account bill at no extra cost to the employer.

13. SITE BOOK

For the purpose of quick communication, the Contractor shall maintain and preserve at site, a book with machine numbered pages in triplicate. Any instruction/advice given and recorded in the site order book by the Consultant/Employer shall be considered as a notice served on the Contractor.

14. QUALITY CONTROL

For execution, control and monitoring of work and as well as for performing routine field tests the Contractor shall have to establish and maintain a field laboratory and the costs are to be covered within the rate quoted by him and no separate charges for the same will be paid. The field laboratory shall remain operative for the full tenure of the contract and must have at least the following equipments:-

- a) Compression testing machine of minimum capacity of 150 tons
- b) A set of standard sieves (for Coarse and fine aggregates)
- c) Measuring Cylinders
- d) Slump Cone
- e) Adequate number of standard moulds (15cm cubes)
- f) Weighing balance
- g) Slide caliper and screw gauge
- h) Arrangement for design mix.
- i) Weigh batch in sufficient Nos.

Any other apparatus if deemed necessary and called for by the Employer/Consultants shall also be provided by the Contractor at his own expense. Materials should be tested in the field laboratory in presence of Consultant's/Employer's representative(s). In addition to that, the contractors shall get the materials tested in local Govt. Engineering College/Polytechnic/approved laboratory at his / their own cost and the results should be preserved carefully and attached with the respective running bills.

15: COMPLETION DRAWINGS AND PHOTOGRAPHS:

The Contractor, while reporting on completion of their work, shall furnish along with to the Consultant :- i) "as done" completion drawing of services viz. sanitary/plumbing, electrical work etc. on ammoni prints, ii: Inventory of all fittings fixed by him in the work, & iii) Enlarged completed photographs of the work.

16: DISCREPANCIES AND ADJUSTMENT OF ERRORS:

The several documents forming the contract are to be taken as mutually explanatory of one another; detailed drawings being followed in preference to small scale drawings and figured dimensions in preference to scaled dimensions.

In the case of discrepancy between schedule of quantities, the specifications / and / or the Drawings, the following order of preference shall be observed:-

a: Description in the schedule of items and Quantities;

b: Technical specifications

c: Drawings;

If there are varying or conflicting provisions made in any one document forming part of the Contract, the accepting authority of the employer shall be the deciding authority with regard to the intention of the document.

Any error in description, quantity or rate in Schedule of quantities or any omission there from shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the work comprised therein according to drawings and specifications or from any of his obligations under the contract.

17: TESTS/RESULTS/SITE REGISTERS ETC.

The contractor will be required to maintain the following registers at site of work and should produce the same for inspection of the Employer/Consultant whenever desired by them:-

Typical proforma of registers are enclosed (refer Table below)

Table I	Proforma of Cement Register
Table II	Proforma of Steel Register
Table III	Proforma of Water proofing material / paint / pesticide / lead Register
Table IV	Proforma of CI Rain Water Pipe Register
Table V	Proforma of HCI Pipe Register
Table VI	Proforma of Bulkage Test of Sand Register
Table VII	Proforma of Slump Test Register
Table VIII	Proforma of Silt Test Register
Table IX	Proforma of Brick Test Register
Table X	Proforma of Sieve Analysis of Coarse Aggregate Register
Table XI	Proforma of Sieve Analysis of Fine Aggregate Register
Table XII	Proforma of Concrete Cube Test Register
Table XIII	Proforma of G. I. Pipe Register
Table XIV	Proforma of Hindrance Register
Table XV	Proforma of Register of abnormally high / low Rated Item.

SECTION – VII

SAFETY CODE

1. The contractor should maintain all first aid appliances includingadequate supply of sterilized dressing and cotton wool in a readilyaccessible place.
2. In case of any injured person if it is needed hospitalization even afterproper first aid treatment then the injured person should be admittedto the nearest hospital without loss of time.

SCAFFOLDS

- i. Suitable scaffolds shall be provided for workmen for all work thatcannot safely be done from the ground, or from solid constructionexcept in the case of short duration work which can be done safelyfrom ladders. When a ladder is used, it shall be of rigid constructionmade either of good quality wood or steel. The steps shall have aminimum width of 450 mm and a maximum rise of 300 mm. Suitablehand holds or good quality wood or steel shall be provided and theladder shall be given an inclination not steeper than 1/4 to 1 (1/4 horizontal and 1 vertical).
- II. Scaffolding or staging more than 4 meter above the ground floorswung or suspended from an overhead support or erected withstationery support shall have a guard rail properly bolted, braced orotherwise secured, at least 1 meter above the floor or platform of suchscaffolding or staging and extending along the entire length of theoutside and ends thereof with only such openings as may benecessary for the delivery of materials. Such scaffolding or stagingshall be so fastened as to prevent it tram swaying from the building orstructure.
- III. Working platforms, gangways and stairway shall be so constructed thatthey do not sag unduly or unequally and if the height of the platform,gangway or stairway is more than 4 meter above ground level or floorlevel, they shall be closely boarded and shall have adequate widthand be suitably fenced as described in (ii) above.
- IV. Every opening in the floor of a building or in a working platform shall beprovided with suitable means to prevent the fall of persons or materialsby providing suitable fencing or railing whose minimum height shall be1 Mt.Wherever there are open exceptions in ground, they shall be fencedoff by suitable railing and danger signals installed at night so as toprevent persons slipping into the excavations.
- V. Safe means of access shall be provided to all working places. Everyladder shall be securely fixed. No portable single ladder shall be over9 m in length while the width between side rails in rung ladder shall inno case be less Man 290mm for ladder up to and including 3m inlength. For longer Ladders this width shall be increased at least 20mm for each additional meter of length.
- VI. A sketch of the ladders and scaffolds proposed to be used shall beprepared and approval of the Engineer obtained prior to construction.

OTHER SAFETY MEASURES

- VII: All personal of the Contractor working within this plant site shall beprovided with safety helmets. All welders shall wear welding goggleswhile doing welding work and all in metal workers shall be providedwith safety gloves. Persons employed on metal cutting and grindingshall wear safety glasses.

- VIII: Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. All safety rules shall be observed while working on live electrical system or installation as stipulated in I.E. rules.

EXCAVATION AND TRENCHING

- IX: All trenches, 1.2M or more in depth, shall at all times be supplied with at least one ladder for each 30M in length or fraction thereof. The ladder shall be extended free bottoms of the trench to at least 1 m above the surface of the ground. Sides of trenches which are 1.5M or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated material shall not be placed within 1.5m of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.
- X: The Contractor shall take all measures on the site of the work to protect the public from accidents and shall be bound to bear the expenses of defense of every unit, action or other proceedings at law that may be brought by any persons for injury sustained owing to neglect of the above precautions and to pay any such persons or which may with the consent of the Contractor, be paid to compromise any claim by any such person.

DEMOLITION

- XI: Before any demolition work is commenced and also during the process of the work :-
- a: All roads and open areas adjacent to the work site shall either be closed or suitably protected;
 - b: No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged;
 - c: All practical steps shall be taken to prevent danger to persons employed from the risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

PERSONAL SAFETY EQUIPMENTS

- XII: All necessary safety equipment as considered adequate by the Engineer should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the Contractor should take adequate steps to ensure proper use of equipment by those concerned :
- a: Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
 - b: Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes shall be provided with protective goggles.
 - c: Those in welding work shall be provided with welder's protective eyesight lids.
 - d: Stone breakers shall be provided with protective goggles and protective clothing and sealed at sufficiently safe intervals.
 - e: When workers are employed in sewers and manholes, which are in use, suitable railing and provided with warning signals or boards to prevent accident to the public;
 - f: The Contractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting the following precautions should be taken :
 - i: No paint containing lead or lead products shall be used except in the form of paste or ready made paint.

- ii: Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.
- lii: Overalls shall be supplied by the Contractor to the workman and adequate facilities shall be provided to enable the working painters to wash during cessation of work.
- XIII: When the work is done near any public place where there is risk of drowning all necessary equipments should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

XIV: HOISTING MACHINES

- 1) Use of hoisting machines and tackle including their attachments anchorage and supports shall conform to the following standards or conditions.
 - a: These shall be of good mechanical constructions sound material and adequate strength and free from patent defect and shall be kept in repair and in good working order.
 - b. Every rope used in hoisting or lowering materials or as means of suspension shall be of durable quality and adequate strength and free from patent defects.
 - 2) Every crane driver or hoisting appliance operator shall be properly qualified. No person under the age of 21 years shall be in charge of any hoisting machine including any scaffolding winch or give signals to operator.
 - 3) In case of every hoisting machine all of every chain ring hook, shackles shovels and pulley block used in hoisting or as means of suspension the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
 - 4) In case of departmental machines, the safe working load shall be notified by the Engineer. As regards Contractor's machines, the Contractor shall notify the safe working load of the machine to the Engineer whenever he brings any machinery to site of work and get it verified by the Engineer concerned.
- XV) Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with sufficient safeguards, hoisting appliances should be provided with such means as will reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary, should be provided. The workers should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.
- XVI: All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work
- XVII: These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the Contractor.

- XVIII: To ensure effective enforcement (the rules and regulations relating to safety) precautions the arrangements made by the Contractor shall be open to inspection by the Labour Office, Engineers of the Department or their representatives.
- XIX: Notwithstanding the above clause from (I) to (VXIII), there is nothing in those to exempt the Contractor from the operations of any other Act or Rule in force in the Republic of India.

SECTION – VIII

MODEL RULES FOR THE PROTECTION OF HEALTH AND SANITARY ARRANGEMENTS FOR WORKERS

1. APPLICATION

These rules shall apply to all buildings and construction work relating to Construction of Bank Building at **Sariahtali, Nalbari, Assam** of UCO Bank and the Contractor shall bear all cost for making the necessary provisions.

2. DEFINITION

(a) 'Work Place' means a place at which, at an average, 50 workers are employed in connection with construction work.

(b) 'Large work place' means a place at which average 500 or more workers are employed in connection with construction work

3. FIRST AID

(a) At every work place, there shall be maintained in readily accessible place first aid appliance including an adequate supply of sterilized dressings and sterilized cotton wool. The appliance shall be kept in good order and in large work place, they shall be placed under the charge of a responsible person who will be readily available during working hours.

(b) Where large work places are remote from regular hospitals, an indoor ward shall be provided with one bed for every 250 employees

(c) Where large work places are situated in cities, towns in their suburbs and no beds are considered necessary owing to the proximity of city or town hospitals, suitable transport shall be provided to facilitate removal of urgent cases to the hospitals. At other work places, some conveyance facilities, such as a car, shall be kept readily available to take injured person or persons suddenly taken ill to the nearest hospital.

4. DRINKING WATER

(a) In every work place there shall be provided and maintained at suitable places easily accessible to labour sufficient supply of cold water fit for drinking."

(b) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored. .

(c) Every water supply or storage shall be at a distance of not less than 15m from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well which is within the proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust and water proof.

(d) A reliable pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

5. WASHING AND BATHING PLACES

(a) Adequate washing and bathing places shall be provided, separately for men and women.

(b) Such places shall be kept in clean and drained condition.

6. SCALE OF ACCOMMODATION IN LATRINES AND URINALS

There shall be provided with the precincts of every work place, latrines and urinals in an accessible place and the accommodation, separately for each of them shall not be less than the following scale.

No. of seats

- | | |
|--|-------------|
| a) Where the number of persons does not exceed 50 | - 2 |
| b) Where the number of persons exceeds 50, but does not exceed 100 | -3 |
| c) For every additional 100 | - 3 per 100 |

In particular cases the Engineer shall have the powers to vary the scale where necessary.

7. LATRINES AND URINALS FOR WOMEN.

If women are employed, separate latrines and urinals screened from those for men and marked in the vernacular in conspicuous letters 'For Women Only' shall be provided on the scale laid in Rule 6. Those for men shall be similarly marked 'For Men Only'. A poster showing the figure of a man or a woman shall also be exhibited at the entrance of latrines for the respective sex. There shall be adequate supply of water close to the urinals and latrines.

8. LATRINES AND URINALS

All latrines shall be provided with septic tanks or leach pits in case of small units. All the latrines shall be kept in good sanitary condition.

9. CONSTRUCTION OF LATRINES

The inside walls shall be constructed of masonry or some suitable heat-resisting non-absorbent materials and shall be cement washable inside and outside at least once a year. The dates of cement washing shall be noted in a register maintained for this purpose and kept available for inspection. Latrines will not be of a standard lower than bore hole system and should have thatched roofs.

10. DISPOSAL OF EXCRETA

Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta shall be made by septic tank or leach pit duly approved by the Engineer and in conformity with the requirements of local public health authorities.

11. PROVISIONS OF SHELTER DURING REST.

At every work place there shall be provided free of cost, two suitable sheds, one for meals and the other for rest separately for men and women for the use of labour. The height of the shelter shall not be less than 3.5 M from the floor level to the lowest part of the roof. The sheds should be roofed with at least thatch and mud flooring and will be provided with a dwarf wall around not less than 750 mm. Sheds should be kept clean and the space should be on the basis of at least 0.50 square meter per head.

12. CRECHES

a) At every work place, at which 50 or more women workers are ordinarily employed, there shall be provided two huts for the use of children under the age of 6 years, belonging to such women, one hut shall be used for infants' games and play and the other as their bed room. The huts shall not be constructed on a lower standard than the following :-

i : thatched roofs

ii : mud floors and walls

iii: planks spread over the mud floor and covered with matting. The huts shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provisions of sweepers to keep the place clean. There shall be two dais in attendance. Sanitary utensils shall be provided to the satisfaction of the Health Officer of the

area concerned. The use of the hut shall be restricted to children, their attendants and mothers of the children.

b) Where the number of women workers is more than 25 but less than 50, the Contractor shall provide at least one hut and one dai to look after the children or women working.

c) The size of crèches or crèches shall vary according to the number of workers

d) The crèche or crèches shall be properly maintained and necessary equipment like toys, etc. shall be provided

13 CANTEEN

A cooked food canteen on a moderate scale shall be provided for the benefit of workers wherever it is considered expedient.

SECTION- IX

TECHNICAL SPECIFICATIONS FOR MATERIALS AND CIVIL WORK

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SECTION - A : MATERIALS

1. Materials shall be of approved quality. A list of materials of approved brand and manufacture is indicated in the list of materials of Approved Brand manufacture. The list is given to ensure the standard of quality and performance.
2. Contractors shall obtain approval of representative of Employer/Consultant on sample of all materials before placing order and the approved sample shall be carefully preserved in an appropriate manner at the site office for verification by the representative of Employer/Consultant.
3. For standard bought out items, the sizes manufactured by the firms listed shall prevail in case of discrepancy with the sizes mentioned in the schedule without any financial adjustment.
4. Materials shall be tested at site/any approved Testing Laboratory. The Laboratory Test Certificate in original shall be submitted to the representative of Employer/Consultant. Test results are also to be recorded at site registers appropriately.
5. Wherever work as per manufacturer's specification is indicated, it will be obligatory on the part of the contractor to submit manufacturer's specification to Consultant/Employer. The Quoted rates shall be deemed to include for the complete work specified by the manufacturer even though not specifically mentioned in the schedule of items. Moreover, the quoted rates shall be deemed to include for the complete work specified by the manufacturer even though not specifically mentioned in the schedule of items.
6. It shall be obligatory for the contractor to furnish certificates, if demanded by the representative of Employer/Consultant, from manufacturer or the material supplier, stating that the work has been carried out by using their material.
7. All materials supplied by the representative of Employer/Consultant/any other specialist firm shall be properly stored and the Contractor shall be responsible for its safe custody until they are required on the works and till the completion of work.
8. All equipment and facilities for carrying out field tests on materials shall be provided by the Contractor without any extra cost.
9. Unless otherwise shown on the Drawings or mentioned in the "Schedule of Quantities" or anywhere in the contract, the quality of materials, workmanship, dimensions etc shall be as specified hereunder.
- 9.1 Material for filling shall be selected material as specified for filling and shall be free from building rubbish or organic decomposed material. They shall be obtained either from excavation or brought from outside, as specified, in the schedule of items.
- 9.2 **Cement**
Cement unless otherwise specified of grade 43, conforming to IS.455/IS and grade 53 conforming to IS: 12269 shall be used. The use of cement other than ordinary Portland cement/Blast furnace slag cement will not be allowed unless specifically advised by representative of Employer/Consultant. Cement shall be stored in dry weatherproof go-down/shed built by the contractor at his own cost in order to prevent deterioration by dampness or intrusion of foreign matter. Not more than 10 bags should be kept in one stack and it shall be stored in such a manner as to permit easy access for proper inspection. It shall be stored in such a way as to allow the removal and use of cement in chronological order of receipt i. e., first received being first used. Cement

deteriorated and/or clodded shall not be used on work but shall be removed at once from the site at Contractor's cost.

Daily record of cement received and consumed shall be maintained by the Contractor in the cement register at site and submitted to representative of Employer/Consultant if called for. Theoretical consumption of cement for different materials brought at site by the Contractor shall also be submitted with proper documents with every bill for verification. The consumption of cement for different items of work shall be as given in the tender and in its absence as per C. P. W.D. schedule. 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 1440 kg. Cement stored for more than three months shall be got tested before using it in work.

9.3 Lime

Lime shall be made from approved Lime Stone or Kankar and properly burnt and shall be of appropriate class for specific work given in IS:712-1984. It shall be free from excess of unburnt kankar or lime stone ashes or other extraneous materials and shall be stored to prevent damage by rain, moisture or air slaking. Lime shall be used within 14 days from the date of stacking and damaged lime shall not be used but shall be removed from the site of work forthwith at Contractor's cost.

9.4 Fine Aggregate

Shall be from natural source, chemically inert, clean, sharp, hard, durable and well graded and free from deleterious materials not exceeding the permissible limit as per IS : 383-1970. The Silt Content shall be within 8%. If it is in excess, washing shall be done in an approved manner to bring it within allowable limit. The fine aggregate for concrete shall be graded and the Fineness Modulus shall be between 2.60 to 3.20. The Fineness Modulus of fine aggregate shall be between 1.80 to 2.60 for plaster & masonry work. The fine aggregate shall be stacked carefully on a clean and dry surface so that it will not mix up with deleterious foreign materials. If such a surface is not available, thick floor or a thin layer of lean concrete shall be prepared. The percentage of Materials shall be within the permissible limits as specified in IS

9.5 Course Aggregate

It shall consist of crushed or broken stone 95% which shall be retained on 4.75 Mm IS test Sieve. It shall be obtained from crushing Granite, Trap, Basalt or similar approved stones. Coarse aggregate shall be chemically inert when mixed with cement and shall be roughly cubical in shape and free from soft friable, thin, laminated or flaky pieces. Maximum percentage of deleterious materials shall not exceed those specified in IS 383-1970. The coarse aggregate used in the work shall conform to the grading as limits specified in IS: 383-1970. It shall be washed if so desired by the Employer or Architects. Aggregates shall be stored on platforms or otherwise so as to avoid inclusion of foreign materials. It shall be thoroughly wetted before being charged into the hopper of the concrete mixer.

9.6 Reinforcement

High Strength Deformed Bars Unless specified otherwise, high strength deformed bars shall conform to IS:1786-1985 of grade Fe 415 and obtained from approved manufacturer. Where mild steel bars are specified they shall conform to IS - 432 Part-I and shall be obtained from approved manufacturer. Contractor shall get steel reinforcement tested at his cost as and when required and directed by the Employer/Architects/Consultants.

9.7 Bricks

The bricks shall be locally available kiln burnt bricks of generally regular and uniform size, shape and colour, uniformly well burnt throughout but not overburnt. They shall be free

from cracks or other flaws. They shall show a fine grained, uniform, homogeneous and dense texture on fracture and be free from lumps of lime, laminations, cracks, air-holes, soluble salts causing efflorescence or other defects which may in any way impair their strength, durability, appearance, usefulness for the purpose intended. The size of brick shall be nominally 250 mm x 125 mm x 75 mm or 230 mm x 115 mm x 65 mm with a tolerance on dimension of $\pm 8\%$. After Immersion in water, absorption by weight shall not exceed 20 percent of the dry weight of the brick when tested according to I. S. 1077-1970. The bricks shall have minimum average compressive strengths as specified nomenclature of the items. The compressive strength of any individual brick on testing shall not fall below the average compressive strength by more than 20 (twenty percent). The rating of efflorescence of bricks shall not be more than 'Moderate'. The Bricks to be used for the work shall be approved by the representative of Employer/ Consultant beforehand.

9.8 **Water**

Water for mixing Cement/Lime mortar of concrete shall not be salty or brackish and shall be clean, reasonably clear and free from injurious quantities of deleterious materials. It shall not contain any sugar or excess of oils, acid and injurious alkali, salts, organic matter which will either weaken the mortar or concrete or cause efflorescence or attack the steel in reinforced cement concrete. Water shall be obtained from source approved by the representative of Employer/Consultant. Potable water is generally considered satisfactory for mixing and curing concrete, mortar, masonry etc. Water shall be tested once before undertaking the construction work in an approved testing laboratory to establish its suitability. All charges connected therewith shall be borne by the Contractor. The pH value of water shall generally be not less than 6.

The permissible values of NaOH, H₂SO₄ and other organic and inorganic solids should be as per IS:456 and tile tests should be in accordance with IS :3025.

9.9 **Timber**

Timber for carpentry/joinery works of all description shall be as specified as in schedule and seasoned, naturally or artificially as indicated therein. These shall be free from knot, shakes, fissures, flaws, sub-cracks and other defects to a reasonable extent. Representative of Employer/Consultant's decisions in this regard is final and binding. The moisture content for timber normally should not exceed the following limits :-

- I) Timber for frames 14%
- II) Timber for planking/ shutters etc. 12% Tolerance up to maximum 5% on above is permissible. In measuring cross-sectional dimensions of timber for the frames/shutters styles, rails or panel members, tolerance up to 1.5 mm shall be allowed for each planed surface.

9.10 **Steel Windows, Doors & Ventilators**

Steel windows and doors shall be fabricated out of approved steel sections. They shall be obtained from approved manufacturers. Unless otherwise stated the Indian Standard Specifications applicable for steel doors, Windows and ventilations shall be IS:1038. Wherever rolled steel sections are used the section should however conform to I.S. 226 and I.S.1977 latest addition, and steel should be of weldable quality.

9.11 **Ceramic Tiles**

White or colored ceramic glazed/unglazed tiles shall be obtained from approved manufacturer and shall be flat and true to shape. They shall be free from cracks, crazing, spots, chipped edges and corners. The glazing and colour shall be of uniform shade. Tolerance in dimension shall be ± 1.0 mm in sizes and ± 0.5 mm in thickness. The rear face shall be grooved and recessed in parts to provide the necessary key for mortar. They shall generally conform to I.S. 777.

9.12 **Kota/Cudappah Stone**

Slabs shall be of selected quality, hard, sound, dense and homogenous intexture, free from cracks, decay, weathering and flaws. They shall behand/machine cut to the specified thickness and of approved quality andsize shall be uniform in colour with straight edges. The tolerance in thicknessshall be ± 2 mm. Before starting the work, the contractor shall get the samplesapproved from Employer/Consultant.

9.13 Marble Slabs

Marble shall conform to the following characteristics :-Moisture absorption after 24 hours immersion: Max. 0.4% by weight tested as perl.S.1124.

Hardness : Min. 3 on Mhos scaler

Specific Gravity : Min. 2.5 tested as per I.S. 1122.

The thickness shall be as specified with a tolerance ± 2 mm.

9.14 Glazing

Glass used for glazing shall be sheet glass/float glass as specified, clear orobscured as directed by the Employer/Consultant of approved quality freefrom flaws, specks bubbles.

9.15 C. I. Rain Water Pipes

All C. I. pipes and fittings shall be of approved manufacturer free fromcracks, chipped edges or corners and other damages. The pipes shall be ISstamped and shall conform I.S. 3989.

9.16 Collapsible Gates

These shall be of approved manufacturer and fabricated from MS sectionsconsisting of vertical double channels each 18 x 9 x 3 mm at 100 mm c/sbraced with flat iron diagonals 18 x 5 mm and top and bottom rails of eitherT's or E's with minimum web of 40 x 12 mm and flange 40 x 6 mm. The rollerwheels shall be of grey iron castings and rivets shall be snap headed and notless than 6 mm dia.The gates shall be provided with necessary bolts and nuts, loadingarrangements, stoppers, handles etc. even if not specified.

9.17 Rolling Shutter

Rolling shutter shall be of approved manufacturer as described in theschedule of quantities and fabricated from M.S. laths in single pieces,machine rolled and straightened with an effective bridge depth and shallbe interlocked together throughout their entire length and joined at the endwith end locks. These shall be mounted on specially designed pipe shaft.The springs shall be preferably coiled type manufactured from high tensilespring steel wire or strip of adequate strength to balance shutter at allpositions. The spring pipe shaft shall be supported on MS brackets andcovered with MS sections as that of lath. The guide channels shall be of MSdeep channel pressed/rolled sections. The gap between legs should be justsufficient to allow free movement of shutter without making any rattlingsound. The guide channels shall be provided with minimum three fixingcleats or supports with as pacing not exceeding 750 mm for fixing towalls/columns etc. with bolts/screws.

9.18 Marble Mosaic Tiles

Tiles shall conform to IS:1237-1959. They shall be of sizes as specified withtolerances of (+/-) 1 mm in length and breadth. The tolerance on thicknessshall be 0, +3 mm & + 5 mm for 20 mm, 25 mm & 30 mm. tiles respectively. Thetiles shall be manufactured with hydraulic pressure of not less than 140kg/sq.cm.

9.19 Paints

Dry distemper, oil bound distemper, cement primer, oil paint, enamel paint,flat oil paint, plastic emulsion paint, anti-corrosive primer, red lead, yellowzinc chromate, water-proof cement paint shall be from an approvedmanufacturer as listed. Ready mixed paints

received from the manufacturer without any admixture shall be used, except for addition of thinner, if recommended by the manufacturer.

9.20 Cement Admixtures

Cement admixtures are to be obtained from approved manufacturer with the explicit approval of the representative of Employer/Consultant. The use of admixture containing Calcium Chloride, Fluorides, Nitrates and Sulphates is prohibited. The representative of Employer/Consultant's decision as regards use of admixtures is final and binding.

9.21 Hardware Fittings

The Hardware Fittings, Ferrous or Non-ferrous shall be obtained from approved manufacturer and IS stamped if available. The MS / Iron fitting are to be oxidized and Aluminum fittings anodized in natural colour mat satin finish, even though not specified in the schedule of quantities. The sample for fittings shall be submitted to the Employer/Architects for their approval.

9.22 Mortars

Cement mortar shall be of proportions specified for each type of work in the schedule. It shall be composed of cement and sand. The ingredients shall be accurately gauged by measure and shall be well and evenly mixed together, care being taken not to add more water than is required. No mortar that has begun to set shall be used. If hand mixing is done in lieu of mechanical mixture, then it shall be done on a pucca water-proof platform. The gauged materials shall be put on the platform and mixed dry. Water will then be added and the whole mixed again until it is homogeneous and of uniform colour. The contractor shall use 10% extra cement for hand mixing for which no extra payment will be made.

9.23 Aluminum doors & windows

Shall be obtained from approved manufacturer. All sections used shall be 'INDAL'. Thickness of anodic coating to aluminum members shall not be less than 15 micron.

9.24 Polysulphide Sealant

Polysulphide sealant if specified in the schedule of quantities should be obtained from approved manufacturers.

10.0 Codes

Wherever reference to codes is made, they shall mean the latest version of the particular IS Code under reference.

LIST OF MATERIALS OF APPROVED BRAND AND / OR MANUFACTURE

CEMENT	Grade 43 & 53 OP or Slag cement of ACC/STAR MODI/L&T/CENTURY/LAFARGE/AMBUJA/BIRLA./MAX
WHITE CEMENT	JK & BIRLA.
STEEL	TISCO, SAIL, RINL or any ISI approved manufacturer or Reroller authorised by TISCO/SAIL.
CERAMIC TILES	I) UNGLAZED : SPARTEX, KAJARIA PLUS, NITCO, Regency. II) GLAZED First Quality of . i) H & R Johnson II) Somany iii) Cera iv) Decora V) NITCO
WATERPROOFING COMPOUND :	ROFFE, PIDILITE, SIKA QUALCRETE,CICO OF APPROVODE GRADE.
RED OXIDE ZINC CHROMATE:	Shalimar, Asian Paints, Jenson andNicholson.
WATERPROOF CIMENT PAINT :	SNOECEM PLUS OR SIMILARAPPROVATE BRAND.
GLAZING	: Modifloat and Asahifloat.
SHEET GLASS:	Indo Ashal, Tribeni & Shreevallabh
SYNTHETIC ENAMEL PAINT :	DULUX (ICI), LUXOL (BERGER)
ACRYLIC DISTEMPER :	ICI, BERGER, JOHNSON&NICHOLKSON, ASIAN, BERGER
ACRYLIC DITEMPER :	ICI, BERGER, JOHNSON&NICHOLKSON, ASIAN BERGER.
FLUSH DOOR :	GREEN PLY, CENT URI, SYLVAN, FIDEN OR EQUIVALENT
HARDWARE FITTINGS: I)	FERROUS : MOWJEE AND EARLBIHARI OR EQUIVALENT
	ii) NON-FERROUS :EARL BIHARI, METACO & ARGENT OR EQUIVALENT ISI STAMPED PRODUCT.
COLLAPSIBLE GA TE & ROLLING SHUTTER	: ANY ISI APPROVED MANUFACTURER.
ALUMINIUM DOOR :	ANY ISI APPROVED MANUFACTURER
WATERPROOFING TREATMENT:	SIKA / PEDILITE / CHOKSHI OR EQUIVALENT
TILE FIXING ADHESIVE :	ROFFE & PIDILITE
HDPE PIPES:	EVEREST GIPS OR EQUIVALENT

SECTION – B

EARTHWORK

1.0 GENERAL

The excavation will generally refer to open excavation of foundation area wet or dry in all sorts of soils at any depth, unless otherwise specified except hard rocks for which separate provisions are made.

2.0 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.

3.0 SETTING OUT

The contractor shall clear the entire site by cutting/uprooting jungles, bushes, grass, vegetation growth and trees and generally level the site and set out the centre line of the Building or other involved works and get the same approved from representative of Employer/Consultant. It shall be the responsibility of the contractor to install substantial reference marks; benchmarks etc. and maintain them as long as required by the representative of Employer/Consultant. The contractor shall assume full responsibility for proper setting out, alignment, elevation and dimension of each and all part of the works.

4.0 GROUND LEVEL AND SITE LEVEL

Before starting the excavation the existing ground level of the entire plot shall be taken by the contractor in consultation with the representative of Employer/Consultant and a proper record of these levels kept, which shall be jointly signed by the contractor and the representative of Employer/Consultant.

5.0 EXCAVATION AND PREPARATION OF FOUNDATION FOR CONCRETE OTHER THAN HARD ROCK

Excavation shall include removal of all material of whatever nature including moored, soft rock, boulders, old foundations, concrete, asphalt or paved surfaces etc. at all depths and whether wet or dry necessary for the construction of foundation and sub-structure including mass excavation for underground reservoir, chess pits, septic tanks etc. where applicable, exactly in accordance with lines, levels, grades and curves shown in the drawings or as directed by the representative of Employer/Consultant. The bottoms of excavation shall be leveled both longitudinally and transversely or as directed by the representative of Employer/Consultant. Should the contractors excavate to a greater depth or width than shown on the drawings or as directed by the representative of Employer/Consultant, he shall at his own expenses fill the extra depth or width in cement concrete in proportion as directed by the representative of Employer/Consultant but in no case with concrete of thin linear than 1:5:10 cement concrete. The contractor shall report to the representative of Employer/Consultant when they are ready to receive concrete. No concrete shall be placed in foundations until the contractor has obtained representative of Employer/Consultant approval. In case excavation is done through different strata of soil and if the same is payable as per provision in the Schedule of Quantities the contractor shall set the dimensions or the strata decided by the representative of Employer/Consultant for payment. If no specific provisions is made in the schedule of quantities, it will be presumed that excavation shall be in all types of strata except hard rock and the contractor's rate shall cover for the same, which are treated as a single entity. After the excavation is passed by the representative of Employment/consultant and before having the concrete, the contractor shall get the depth and dimensions of excavations, levels, nature of strata

as applicable as per schedule of quantities and measurements recorded from the representative of Employer and Consultant.

5.1 Shoring

The sides of the excavations, if required, should be protected by shoring in such a way as is necessary to secure them 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 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. No extra payment will be made for shoring.

5.2 Protection

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

5.3 Stacking of Excavated Materials

All materials excavated will remain the property of the employer. The excavated materials at the first instance shall be sorted as directed by representative of Employer/Consultant and stacked appropriately by the sides of trenches as directed by the representative of Employer/Consultant before they are disposed off and leveled within the site at locations directed by the representative of Employer/Consultant. Materials suitable and useful for back filling, plinth filling or leveling of the plot or other use shall be stacked in convenient places in such a way so as not to obstruct free movement of men, animals and vehicles or encroach on the area required for constructional purposes. The cost on account of sorting out useful materials/disposal within the site and removal or spoils etc outside in conformity with Local Municipal Rules will not be additionally paid for.

5.4 Back Filling / Plinth Filling

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 the sides of excavation shall be refilled to the original surface with approved excavated materials in layers 15 cm in thickness watered and rammed with iron and wooden rammers weighing 7-8 kg. with a base of 20 cm square or 20 cm diameter. 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 space where it is temporarily stacked and used in refilling. When sand filling is done, it shall be consolidated by flooding with water. No excavation or foundations shall be filled in or covered up until all measurements at excavations, masonry concrete and other works below ground level jointly recorded. Black cotton soil shall not be used for back filling or in plinth filling.

5.5. Dewatering

Rate 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 bends or other means. Pumping out 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 set in foundation trenches or in tank excavations, pumping out water shall be from auxiliary pit of adequate size dug slightly outside the excavation. 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 from water:

During inspection and measurement. When concrete and/or masonry wall are in progress and till they come above the natural water level, and Till the representative of Employer/Consultant consider that the concrete mortar is sufficiently set.

5.6 Surplus Excavation Materials

All materials and spoils certified as surplus and not useful, shall be removed by the Contractor from the site in an approved manner at locations to be arranged by him in conformity with local regulations. The quantity to be disposed of shall be got pre-approved by Employer / Consultant.

The item of removal of surplus excavated materials shall only be undertaken by the Contractor only when specific instruction in this regard has been obtained from the representative of Employer/Consultant. The rate or the item will be mutually decided when such removal is advised.

6.0 Method of Measurement

6.1 Excavation

Excavation shall be measured in cum. As per drawing, the length and width being governed by the maximum dimensions of soling/bed concrete/structure concrete as in drawing and depth considered as the difference between average foundation level in a pit and average of preconstruction level there at. No extra measurements will be allowed for excavation for formwork, shoring, and working spaces or cut stability. No extra will be entertained for cost of dewatering and keeping trenches dry, protective shoring, if any needed. No increase in bulk after cutting will be entertained. No deduction will be made for volume of pile heads, tree trunks or other masonry structures nor any extra on account of above is payable.

6.2 Filling

Plinth filling shall be measured as net consolidated volume in cum as per drawing.'

SECTION – C**1.0 PLAIN AND REINFORCED CEMENT CONCRETE**

All concrete work shall be carried out by the contractor under the supervision of a concrete foreman sufficiently experienced in this type of work. Ingredients to be used in concrete and Reinforced concrete work:

Ingredients to be used in concrete should conform to the specifications as indicated under "Technical Specifications for Materials" given earlier. As regards admixture, this shall be used with prior approval of representative of Employer/Consultant.

1.1 Mix Proportion.

The mix proportions shall be selected to ensure that the workability of the fresh concrete is suitable for the conditions of handling and placing so that after compaction it surrounds all reinforcements and completely fills the formwork.

The determinations of the proportions of cement, aggregates and water to attain the required strength & workability shall be made as follows:

- a) By designing the concrete mix such concrete shall be called "Design Mix Concrete" and will be permitted for use when complete quality control is ensured through use of weigh-batches, equipped field laboratory, approved transportation method and skilled technician.
- b) By adopting nominal concrete mix, such concrete shall be called "Nominal Mix Concrete". The minimum cement content for nominal mix concrete shall be as under :

Grade of Concrete Cement/cum. of concrete (in kg)

M 20 400

M 15 317

1:3:6 235

1:4:8 180

1. 2 Design Mix Concrete:

The mix shall be designed to produce the grade of concrete having the required workability and a characteristic strength not less than values given in table A". The procedure given in Indian standard should be preferred for the design but other Standard methods may also be followed. As long as quality of material does not change a mix design done earlier may be considered adequate for later work.

When mix is designed, the records shall be maintained in the format annexed.

TABLE A-GRADES OF CONCRETE

GRADE OF CONCRETE	SPECIFIED CHARACTERISTIC COMPRESSIVE STRENGTH	
	AT 7 DAYS N/SQ.MM	AT 28 DAYS N/SQ.MM
M10	7.0	10
M15	10.0	15
M20	13.5	20
M25	17.0	25
M30	20.0	30
M35	23.5	35
M40	27.0	40

1.3 Nominal Mix CONCRETE

Nominal mix concrete may be used for concrete of grades M5, M7. 5, M10, M15 and M20. The proportion of materials for nominal mix concrete shall be in accordance with Table "B". However strength requirement is to be preestablished before resorting to mass work. The proportions of fine to coarse aggregates should be adjusted from upper limit to lower limit

progressively as the grading of the fine aggregate becomes finer and the maximum size of coarse aggregate becomes larger. Graded coarse aggregates shall be used.

The cement content in the mix specified 'B' for any nominal mix to be proportionately increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction, so that the water cement ratio is specified is not changed. In the case of vibrated concrete, the limit specified may be suitably reduced to avoid segregation. The quantity of water used in reinforced concrete work should be the quantity of water used in reinforced concrete work should be sufficient but not more than sufficient to produce dense concrete of adequate workability for its purpose which properly grip all the reinforcement. Workability of concrete should be controlled by maintaining a water content that is found to give a concrete which is sufficiently wet to be placed and compacted without difficulty with the means available.

TABLE B - PROPORTIONS FOR NOMINAL MIX CONCRETE.

Grade Of Concrete	Total quantity of dry Aggregate by mass Per 50 kgs of cement To be taken as the sum Of the individual Masses of fine and Coarse aggregate (maximum)	Proportion of Fine aggregate To coarse Aggregate	Quantity of Water per 50 Kgs of cement (maximum)
	KG	BY MASS	LITRE
M5	800	Generally 1:2	60
M7.5	625	But subjected	45
M10	480	To an upper	34
M15	350	Limit of 1:1 ½	32
M25	250	And a lower Limit of 1:2 ½	30
			2.0

2.0 PRODUCTION AND CONTROL OF CONCRETE

In proportioning Concrete the quantity of both Cement, Coarse/Fine Aggregate and water should be determined by weight in case of design mix or volume in case of nominal mix. Where weight of cement is determined on the basis of mass of cement per bag, a reasonable number of bags should be weighed periodically to check the net mass. Where the cement is weighed on the site and not in bags it should be weighed separately from the aggregates. Water should be either measured by volume in calibrated tanks or weighed. Any solid admixture that may be added may be measured by mass, liquid and paste admixture may be measured by volume or by mass. Batching plant when used should conform to IS: 4925. All measuring equipments should be maintained in a clean serviceable condition and their accuracy periodically checked. Except where it can be shown to the satisfaction of the representative of Employer/Consultant that supply of properly graded aggregate of uniform quality can be maintained over the period of work, the grading of aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in right proportions, as required, the different sizes being stacked in separate Stock-piles. The grading of coarse and fine aggregate should be checked as frequently as possible to ensure that the specified grading is being maintained. No change in proportions or substitutions in materials shall be made without additional tests to show that the quality and strength of concrete are satisfactory.

2.1 Mixing

Concrete shall be mixed in a standard mechanical mixer. The mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer the concrete should be remixed. The mixing time may be 1-1/2 to 2 minutes generally. In exceptional circumstances such as mechanical breakdown of mixer, work in remote areas or when the quantity of concrete work is very small, hand mixing may be permitted subject to adding 10% extra cement for which no extra payment will be made to the contractor. When hand mixing is permitted it shall be carried out on a watertight platform and concrete is uniform in colour and consistency. Workability of concrete should be controlled by direct measurement of water content and it should be checked at frequent intervals. For Nominal Mix workability measured by slump test may have values given in table "C".

TABLE - 'C'

Sl. No.	Type of work	When vibrated	When not vibrated
1.	Mass concrete in RCC foundation footings, retaining walls and pavement	2.5 cm (1")	5 cm (2")
2	Beams, slabs, columns With sample reinforcement	2.5 cms to 5 cms (1" to 2")	5 cms to 10 cms (2" to 4")
3.	Thin sections with congested reinforcement	5 cms to 10 cms (2" to 4")	10 cms to 15 cms (4" to 6")

Note: Should conditions governing slump and workability change pointing to advisability of an increased slump, this shall only be done by decreasing the amount of aggregate and not by increasing the amount of water.

2.2 Transportation

The method of transportation shall be got pre-approved from Consultant/Employer. Concrete shall be transported from the mixer to the formwork as rapidly as possible by methods, which will prevent segregation or loss of any of the ingredients and maintaining the required workability. In no case, more than 30 minutes shall elapse between mixing and consolidation in its position. During hot and cold weather, concrete shall be transported by deep containers. Other suitable methods to reduce the loss of water by evaporation in hot weather and heat loss in cold weather may also be adopted. For buildings with height more than 18.0 Meter, transportation of concrete by suitable and pre-approved mechanical devices is essential.

2.3 Placing

The concrete shall be deposited as neatly as practicable in its final position to avoid rehandling. The concrete shall be placed and compacted before setting commences and should not be subsequently disturbed. Methods of placing should be such as to preclude segregation. Care should be taken to avoid displacement of reinforcement or movement of form work. Concrete shall not be dropped into position from a height greater than 2.0 m

2.4 Compaction

Concrete should be thoroughly compacted and fully worked around the reinforcement, embedded fixtures and into corners of the formwork. Mechanical vibrators should generally be used. Over-vibration or vibration of very wet mixes is harmful and should be avoided. Under-vibration is also harmful.

Whenever vibration is to be applied externally the design of form work and the disposition of vibrators should receive special consideration to ensure efficient compaction and to avoid surface blemishes. Beams and columns shall be vibrated using immersion vibrators. Thin sections like walls of water tanks, chajjas, and aprons etc. should be vibrated preferably using surface vibrators. It is better to vibrate in smaller intervals for short period of time, rather than at wider intervals for longer periods of time. The vibrator shall be used only to aid compaction and not to push concrete laterally in the forms.

3.0 CONSTRUCTION JOINTS

Concreting shall be carried out continuously up to construction joints, the position and arrangement of which should be indicated by the designer. The locations of construction joints shall preferably be kept parallel to the principal reinforcements. Where it is unavoidable, and is at right angles to the principal reinforcement, it shall be kept at approx. 1/3rd to 1/4th of the span. All joints shall be vertically formed with proper wooden stop boards. When work is to be resumed on a surface, which has hardened, such surface shall be roughened. It shall then be swept clean and thoroughly wetted. For vertical joints neat cement slurry shall be applied on the surface before it is dry. For horizontal joints the surface shall be covered with a layer of mortar about 10 to 15 mm thick composed of cement and sand in the same ratio as the cement and sand in concrete mix. This layer of cement slurry or mortar shall be freshly mixed and applied immediately before placing of concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of particles of aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement slurry. On this surface, a layer of concrete not exceeding 150 mm in thickness shall first be well rammed against old work, particular attention being paid to close pots. Work therefore shall proceed in the normal way.

4.0 CURING

Unless otherwise specified all exposed surfaces of concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer or sacking canvas or similar materials and kept constantly well at least 7 days from the date of placing of concrete. Mere sprinkling of water on vertical surfaces shall not be allowed. The rate of RCC/plain concrete work shall include cost of curing. Approved curing compounds may be used at no additional cost to the owner in lieu of moist curing with the permission of the representative of Employer/Consultant. Such compounds shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set.

5.0 FACILITIES FOR PREPARATION AND TESTING OF CONCRETE AT SITE

In order to exercise the required degree of constant control over the concrete materials and its preparation the contractor is expected to set up and maintain at his own expense a Testing Laboratory at Site equipped with at least the following equipments :-

- i) Compression Testing machine of capacity 80t/100t;
- ii) A set of standard sieves;
- iii) Measuring cylinders, adequate number of cube and cylinder moulds and slumps cones;
- iv) Weighing balance,
- v) Vicat apparatus;
- vi) Curing tanks for Cubes.

5.1 Sampling, Testing and Acceptance of Concrete

Samples from fresh concrete shall be taken and cubes shall be made, cured and tested at 28 days in accordance with IS 516.

Tests shall be conducted for compressive strength on 15 cm x 15 cm x 15 cm Cubes of Concrete. Companion Specimens shall be cast from a single batch concrete and shall be of the same age at the time of testing. In order to get a relatively quicker idea of the quality of concrete, additional tests of compressive strength tests at 7 days shall be carried out in addition to 28 days compressive strength tests. In all cases, 28 days compressive strength specified in Table 'A' shall alone be the criterion for acceptance or rejection of the concrete.

5.2 **Frequency of Sampling**

The frequency of sampling shall be as indicated in the list of mandatory tests. Works test cubes shall represent quality of concrete incorporated in the work and taken out in sets of 6 cubes. The concrete for preparation of one set of 6 cubes shall be taken from one batch of mixed concrete discharged from. The cubes shall be moulded in accordance with IS Code of practice. Out of 6 cubes, 3 cubes shall be tested at an age of 7 days. In case of testing in an approved laboratory the contractor shall arrange to transport the cubes from site to the laboratory and forward the test results to the representative of Employer/Consultant. The contractor shall bear all expenses in connection with the preparation of test cubes, cost of concrete, labour and transportation charges to the approved laboratory etc. including laboratory testing charges and his rate for concrete item shall be quoted accordingly.

The Specimens shall be tested as per IS : 516. The samples may be tested at site laboratory generally but should be tested in any other Government Test House or approved laboratory whenever asked for by the representative of Employer/Consultant for which no additional payment shall be made. The work's concrete cubes shall be deemed to comply with the strength requirements if, the individual variation is not more than $\pm 15\%$ of the average test strength of three specimens. For mix design, however, acceptance criterion will be decided based on "Standard Deviation" as per IS : 456.

5.3 **Concreting under special condition**

The specifications and references given in IS: 456 for concrete in extreme weather condition should be adhered to.

6.0 **DEFECTIVE OR POOR CONCRETE : PROCEDURE FOR DEALING WITH**

Concrete, which does not meet the strength requirement, shall be dealt with as under at the discretion of the representative of Employer/Consultant: i) The structural adequacy of the parts affected shall be investigated and any consequential action as needed shall be taken. Costs of any such consequential action or any tests to be advised by the representative of Employer/Consultant are to be borne by the Contractor.

ii) If it is advised by the representative of Employer/ Engineer to retain the concrete having strength less than that specified payment shall be made at a reduced rate pro-rata to the strength obtained if not covered by Cl. (iii) below.

iii) If the deficiency in the opinion of the representative of Employer/Consultant is such as to necessitate removal of the concrete from the structure, then on being so directed by the representative of Employer/Consultant the Contractor at his own expense shall remove the portion of the concrete certified as deficient, and replace by concrete of specified strength at no additional cost.

A register shall be maintained at site by the Contractor with the following details entered and initialed by the Contractor and the representative of Employer/2. Consultant.2._

- i) Reference to specific structural members receiving the batch of concrete from which the cubes were cast.
- ii) Identification mark on cubes;
- iii) Mix of concrete;
- iv) Date and Time of casting,
- v) Crushing strength as obtained at the end of 28 days and days for each set.
- vi) Laboratory in which tested and certificates reference.

Concrete of each grade shall be assessed separately and shall be assessed daily for compliance. Concrete is liable to be rejected if it is porous or honeycombed, its placing has been interrupted without providing a proper construction joint, the reinforcement has been displaced beyond acceptable standard or construction tolerances have not been met. However the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the representative of Employer/Consultant.

7.0 FORM WORK

The form work shall conform to the shape, lines and dimensions as shown on the plans and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete and shall be sufficiently water tight to prevent loss of cement slurry from the concrete.

The allowable tolerances to formwork shall be as under:

i) Deviation from specified dimensions of cross-section of columns & beams	+/- 3 mm
ii) Plumb	1 in 1000 of height
iii) Levels	± 3 mm before any deflection has taken place.
iv) General setting out	+/- 3 mm up to 4 meters and
± 5 mm beyond 4 meters.	

Craft paper or polythene sheets shall be used by the Contractor to ensure water tightness without additional costs to the Employer. Form work or centering shall be constructed of steel or timber or shuttering ply and adequately designed to support the impact load of full load of weight concrete and labourers without detection and retain its form during laying and setting of concrete. Timber used shall be properly seasoned so as to prevent warping when wetted. A camber in all directions of 6 mm for every 5 meter span in all slab and beam centering shall be provided to allow for unavoidable sagging due to compression or other causes.

All props either timber or steel, shall be straight and of full height and no joints shall be allowed. Where timber props like bullies are used, they shall have a minimum diameter of 100 mm and shall be straight and adequately strong.

Props shall be braced with wooden battens and where additional staging is necessary extra care shall be taken to use bigger diameter props with bracing at 4 or 5 levels at no extra cost. All prop shall be supported on soleplates and double wedges. At the time of removing props, wedges shall be gently eased off and not knocked out.

All rubbish, chippings, shavings and saw dust shall be removed from the interior of the forms and shall be cleaned and thoroughly wetted or treated, if considered necessary, with any approved material before concrete is poured at contractor's own cost. Care shall be taken that for such approved material is kept out of contact with the requirement.

Form work shall be removed when the concrete has reached a strength of at least twice the stress to which the concrete may be subjected at the time of removal of formwork.

This shall be stripped without shock or vibration and shall be eased off carefully in order to allow the structure to take up its load gradually. Formwork shall not be disturbed until concrete has adequately hardened to take up the superimposed load.

In normal circumstances (generally where temperatures are above 20degree Centigrade and where ordinary Portland cement is used) forms shallbe struck after expiry of the following periods unless otherwise directed at siteby the representative of Employer/Consultant:

<u>Location</u>	<u>Striking time in days</u>
a) Vertical sides of walls, stabs, beams and columns	2
b) Bottoms of slabs upto 4 .5 m span	7
c) Bottom of slabs above 4.5 m span & 14 bottom of beams upto 6 m span	
d) Bottom of beams over 6 m span	21

8.0 REINFORCEMENT CLEANING, BENDING, PLACING ETC.

8.1 Cleaning of Reinforcement

Before steel reinforcement is placed In position, the surface of thereinforcement shall be cleaned of rust, dust, grease and any otherobjectionable substances.

8.2 Bar Bending schedule of reinforcement

On receipt of structural drawing, contractor shall prepare bar bendingschedule of reinforcement and shall get it approved by the representative ofEmployer/Consultant.

8.3 Cutting in Reinforcement

Before steel reinforcement bars are cut, the contractor shall study the lengthof bars required as per drawings and shall carry out to suit the sizes requiredas per drawings.

8.4 Placing and Security

Reinforcement bars shall be accurately placed and secured in position andfirmly supported or wedged by precast concrete blocks of suitable thickness,at sufficiently close intervals so that they will not sag between the supports orget displaced during the placing of concrete or any other operation of theworks. It is most important to maintain reinforcement in its correct positionwithout displacement and to maintain the correct specified cover. Thecontractor shall be responsible for all costs for rectification required in casethe bars are displaced out of their correct positions.

8.5 Binding Wire

The reinforcements shall be accurately tied wherever they cross each otheror whenever required for with 20 gauge black soft annealed steel wire. Thecost of materials and labour required for binding the reinforcement shall beincluded in the contractors quoted rate for reinforcement.

8.6 WELDING

Welding in lieu of splices may be carried out only after authorization in writingby the representative of Employer/Consultant. Welding shall be carried outas per relevant IS Code of Practice. However, no extra payment shall beallowed for the same.

8.7 BEND etc.

Bends, cranks, etc. in steel reinforcement shall be carefully formed, carebeing taken to keep bends out of winding. Otherwise all rods shall be trulystraight. For any bend minimum radius of eight times diameter of the bar shallbe used unless otherwise specified In the drawing. However, in respect ofstandard hooks the radius of bends shall be two times the diameter of bar.

Heating of reinforcement bars to facilitate bending will not be permitted. Thebars shall be always be bent cold. In case of mild steel reinforcement bars oflarger sizes where cold bending is not possible they may be bend by heatingwith written permission of the

representative of Employer/Consultant. Bars when bent shall not be heated beyond cherry red color 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.

8.8 Inspection of Reinforcement

No concreting shall be commenced until the representative of Employer/Consultant have inspected the reinforcement in position and until their approval have been obtained. The contractor for inspection of reinforcement shall give a notice of at least 72 hours to the representative of Employer/Consultant. If in the opinion of the representative of Employer/Consultant any material is 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 representative of Employer/Consultant to their entire satisfaction at his own cost.

8.9 Cover for Reinforcement

Cover shall be measured from the outer surface of main reinforcement. Cover shall be as follows :

- 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 beam 25 mm or the diameter of such rod or bar, whichever is greater,
- c) For tensile, compressive, shear or in other reinforcement in 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 diameter of such reinforcements, whichever is greater,
- e) For main reinforcement in isolated footing (side and bottom) clear cover shall be 50mm,
- f) For column bars clear cover shall be 40 mm, unless otherwise specified in drawings,
- g) For bars in slabs of strip footings and mat foundations clear cover shall be 50 mm. Slab bars shall be placed over beam bars, in the case of beam and slab type foundations.
- h) For any other types covers as specified in I.S. 456 shall be provided.

8.10 High Strength deformed Bars/Steel

High strength deformed bars manufactured by approved manufacturer conform to Fe 415 Gr. IS 1786-1985 shall be used in work.

9.0 PRE-CAST CONCRETE

All thin pre-cast RCC members shall be cast using ply board base and timbered side shuttering. Casting on floor over sand bed is not permitted. Reinforcement cage to proper size as per design or instruction shall be placed after pouring concrete for the cover portion, duly leveled. The top surfaces shall be finished smooth with additional cement in simultaneous operation. Deshuttering shall be done carefully and rendering with cement mortar shall be immediately carried out.

Pre-cast members shall be fixed in position only after 15 days curing.

10.0 METHOD OF MEASUREMENTS

10.1 Concrete

- a) Actual net volume of work as actually executed and accepted based on the drawing and authorized variation if any shall be measured in Cum unless stated otherwise. No deduction for reinforcements shall be made.

- b) Precast concrete work shall be measured in the same way as specified in the foregoing paragraph

10.2 Form Work and Centering

- a) Actual net area of form work in contact with concrete shall be measured in Sq m unless stated otherwise, small charmers or fillet (Each not exceeding 10 sq cm. in cross section) and voids not exceeding 200 sq cm each on the exposed surface shall be ignored as if those are non-existent.
- b) No separate payment shall be made for form work in case of precast units.
- c) The work and payment thereof includes stripping off after completion of the work.

10.3 Reinforcement

- a) Actually net measurements by weight of reinforcement as actually used in the permanent works and accepted shall be paid for. Authorized extra for laps, hooks, steel chairs, spacer bars for keeping reinforcements in position shall be measured and paid for. The weight of binding wire or any fixture, shall be excluded from the measurement. The weight of bars shall be as per IS Code taken up to three decimal places. No extra for wastage, unnecessary overlaps or rolling margin shall be paid for.
- b) Bar neither shown in drawings nor instructed by the representative of Employer/Consultant but required or constructional facilities shall not be measured.

SECTION –D

BRICK MASONRY

1.0 BRICK WORK

1.1 General

All brick work shall be carried out as shown on the drawings with setbacks, projections, curvatures, cuttings, footings etc. No additional cost for use of cut backs shall be allowed. Wherever the proportion of cement mortar has not been specifically mentioned, cement mortar in the proportion of 1:6 shall be used. Flat brick arches shall be provided wherever required without any extra cost. Brick work shall be kept wet while in progress, till mortar has properly set. Minimum curing period for work shall be 10 (ten) days. On holidays or when work is stopped, top of all unfinished masonry shall be kept wet. Should the mortar become dry, white or powdery, for want of curing, work shall be pulled down and rebuilt at the contractor's expense. All external brick work shall be done from outside by erecting rigid external scaffolds only.

2.0 BRICK MASONRY

2.1 Soaking

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

2.2 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.

2.3 Laying

Unless otherwise specified, the brick work shall be laid in English bond. The brick shall be laid in cement mortar to line, level and thoroughly bedded in mortar and all joints shall be properly flushed and packed with mortar and no hollows left anywhere. Brick 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 the course and the next below should not come over one another and shall not normally be nearer than quarter of a brick length. Fixtures, lugs, frames etc, if any, shall be built in at places shown in the plans while laying the course only and not later by removal of bricks already laid unless instructed by the representative of Employer/Consultant. Care shall be taken during construction to see that edges of bricks are not damaged.

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

2.4 Joints

Joints shall preferably not exceed 10 mm (about 3/8") in thickness,

2.5 Uniform raising

Brick work shall be carried up regularly. In all cases where the nature of work will admit, not leaving any part 60 cm lower than another. But where building at different levels necessary, the bricks shall be stopped so as to give later a uniform level and effective bond. Horizontal courses should be to line and level, and face plumb as shown on the plan.

The rate of laying masonry may be up to a height of 80 cm (about 32 inch) per day if cement mortar is used, and 45 cm (about 18 inch) if lime mortar is used.

2.6 Scaffolding

The scaffolding must be strong and rigid stiffened with necessary crossbearers and always decked and boarded on the sills with closeboarding's/ceilings to prevent injury to persons or damage of materials. The contractor shall have to allow other tradesmen engaged by the employer to make use of the scaffoldings at no addition cost. Rates for brickwork include all necessary costs and removal on completion of suitable scaffolding needed for the work. The contractor has to erect scaffolding arrangement for the same including licensing fees etc. shall be borne by the contractor and the employer is kept free from any liability on this account.

3.0 HALF BRICK WORK AND 75/65 MM THICK BRICK WORK

The mortar mix for half-brick and 75/65 mm brick work shall be as specified in the schedule of quantities. Half brick thick and brick on edges walls shall be provided with wire netting reinforcements. For half brick thick wall and brick on edge wall wire netting shall be provided at every third course and an alternate course respectively with wire netting 40 mm mesh made of 20 SWG soft G. I. iron wire, turned around the specified courses for continuity.

4.0 BRICK FLAT SOLING

For soling the bricks shall be picked slightly over burnt of approved brand, sound, hard, 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 at maximum consolidation.

All necessary timings or flitting for laying of the soling in line and required grade shall be done. The sub-grade shall be marked by stacks and strings to required depth for laying of soling. The cushioning as well as filling at joints shall be done with local sand. 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 bond pattern as directed by the representative of Employer/Consultant and firmly embedded true to line and filled with local sand.

5.0 MEASUREMENTS

The measurements shall be made Net as per drawing or actual, whichever is less. No deduction shall be made for ends of dissimilar materials up to 500 sq. cm in section.

SECTION-E

PLASTERING

1.0 SCAFFOLDING

Scaffolding for carrying out plastering work shall preferably be double scaffolding having two sets of vertical supports so that the scaffolding is independent of the walls.

1.1 Preparation of surface

All putlog holes in brickwork and junction between concrete and brickwork shall be properly filled in advance. Joints in brickwork shall be raked about 5mm deep and concrete surface hacked to provide the grip to the plaster. Projecting burns of mortar formed due to gaps at joints in shuttering shall be removed.

The surface shall be scrubbed clean with wire brush/coir brush to remove dirt, dust etc. and the surface thoroughly washed with clean water to remove efflorescence, grease and oil etc. and shall be kept thoroughly wet prior to application of plaster.

1.2 Ordinary Cement Plaster

The preparation of surface shall be as stated above. The thickness and proportion of plaster shall be as specified in the schedule of Items. 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 and neatly finished. Rounding of corners and junctions where required shall be done without extra charges. Plastering in narrow grooves or making designed grooves on plastered surfaces are not separately payable. The mortar shall adhere to the surface intimately when set and there should be no hollow sound when struck. The completed plastered surface shall be cured for a minimum period of 10 days.

2.0 NEERU FINISH

'Neeru' shall be made of pure fat lime conforming to appropriate class mentioned in IS: 712. The lime shall be slaked with fresh water and thereafter shifted and reduced to a thick paste by grinding in a mill.

'Neeru' thus prepared shall be kept moist until use and shall be utilized within 15 days after preparation.

A thin layer of 'Neeru' shall then be applied on the plastered surface while it is still green. 'Neeru' shall be rubbed into the surface by trowelling until an even and smooth finish is obtained. Any leveling work etc shall be carried out at the plastering stage itself and not while putting 'Neeru' finish.

The surface shall be kept moist for seven days following which a coat of white wash may be applied, if specified.

3.0 PLASTER OF PARIS

Surface of walls/ceiling where specified shall be treated with plaster of Paris calcium sulphate Hemihydrates materials. It shall have a fineness such that residue after sieving of dry materials for 5 minutes through IS. Sieve designation 3.75 mm. will not exceed 1% by weight & initial setting time shall not be less than 13 minutes. The particular brand of this special plaster and its composition must be previously approved by the Consultant/Employer.

The paste of material made with water shall be applied by means of English Trowel.

The entire surface must be very smooth on completion and unevenness must be removed. Special trained and skilled artisans with previous experience of this work will have to be employed for the purpose of achieving high grade finish. Before application of plaster of

paris, the surface to be treated shall be thoroughly cleaned, brushed and patching must be scraped properly and all holes, cracks and patches shall be made good with approved materials.

3.0 **METHOD OF MEASUREMENT**

Measurement shall be in sq. mt as per drawing or actual whichever is less. Half the area of opening shall be deducted for each face of wall plaster and jambs and soffits will not be separately paid for. Deduction for ends of dissimilar materials if less than 0.5 sq. mt. will not be made.

SECTION – F**FLOOR FINISHING****1.0 TERRAZZO (MARBLE CHIPS) FLOORING LAID IN SITU.****1.1 General**

The thickness of the under layer shall be measured with a permissible tolerance of ± 3 mm. The thickness of the top layer after polishing shall be measured with a tolerance of ± 1.5 mm.

1.2 Under Layer:

Cement concrete of specified mix shall be used. The panels shall be of sizes as directed by representative of Employer/Consultant and generally not exceeding 2 sq. mt. in area and 2 Mt in length for inside situations. In exposed situations the length of any side of the panel shall preferably be not more than 1.25 Meters or as directed. Cement slurry @ 2.00 kg. per sq. mt. shall be applied before laying of under layer over the cement concrete / R C. C. surface which will not be separately paid for.

1.3 Strip Fixing

Glass strips or aluminum strips as given in the schedule shall be fixed with their top at proper level.

1.4 Top layer

Mortar: The mix for terrazzo topping shall consist of cement with or without pigment, marble powder, marble aggregate (marble chips) and water. The cement and marble powder shall be mixed in the proportion of 3 parts of cement to one part marble powder by weight. For every part of cement marble powder mix, the proportion of aggregate by volume shall be as follows.

Size of Aggregate	Proportions of Aggregates to binder mix
For predominantly grade 00,0 and 1	1.50 parts
For predominantly grade 2 and 2	1.25 parts
For predominantly grade 4 and 5	1.25 parts

Grade No.	Size of Aggregate in (MM)	Minimum thickness of top layer in (MM)
00	1-2	6
0	2-4	9
1	4-7	9
2	7-10	12

Where aggregate of size larger than 10 mm are used the minimum thickness of topping shall not be less than 1.5 times the maximum size of the chips. Where large size chips such as 20 mm or 25 mm are used they shall be used only with a flat shape and bedded on the flat face so as to keep the maximum thickness of wearing layer. Before starting the work, the Contractor shall get the sample of marble chips approved by the representative

of Employer/Consultant. The cement to be used shall be ordinary grey cement, white cement, colored cement or cement with admixture of coloring matter of approved quality in the ratio specified in the description of the Item or in the ratio to get the required shade as ordered by the representative of Employer/Consultant. Coloring matter where specified, shall be mixed dry thoroughly with the cement and marble powder and then chips added and mixed as specified above. The full quantity of dry mixture of mortar required for a room shall be prepared in a lot in order to ensure a uniform colour. This mixture shall be stored in a dry place and well covered and protected from moisture. The dry mortar shall be mixed with water in the usual way as and when required. The mixed mortar shall be homogeneous and stiff and contain just sufficient water to make it workable.

The terrazzo topping shall be laid while the under layer is still plastic but has hardened sufficiently to prevent cement from rising to the surface. This is normally achieved between 18 to 24 hours after the under layer has been laid. A cement slurry preferably of the same color as the topping shall be brushed on the surface immediately before laying is commenced. It shall be laid to a uniform thickness slightly more than that specified in order to get the specified finished thickness after rubbing. The surface of the top layer shall be troweled over, pressed and brought true to required level by a straight edge and steel floats in such a manner that the maximum amount of marble chips come up and are spread uniformly over the surface.

1.5 **Polishing, Curing and Finishing**

Polishing shall be done by machine. About 36 hours after laying the top layer, the surface shall be watered and ground evenly with machine fitted with special rapid cutting grit blocks (carborundum stone) of coarse grade (No. 60) till the marble chips are evenly exposed and the floor is smooth. After the first grinding, the surface shall be thoroughly washed to remove all grinding mud and covered with a grout of cement or/and coloring matter in same mix and proportion as the topping in order to fill any pin holes that appear. The surface shall be allowed to cure for 5 to 7 days and then ground with machine fitted with fine grit blocks (No. 120). The surface is cleaned and repaired as before and allowed to cure again for 3 to 5 days. Finally the third grinding shall be done with machine fitted with fine grade grit blocks (No. 320) to get even and smooth surface without pin holes. The finished surface should show the marble chips evenly exposed.

Where use of machine for polishing is not feasible or possible, rubbing and polishing shall be done by hand, in the same manner as specified for machine polishing except that carborundum stone of coarse grade (No. 60) shall be used for the 1st rubbing, stone of medium grade (No. 80) for second rubbing and stone of fine grade (No. 120) for final rubbing and polishing.

After the final polish either by machine or by hand, oxalic acid shall be dusted over the surface @ 33 gm per square meter sprinkled with water and rubbed hard with a namdah block (Pad of woolen rags). The following day, the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean. Curing shall be done by suitable means such as laying moist, sawdust or ponding water. The finished floor shall not sound hollow when lapped with a wooden mallet.

1.6 **Precautions :**

Flooring in lavatories and bathrooms shall be laid after fixing of squatting pans and floor traps. Traps shall be plugged, while laying the floors and opened after the floors are cured and cleaned. Any damage done to W.C.'s squatting pans and floor traps during the execution of work shall be made good by the Contractor. During cold weather, concreting shall not be done when the temperature falls below 4 degree centigrade. The concrete placed shall be protected against frost by suitable coverings. Concrete damaged by frost shall be removed and work redone. During hot weather, precautions shall be taken to see that the temperature of wet concrete does not exceed 38 degree centigrade. No concreting

shall be laid within half an hour of the closing time of the day unless permitted by the representative of Employer/Consultant.

The floor shall be protected from any damage during the execution of work.

2.0 TERRAZZO (MARBLE CHIPS) SKIRTING-IN-SITU

2.1 Thickness:

The thickness of the bottom and top coats shall be as specified. The total thickness of skirting specified is of the total thickness of plaster as measured from the unplastered face of the masonry. Average thickness of the undercoat shall not be less than 6 mm and minimum thickness over any portion of the surface shall not be less than 4 mm. A tolerance of 1.5 mm is applicable over the finished specified top coat.

3.0 GLAZED / UNGLAZED CERAMIC TILE FLOORING:

3.1 Preparation of Surface and Laying

Sub-grade concrete or the RCC slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The bedding for the tile shall be either with cement mortar 1:3 (1 cement: 3 coarse sand) or approved cement based ready to use mortar on cement plastered (1:3) surface as specified. The average thickness of the bedding for cement mortar shall be 10 mm while the thickness under portion of the tiles shall not be less than 5 mm. Mortar shall be spread, tamped and corrected to proper levels and allowed to harden sufficiently to offer a rigid cushion for the tiles to be set and to enable the mason to place wooden plank across and squat on it. Over this mortar bedding neat grey cement slurry of honey like consistency shall be spread @ 3.3 Kg of cement per square meter over such an area as would accommodate about twenty tiles. Tiles shall be soaked in water, washed clean and shall be fixed in this grout one after another, each tile gently being tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern.

The surface of the flooring during laying shall be frequently checked with a straight edge about 2 m long so as to obtain a true surface with the required slope.

Where full size tiles cannot be fixed these shall be cut to the required sizes and their edges rubbed smooth to ensure straight and true joints.

Tiles, which are fixed in the floor adjoining the wall, shall enter not less than 10 mm under plaster, skirting or dado.

After tiles have been laid surplus cement grout shall be cleaned off.

3.2 Pointing and Finishing :

The grey cement grouts in joints shall be cleaned off with wire brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigment if required to match the colour of tiles. The floor shall then be kept wet for 7 days. After curing, the surface shall be washed and finished clean. The finished floor shall not sound hollow when tapped with a wooden.

4.0 CERAMIC TILES IN SKIRTING AND DADO

4.1 Laying

Tiles shall be laid either on 12 mm thick plaster of cement mortar 1:3 (1 cement : 3 coarse sand) or mix as specified shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonally closed intervals. The plaster thickness shall be reduced, as directed only for a leveling course, when ready to use approved cement based mortar is used. The tiles should be soaked in water, washed clean and a coat of cement slurry or ready to use cement based mortar as the case may be applied liberally at the back of tiles and set in the bedding mortar. Approved epoxy adhesives, if specified in the bill of quantities shall be used in lieu of cement slurry as per manufacturer. The tiles shall be tamped and corrected to proper plane and lines. The

tiles shall be set in the required pattern and buttjointed. The joints shall be as fine as possible. Top of skirting of dado shall be truly horizontal except where otherwise indicated. Full size tiles cannot be fixed, these shall be cut (sawn) to the required size and their edges rubbed smooth.

4.2 **Curing and Finishing:**

The joints shall be cleaned off the grey cement grout with wire brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement added with pigments if required to match the color of tiles. The surface shall then be kept wet for 7 days.

After curing, the surface shall be washed and finished clean. The finished work shall not sound hollow when tapped with a wooden mallet.

5.0 **KOTA / CUDDAPAH STONE FLOORING**

5.1 **Dressing:**

Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be true rubbed with coarse sand or machine rubbed before paving. All angles and edges of the tiles shall be true, square and free from chippings and the surface shall be true and plane.

5.2 **Preparation of Surface and Laying :**

The sub-grade concrete or the RCC slab on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be with cement mortar 1:4 (1 cement : 4 coarse sand) or with lime mortar (1 lime putty: 1 surkhi : 1 coarse sand) as given in the description of the item except that the edges of the slabs to be jointed shall be buttered with grey cement, with admixture of pigment to match the shade of the slab.

5.3 **Polishing and Finishing:**

The day after the slabs are laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey or white cement mixed with or without pigment to match the shade of the stone slabs. The flooring, thus laid, shall be ground evenly with machine as specified in Para 3.2, except that (a) first polishing with coarse grade carborundum stone shall not be done, (b) cement slurry with or without pigment shall not be applied on the surface before polishing.

6.0 **KOTA / CUDDAPAH STONE IN SKIRTING, DADO, RISERS, STEPS ETC.**

6.1 **Preparation of Surface:**

Shall be as specified in case of Glazed tiles and Dado.

6.2 **Laying:**

The stone slab for risers of steps and skirting/dado shall be set in grey or white cement admixed with or without pigment to match the shade of the stone as specified in the description of the item, with the line of the slab at such a distance from the wall so that the average width of the gap shall be 20 mm and at no place the width shall be less than 15 mm. If necessary, fixed in the wall at suitable intervals. The skirting/dado or riser face shall be checked for plane and plumb and corrected. The joints shall thus be left to harden then the rear of the skirting or riser slab shall be packed with cement mortar 1:3 (1 cement: 3 coarse sand) or other mix as specified in the description of the item. The fixing hooks shall be removed after the mortar filling the gap has acquired sufficient strength.

6.3 **Curing, Polishing and Finishing:**

It shall be as specified in Para 5.3 as applicable, except that cement slurry with or without pigment shall not be applied on the surface and polishing shall be done only with hand. The face and top skirting shall be polished.

7.0 ARTIFICIAL STONE FLOORING

Selection of materials, method of mixing placing and compacting shall generally conform to the specifications under plain and reinforced cement concrete described earlier. A stiff mix consistent with workability shall be used.

7.1 Preparation of surface:

Before the operation for laying topping is started the surface of base concrete shall be thoroughly cleaned of all dirt, loose particles, caked mortar, droppings and laitance, if any by scrubbing with coir or steel wire brush. Where the concrete has hardened so much that roughening of surface by wire brush is not possible, the surface shall be roughened by chipping or hacking at close intervals. The surface shall then be cleaned with water and kept for 12 hours and surplus water shall be removed by mopping before the topping is laid.

7.2 STRIP FIXING

Where mentioned glass strips or Aluminum strips as given in the schedule shall be fixed with their top at proper level.

7.3 LAYING

The screed strips shall be fixed over the base concrete dividing it into panels. The panels shall be uniform size and no dimension of a panel shall exceed 2m and the area of a panel shall not be more than 2 sq. m. Before placing the concrete for topping, neat cement slurry shall be thoroughly brushed into the prepared surface of the base concrete just ahead of the finish. Concrete of specified proportion and thickness shall be laid in alternate panels to required level and shape and thoroughly tamped.

7.4 Finishing the surface

After the concrete has been fully compacted it shall be finished by troweling or floating with mixed cement rendering. Finishing operations shall start shortly after the compaction of concrete and the surface shall be troweled three times at intervals so as to produce a uniform and hard surface. The satisfactory resistance of floor to wear depends largely upon the care with which trowelling is carried out. The time interval allowed between successive trowelling is very important. Immediately after placing cement rendering, only just sufficient trowelling shall be done to give a level surface. Excessive trowelling in the earlier stages shall be avoided as this tends to bring a layer rich in cement to the surface. Some time, after the first trowelling the duration depending upon the temperature, atmospheric condition and the rate of set of cement used, the surface shall be re-trowelled to close any pores in the surface and to bring the surface to a true level and to scrap off the excess water in concrete. No dry cement shall be used directly on the surface to absorb moisture or to stiffen the mix. The final trowelling shall be done well before the concrete has become too hard but at such a time that considerable pressure is required to make any impression on the surface. If directed by the representative of Employer/Consultant, approved mineral pigment shall be added to the rendering to give desired color and shape, to the flooring at no extra cost. The finished floor shall not sound hollow when tamped with a wooden mallet.

8.0 CHEQUERED TILES:

The tiles of approved color shall be of normal size as 20 x 20 cm, 25 x 25 cm and 30 x 30 cm or of standard sizes with equal sides. The size of tiles to be used shall be as shown in drawings or as required by the representative of Employer/Consultant. The centre to centre distance of chequers shall not be less than 2.5 cm and not more than 5 cm. The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not be less than

3 mm. The chequered tiles shall be cement tiles, or terrazzo tiles as specified in the description of the item. The thickness of the upper layer measured from the top of the chequers shall not be less than 6 mm. The tiles shall be given the first grinding with machine before delivery to site. The tiles shall be manufactured under hydraulic pressure of not less than 140kg per square centimeter and shall be given the first grinding with machine before delivery to site.

All exposed joints shall be pointed using mortars/water proof adhesives, as specified with admixture of pigment, duly approved by representative of Employer/Consultant to match the shade of marble. Green work shall be protected from rains/adverse weather conditions by suitably covering the same. The work shall be kept constantly moist for a period of 7 days.

The entire work shall be cleaned by acid polishing on completion of work. The proportion of cement to aggregate in the backing of the tiles shall not be leaner than 1:3 by weight. Similarly, the proportion of cement to marble chips aggregate in the wearing layer of the tiles and the proportion of pigment to be used therein shall not exceed 10 per cent of weight of cement used in mix.

8.1 Laying and Curing

Laying and curing shall be as specified for terrazzo tiles.

9.0 CRAZY MARBLE FLOORING

Crazy marble flooring shall be laid on cement concrete sub-grade. The surface of the sub-grade shall be hacked roughened with steel wire brushes, washed clean & scared with a floating coat of cement slurry @ 2 Kg/Sq Cm to provide bond between sub-grade and flooring.

The under layer of specified thickness and mix shall then be laid over it.

After spreading cement slurry mix @ 2 Kg/Sq. Mt. over the under layer marble stone picks of approved size shape and color free from strains, crack decay etc. shall be laid piece by piece in the manner advised in such a way that the top surfaces of all stone pieces are true to the required level. After fixing of stone pieces, the gap is filled up with the mix of binder Marble chips (4:7) by volume, the binder being a mix of cement (with or without pigment) : marble dust (3:1) by weight. The filled surface shall be troweled, pressed so as to bring it to the level of stone pieces. Polishing, curing and finishing shall be done as done for in-situ terrazzo flooring and specified elsewhere.

10) METHOD OF MEASUREMENTS

Flooring work shall be measured net as per drawing or actual, whichever is less. Measurements for flooring shall be up to the wall (before plaster) and that for skirting shall be from above the floor finish. Net laid area shall be measured in square meters correct to two decimal places.

11.0 TERRAZO TILE/MOSAIC TILE FLOORING

11.1 TERRAZO TILES

Terrazzo tile shall be of best quality of approved manufacturer and generally conform to IS : 1237 latest publication.

The specific sizes of tiles to be used shall be as shown in the drawings or as approved.

11.1.2 TOLERANCE

Tolerance on length and breadth shall be plus or minus one millimeter; tolerance on thickness shall be plus 5 mm. The range of dimensions in any one delivery of tiles shall not exceed 1 mm on length and breadth and 3 mm on thickness.

11.1.3 The tiles shall be manufactured under hydraulic pressure of not less than 140kg. per Square Centimeter and shall be given the first grinding with machine before delivery to site.

11.1.4 The proportion of cement to aggregate in the backing of the tiles shall not be leaner than 1:3 by weight. Similarly the proportion of cement to marble chips aggregate in the wearing layer of the tiles and the proportion of pigment to be used therein shall not exceed 10 per cent of weight of cement used in mix.

11.1.5 The finished thickness of the upper layers shall not be less than 5 mm for size of Marble chips from the smallest up to 6 mm and also, not less than 5 mm for size of Marble chips ranging from the smallest up to 12 mm and not less than 6 mm for sizes of marble chips varying from the smallest up to 20 mm.

11.1.6 LAYING

Sub grade concrete or the R.C.C slab on which the tiles are to be laid shall be cleaned, wetted and mopped. The average thickness of the bedding mortar shall be 20 mm and the thickness at any place shall not be less than 10 mm.

11.1.7 The surface of the flooring during laying shall be frequently checked with a straight edge at least 2 meter long, so as to obtain a true surface with the required slope.

11.1.8 Where full size tiles cannot be fixed, these shall be cut (sawn) to the required size and their edges rubbed smooth to ensure a straight and true joint.

11.1.9 Tiles which are fixed in the floor adjoining the wall shall enter not less than 12mm under the plaster, skirting or dado. The junction between wall plaster and tile work shall be finished neatly and without waviness.

11.1.10 After the tiles have been laid, surplus cement grout that may have come out of the joint shall be cleaned off.

11.2 Curing, Polishing and Finishing:

11.2.1 The day after the tiles are laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey or white cement mixed with or without pigment to match the shade of the topping of the wearing layer of the tiles. The same cement slurry shall be applied to the entire surface of the tiles in a thin coat with a view to protect the surface from abrasive damage and fill the pinholes that may exist on the surface.

11.2.2 The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be ground evenly with machine fitted with coarse grade grit Blocks (No 60). Water shall be used profusely during grinding. After grinding the surface shall be thoroughly washed to remove all grinding mud, cleaned and mopped. It shall then be covered with a thin coat of grey or white cement, fixed with or without pigment to match the color of the topping of the wearing surface in order to fill any pin hole that appears. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit blocks (No. 120).

11.2.3 The final grinding with machine fitted with the finest grade grit blocks (No. 320) shall be carried out the day after the second grinding described in the preceding Para or before handing over the floor, as ordered. For hand polishing the following carborundum stones, shall be used: 1st grinding--coarse grade stone (No. 60). Second grinding--medium grade (No. 80).

Final grinding-fine grade (No 120). In all other respects, the process shall be similar as for machine polishing.

11.2.4 After the final polish, oxalic acid shall be dusted over the surface at the rate of 33 gm per square meter sprinkled with water and rubbed hard with a 'namdah' block (pad of woolen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

11.2.5 If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished. The finished floor shall not sound hollow when tapped with a wooden mallet.

11.2.6 Measurements:

Terrazzo tile flooring shall be measured as laid in square meter correct to two places of decimal. For length and breadth dimensions correct to a cm before laying skirting, dado or wall plaster shall be taken. No deduction shall be made nor extra paid for any opening in the floor of area up to 0.1 square meter (10 cm²). Nothing extra shall be paid for use of cut tiles nor for laying the floor.

11.2.7. Terrazzo tile flooring laid in floor borders and similar band shall be measured under the item of terrazzo tile flooring. No extra shall be paid in respect of similar bands formed of half sizes or multiples of half size standard tiles or other uncut tiles. Skirting & dado paved with tiles shall be measured as follows:

The thickness of the skirting shall be as stated in the schedule of quantity. Length shall be measured along the finished face of riser, skirting or dado correct to a cm. Height shall be measured from the finished level of tread or floor to the top (the underside at tread in the case of steps). This shall be measured correct to 3 mm in case of riser skirting and dado. The area shall be calculated in square meter, correct to two places or decimal.

11.2.8. Rate

The rate shall include the cost of all materials and labor involved in all the operations described above.

12.0 MARBLE STONE FLOORING

12.1 Marble:

Marble shall be hard, sound dense and homogeneous in texture with crystalline texture. It shall be uniform in color and free from stains, crack, decay and weathering.

12.1.1. Dressing of Slabs:

Every stone shall be cut to the required size and shape, fine chisel dressed on all sides to the full depth so that a straight edge laid along the side of the stone shall be fully in contact with it. The top surface shall also be fine chisel dressed to remove all waviness. The sides and top surface of slabs shall be machined rubbed or table rubbed with coarse sand before paving. All angles and edges of the marble slabs shall be true, square and free from chippings and the surface shall be true and plain.

The thickness of the slabs shall be 20, 30 or 40 mm as specified in the description of the item. Tolerance of ± 2 mm shall be allowed for the thickness. In respect of length and breadth of slabs a tolerance of 5 mm shall be allowed.

12.1.2 Laying:

12.1.3 Sub-grade concrete or the R.C.C. slab on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding of the slabs shall be with cement mortar 1:4 (1 cement : 4 coarse sand) or as given in the description of the item.

12.1.4 The average thickness of the bedding mortar under the slab shall be 20 mm and the thickness at any place under the slab not be less than 12 mm.

12.1.5 The slab shall be laid in the following manner :-

Mortar of the specified mix shall be spread under tile area of each slab, roughly to the average thickness specified in the item. The slab shall be washed clean before laying. It shall be laid on top, pressed and tapped with wooden mallet and brought it to level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the mortar shall then be corrected by adding fresh mortar at hollows. The mortar is allowed to harden a bit and cement slurry of honey like consistency shall be spread over the same at the rate of 4.4 kg. of cement per sq.mt. The edges of the slab already paved shall be buttered with grey or white cement with or without admixture of pigment to match the shade of the marble slabs as given in the description of the item. The slab to be paved shall then be lowered gently back in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slab with as fine a joint as possible. Subsequent slabs shall be laid in the same manner. After each slab has been laid, surplus cement on the surface of the slabs shall be cleaned off. The flooring shall be cured for a minimum period of seven days. The surface of the flooring as laid shall be true to levels and slopes as instructed.

12.1.6 The slabs shall be matched as shown in drawings or as instructed by the Consultant Employer.

12.1.7 Slabs which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the plaster skirting or dado. The junction between wall plaster and floor shall be finished neatly and without waviness.

12.1.8 **Polishing and Finishing ;**

Slight unevenness at the meeting edges of slabs shall then be removed by the chiseling finished in the same manner as specified in 11.2 of Terrazzo Mosaic flooring except that cement slurry with or without pigments shall not be applied on the surface before each polishing.

12.1.9 **Measurements**

Marble stone flooring with different kind of marble shall be measured separately and in square meter correct to two places of decimal. Length and breadth shall be measured between the finished faces of skirting, dado or wall plaster as the case may be, correct to a cm. No deduction shall be made nor extras paid for any opening in the floor of area up to 0.05 sq m (5 dm²). No extra shall be paid for laying the floor at different levels. Steps and treads of stairs paved with marble stone slabs shall also be measured under the item of "Marble stone flooring". The width of treads in all cases shall be measured from the outer line to the finished face of riser.

12.1.10 **Rate:**

The rate shall include the cost of all materials and labor involved in all the operation described above.

12.2 Marbles stone in Risers of steps, Dado and Skirting

12.2.1 Marble stone slabs and dressing of slabs shall be as specified in 12.1.1 except that the thickness of slabs shall be as specified in the schedule quantities. A tolerance of +/- 2 mm shall be allowed unless otherwise specified in the description of the item.

12.2.2 **Preparation of Surface :**

The joints shall be raked out to a depth of at least 15 mm in masonry walls, while the masonry is being laid. In case of concrete walls, the surfaces shall be hauled and roughened with wire brushes. The surface shall be cleaned thoroughly, washed with water and kept wet before skirting risers of steps, dado and skirting is commenced. Where necessary, the wall surface shall be cut uniformly to the requisite depth so that the face shall have the projection from the finished face of wall as shown in drawings or as required by the Employer/Consultant.

12.2. 3. LAYING:

The risers of steps, dado and skirting shall be set in grey or white cement admixed with or without pigment to match the shade of the stone, specified in the description of the item with the line of the slab at such a distance from the wall that the average width of the gap shall be 12 mm and at no place the width shall be less than 10 mm. If necessary, the slabs shall be held in position by temporary M. S. hooks fixed into the wall at suitable intervals. The skirting or riser face shall be checked for plane and plumb and connected. The Joints shall thus be left to harden then the rate of the skirting or riser face shall be packed with cement mortar 1 : 3 (1 cement: 3 coarse sand) of other mix as specified in the description of the item. The fixing hooks shall be removed after the mortar filling the gap has acquired sufficient strength.

The Joints shall be as fine as possible. The top line of skirting and risers shall be truly horizontal and Joints truly vertical, except where otherwise indicated.

The risers, dado and skirting slab shall be matched as shown in drawings or as instructed by the Consultant/Employer.

12.2. 4. Curing, Polishing And Finishing:

It shall be as specified in 11.2 of terrazzo mosaic flooring as far as applicable except that cement slurry with or without pigment shall not be applied on the surface and polishing shall be done only with hand. The face and top shall be polished.

12.2.5 Measurements

Lengths shall be measured along the finished face of riser or skirting, correct to a cm. Height shall be measured from the finished level of tread or floor, to the top (the underside of tread, in the case of steps) correct to 1 mm. The area shall be calculated in square meter correct to two places of decimal.

12.2..6 Rate:

The rate shall include the cost of all materials and labour involved in all the operations described above.

13.0 MARBLE | DHOLPUR STONE | GRANITE SLAB IN SURFACE VENEERING WORK IN WALL LINING.

13.1 Marble work shall be paid by under veneer work.

13.1.1 Dressing:

Dressing shall be same as specified in 12.1.1 except that the back shall not be dressed, but left rough cut, in order to ensure a good grip with the hearting or backing. The dressed slabs shall be of the thickness as specified with a tolerance of ± 2 mm. The tolerance in wall lining when a straight edge of 3 m length is placed should not exceed more than 2mm.

13.1.2. Laying And Fixing :

The slab shall be sufficiently wetted before laying to prevent absorption of water from mortar. Sub-grade concrete or the RCC slab on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be as specified in the schedule of quantities. Care shall be taken to match the grains of veneer work as directed by the Consultant/Employer. For purpose of matching, the grains of the marble slabs shall be selected judiciously having uniform pattern of veins/streaks. Preferably, the slabs shall be those got out of the same block from the quarry. The area to be veneered shall be reproduced on the ground and the marble slabs laid in position and arranged in the manner to give the desired matching of grains. Any adjustment needed for achieving the best results shall be then carried out by replacing or interchanging the particular slabs. Special care shall be taken to achieve the continuity of grains between the two slabs one above the other along the horizontal joints. This shall then be got approved from the Consultant/Employer and each marble slab numbered properly and the same number

shall be marked on a separate drawing as well as on the surface to be actually veneered, so as to ensure the fixing of the particular slab on the correct location. In case of marble slabs, granite slabs, dhoolpur stone adjoining pieces shall be secured to each other by means of 75 mm long 6 mm dia brass pins. The slabs shall also be secured to the backing masonry or concrete surface by means of 25 mm x 6 mm size brass cramps of suitable length. Pins and cramps shall be got approved before use. They shall be fixed using cement mortar. For the facing of the columns also the same procedure as mentioned above shall be followed.

13.1.3 Joints:

All joints shall be full of mortar. Special case shall be taken to see that groundings for veneer work are full of mortar. If any hollow groundings are detected by tapping the face stones, these shall be taken out and re-laid. The thickness of the face joints shall be uniform, straight and as fine as possible not more than 1.5 mm and in the face joint the top 6 mm depth shall be filled with mortar specified for the pointing.

13.1.4 Mortar;

The mortar used for jointing shall be as specified in the bill of quantities.

13.1.5 Curing: - The work shall be kept constantly moist on all faces for a period of at least 7 days.

13.1.6 Finishing :- After the marble work is cured, it shall be rubbed with carborandum stone of different grades, No 60, 120 and 320 in succession, so as to give a plane true and highly smooth surface. It shall then be cleaned with a solution of oxalic acid washed and finished clean.

13.1.7 Protection :- Green work shall be protected from rain by suitable coverings. The work shall also be suitably protected from damage during construction.

13.1.8: Scaffolding :- Double scaffolding having two sets of vertical supports shall be provided, where necessary. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed.

13.1.9 Tolerances:

13.1.10 Slabs:

- (a) Length $\pm$ 2 percent
- (b) width
- (c) Thickness $\pm$ 3 percent

13.1.11 Measurements:

The length and breadth shall be measured correct to a cm. The area shall be calculated in square meter nearest to two places of decimal.

13.1.12 Rate:

The rate includes the cost of material and labor required for all the operations described above, except for the cost of providing and fixing brass pins etc. which shall be paid for separately, as stipulated in the item of work.

14.0 CEMENT CONCRETE FLOORING WITH METALLIC HARDENER TOPPING

14.1 The thickness of cement concrete flooring and metallic hardener topping shall be as specified in schedule of quantities.

14.1.1 Metallic Hardening Compound:

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

14.1.2 Sub-Grade :

Shall be as specified in 7.0 Artificial stone flooring.

14.1.3 Under layer :

Cement concrete flooring of specified thickness and mix shall be laid as under layer. The top surface shall be roughened with brushes while the concrete is still green and the forms shall be kept projecting up 12 mm over the concrete surface, to receive the metal hardening compound topping.

14.1.4 Topping:

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

The mixture so obtained shall be laid in 12 mm thickness, on cement 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 pressed in to the bottom concrete so as to have good bond with it. After the initial set has started, the surface shall be finished smooth and true to slope with steel floats.

The men engaged on finishing operation shall be provided with raised wooden platform to sit on, so as to prevent damage to new work.

14.1.5 Curing :

The curing shall be done for a minimum period of 10 days. Curing shall not be commenced until the top layer has hardened. Covering with empty cement gunnies shall be avoided as the color is likely to be bleached with the remnants of cement matter from the bags.

14.1.6 Measurements:

Length and breadth shall be measured correct to 3 cm and its area as laid shall be calculated in sq. m correct to two places of decimal length and breadth shall be measured before laying skirting dado or wall plaster. No deduction shall be made nor extra paid for any opening in the floor of area up to 0.10 sq m.

The flooring done with strips (in one operation) and without strips (in alternate panels) shall be measured together.

14.1.7 Rate

The rate shall include the cost of all materials and labor involved in all operations described above including application of cement slurry on RCC slab or on sub-grade including roughening and cleaning the surface etc.

SECTION - G

EXTERNAL AND INTERNAL PAINTING WORKS

1.0 WHITE WASING WITH LIME

1.1 Scaffolding

Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No bullies, bamboos or planks shall rest on or touch the surface which is being white washed.

For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

Note In case of special type of brick work, scaffolding shall be got approved from representative of Employer/Consultant in advance.

Where ladders are used, pieces of old gunny bags shall be tied on their top to avoid damage or scratches to walls.

For while washing the ceiling, proper stage scaffolding shall be created.

1.2 Preparation of surface

Before new work is white washed the surface shall be thoroughly brushed free from mortar droppings and foreign matter.

In the case of old work, all loose pieces and scale shall be scrapped off and holes in plaster as well as patches of less than 50 sq.cm. area shall be filled up with mortar of the same mix where so specifically ordered by the representative of Employer /Consultant, the entire surface of old white wash shall be thoroughly removed by scrapping and this shall be paid for separately.

1.3 Preparation of Lime Wash

The wash shall be prepared from good quality fresh stone white lime. The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 40 gm of gum dissolved in hot water, shall be added to each 10 cubic decimeter of the cream. The approximate quantity of water to be added in making the cream will be 5 liters of water to one kg of lime. If not directed otherwise, Indigo (Neel) upto 3 gm per kg of lime dissolved in water shall be added and wash stirred well. Water shall then be added at the rate of about 5 liters per kg of lime to produce a milky solution. In case of lime wash on the surface finished with lime punning no indigo should be used unless otherwise directed by the representative of Employer/Consultant.

1.4 Application

The white wash shall be applied with moonj brushes to the specified number of coats. The operation for each coat shall consist of a stroke of the brush given from the top downwards, another from the bottom upwards over the first stroke, and similarly stroke horizontally from the right and another from the left before it dries. Each coat shall be allowed to dry before the next one is applied. Further each coat shall be inspected and approved by the representative of Employer/Consultant before the subsequent coat is applied. No portion of the surface shall be left out initially to be patched up later on. For new work, three or more coats shall be applied till the surface presents a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show signs of cracking and peeling nor shall it come off readily on the hand when rubbed. For old work, after the surface has been prepared as described in Para 1.2, a coat of white wash shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patches do not appear. The washing on ceiling should be done prior to that on walls.

1.5 Protective Measures

Doors, Windows, floors, articles of furniture etc. and such other parts of the building not to be white washed shall be protected from being splashed upon. Splashing and droppings if any shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the contractor.

2.0 CEMENT PAINT

2.1 Preparation of Surface

For new work, the surface shall be thoroughly cleaned of all mortar dropping, dirt, dust, algae, grease and other foreign matter by brushing and washing. The surface shall be thoroughly wetted with clean water before the cement paint is applied. In the case of old work, all loose pieces and scales shall be removed and the surface shall be cleaned of all dirt, dust, algae, oil etc by brushing and washing. Pitting in plaster shall be made good and a coat of water proof cement paint shall be applied over patches after wetting them thoroughly.

2.2 Preparation of Mix

Cement paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish. Cement paint shall be mixed with water in two stages. The first stage comprises of 2 parts of cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer's instructions shall be given preference over the above specification, in case of variation between the two exists.

The lids of cement paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly becomes air set due to its hygroscopic qualities.

2.3 Application

The solution shall be applied on the clean and tested surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The method of application of cement paint shall be as per manufacturer's specification. The completed surface shall be watered after the day's work.

The second coat shall be applied after the first coat has been set for at least 24 hours. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetted. For new work, the surface shall be treated with three or more coats of water proof cement paint as found necessary to get a uniform shade. For old work, the treatment shall be with one or more coats as found necessary to get a uniform shade. ab)

2.4 Precaution

Waterproof cement based paint shall not be applied on surfaces already treated with white wash, color wash, distemper dry or oil bound, varnishes, paints, etc. It shall not be applied on gypsum, wood and metal surfaces. The specifications in respect of scaffolding, protective measures, measurements and rate shall not be as described under white washing with lime.

3.0 PAINTING

Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the representative of Employer/Consultant.

3.1 Commencing Work

Painting shall not be started until the representative of Employer/Consultant has inspected the items of work to be painted, satisfied themselves about the proper quality and given their approval to commence the painting work. Painting of external surface should not be done in adverse weather condition like hail, storm and dust storm. Painting, except the priming coat shall generally be taken in hand after practically finishing all other builders work. The rooms should be thoroughly swept out and the entire building cleaned up at least one day in advance of the paint work being started.

3.2 Preparation of Surface

The surface shall be thoroughly cleaned and dusted. All rust, dirt, scales, smoke and grease shall be thoroughly removed before painting is started. The prepared surface shall receive the approval of the representative of Employer/Consultant after inspection, before painting is commenced.

3.3 Application

Before pouring into smaller containers for use, the paint shall be stirred thoroughly in the containers. When applying also, the paint shall be continuously stirred in smaller containers so that its consistency is kept uniform. If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the representative of Employer/Consultant shall be used. The painting shall be laid on evenly and smoothly by means of crossing and laying off, the latter in the direction of the grain of wood. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite direction, two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat. Where so stipulated, the painting shall be done by spraying. Spray machine used may be (a) high pressure (small air aperture) type, or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be done only when dry condition prevails. Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This should be facilitated by through ventilation. Each coat except the last coat shall be lightly rubbed down with sand paper or fine pumice stone and cleaned off before the next coat is laid. No left over paint shall be put back into the stock tins. When not in use, the containers shall be kept properly closed.

No hair marks from the brush or clogging of paint puddles in the corner of panels, angles of mouldings etc. shall be left on the work. In painting doors and windows, the putty round the glass panes must also be painted; but care must be taken to see that no paint stains etc. are left on the glass. Top of shutters and surfaces in similar hidden locations shall not be left out in paint. In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc. The additional specifications for primer and other coats of paints shall be as according to the detailed specifications under the respective headings.

3.4 Brushes and containers

After work, the brushes shall be completely cleaned of paint by rinsing with linseed oil or with turpentine. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The container, when not in use, shall be kept closed and free from air so that paint does not thicken and also shall be kept safe from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean, and can be used again.

4.0 PRIMING COAT ON WOOD, IRON OR PLASTERED SURFACE

4.1 Preparation of Surface

i) Wooden Surface

The wood work to be painted shall be dry and free from moisture. The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well ducted. Knots, if any, shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler materials with same shade as paint shall be used where specified.

The surface treated for knotting shall be dry before painting is applied. After the priming coat is applied, the holes and indentations on the surface shall be stopped with glazier's putty or wood putty. The primer shall be prepared on site or shall be of approved brand and manufacture as specified in the item. Paint shall be anti corrosive bitumastic paint, aluminum paint or other types of paint as specified in the description of the item. Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in the stopping and the latter is therefore liable to crack.

li) Iron & Steel Surface

All rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought Iron during rolling which become loose by rusting, shall be removed.

All dust and dirt shall be thoroughly wiped away from the surface. If the surface is wet, it shall be dried before priming coat is undertaken.

iii) Plastered surface

The surface shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall then be taken in hand. Before primer is applied, holes and undulations, shall be filled up with plaster of paris and rubbed smooth.

4.2 Application

The primer shall be applied with brushes, worked well into the surface and spread even and smooth. The painting shall be done by crossing and laying off as described in cement paint above.

5.0 PAINTING WITH READY MIXED PAINT / SYNTHETIC ENAMEL PAINT

5.1 Painting on new surface

The surface which has not been painted earlier, or the paint has been removed by paint remover, burning, caustic Soda etc. shall be considered to be new surface.

5.2 Preparation of Surface

i) Wood work

The surface shall be cleaned and all unevenness removed as specified in wooden surface. Knots, if visible, shall be covered with a preparation of red lead. Holes and indentations on the surface shall be filled in with glazier's putty or wood putty and rubbed smooth before painting is done.

The surface should be thoroughly dry before painting

li) Iron and Steel Work

The priming coat- shall have dried up completely before painting is started. Rust and scaling shall be carefully removed by scrapping or by brushing with steel wire brushes, All dust and dirt shall be carefully and thoroughly wiped away.

iii) plastered surface

The priming coat shall have dried up completely before painting is started. All dust of dirt that has settled on the priming coat shall be thoroughly wiped away before painting is started

5.3 Application

The specifications described in Cement paint shall hold good as far as applicable. The number of coats to be applied will be as stipulated in the item. The powder surface shall present a uniform appeared lce and glossy/mat finish 2S described in schedule of quantities free from streaks, blisters etc.

6.0 FRENCH SPIRIT POLISHIN

Pure shellac varying from pale orange to lemon color free from raisin or shall be dissolved in mentholated spirit at the rate of 140 gm of shellac to 1 lt of spirit. Suitable pigment shall be added to get the required color.

6.1 Polishing new surface

Preparation of surface : The surface shall be cleaned. All unevenness shall be rubbed down smooth with sand paper and well dusted. Knots, if visible, shall be covered with a preparation of red lead and glue sized and used hot. Holes and indentations on the surface shall be stopped with glaziers putty. The surface shall be then given a Coat of wood filler made by mixing whiting (ground chalk in mentholated spirit at the rate of 15 kg of whiting per liter of spirit). The surface shall again be rubbed down smooth with glass paper and wired clean.

7.0 METHOD OF MEASUREMENT

Measurements for painting on plastered surfaces shall be the same as that for plaster. For doors, windows etc., the following multiplying factors will be considered .

SECTION – H METAL DOORS/WINDOWS

1.0 STEEL DOORS, WINDOWS ETC

The windows shall be obtained from approved specialized manufacturers. The frames of doors, windows, ventilators etc. shall be formed by cutting section to required lengths and mitered. The corners shall be welded to form a solid framed welded joints. Sash bars of units shall be tinned and riveted into the frames and where they intersect the vertical tie shall be broached and the horizontal tie threaded through it, and the intersection closed by hydraulic pressure. For fixing steel hinges, slots shall be cut in the fixed frame and the hinges inserted inside and welded to the frame at the back. For fixing hinges to inside frame, the method described for fixing to outside frame may be adopted but weld shall be cleaned or holes made in the inside frame and hinge riveted. The hinge pin and washer shall be galvanized or, aluminum alloy 51 S-WP of suitable thickness. The handle shall be mounted on handle plate which shall be welded to the opening frames. The handle shall have a two points nose which will engage with suitable tapered striking plate provided on the fixed frame. Top hung and bottom hung ventilators shall be provided with two plain hinges, with peg stays of sufficient length 3~ specified earlier. Centre hung ventilators shall be made with two outer frames, With mastic water-proof compound embedded between these two (Jute! frames Unless otherwise specified the ventilators shall be provided with spring catch whir-l) when pulled by a Cold, will allow the shutter to open half to open outside and the top half opening inside.

Steel windows and ventilators shall be fixed to brick or concrete surface as shown in drawing or with M. S. Jugs of sizes 100 x 16 x 3 mm and to concrete work by means of 125 mm long counter sunk screw, or raw bolts or other approved fastener after drilling into concrete. With a power drill as specified in the item. The lug shall be grouted in concrete (1:2:4) mix of dimension as directed.

The frames should not be fixed in position until the structural work has been completed and the free deflection has taken place. The doors, windows, etc. shall be erected in true plumb, line and level.

All steel doors, windows, ventilators shall be given a coat of anti-corrosive primer at the shop before delivery to site for erection but in no case prior to the materials have been inspected by the representative of Employer/Consultant.

Final painting shall be done after obtaining approval from the representative of Employer / Consultant

2.0 STEEL GRILL AND RAILINGS

The grills and railings for windows, verandah and balcony etc. shall be of mild steel. The design of grills/railings and shape and sizes of various components shall be according to the drawings. Where ever grills integrated with windows are specified they shall be manufactured at windows manufacturers shop. The edge angles and corners shall be cleaned and true to shape. The joints, if possible, shall be mechanically interlocked and neatly spot welded in such a way that the grill is rigid. Grinding of the joints to achieve a neat regular finish shall be done. The grills shall be fixed to true plumb, line and level as per drawing.

All grills, railings etc. after being fixed in position, shall be cleaned of dust, dirt, rust and loose scales before applying a coat of protective zinc chromate primer.

3.0 ROLLER SHUTTER

These shall be fixed in position as shown in drawing.

Brackets shall be fixed on the lintel or under the lintel as specified withrawl-pluges, and screw bolts etc. The shaft along with the spring shallthen be fixed on the brackets.

The lath portion (shutter) shall be laid on ground and the side guidechannels shall be bound with it with ropes etc. The shutter shall then beplaced in position and top fixed with pipe shaft with bolts and nuts. Theside guide channels and the cover frame shall then be fixed to thewalls through the plate welded to the guides. These plates and bracketshall be fixed by means of steel screw bolts, and raw plugs drilled in thewall .The plates and screw bolts shall be concealed in plaster to maketheir location invisible shall be done accurately in a workman likemanner that the operation of the shutter is easy and smooth.

After being fixed in position, these shall be cleaned off dust, dirt, rust orscales before applying a protective coat of zinc c hromate.

4.0 **COLLAPSIBLE GATE**

T-iron shall be fixed to the' floor and to the lintel at top by means ofanother bolts embedded in cement concrete of floor and lintel. Theanchor bolts shall be placed approximately at 45 cm centersalliteratively in the two flanges of the T -iron The bottom runner (T-iron)shall be embedded in the floor and propel you've shall be formedalong the runner for the purpose. The collapsible shutter shall be fixedat Sides by fixing the end double channels with T-iron rails and also byhold-fasts bolted to the end double channel and fixed in the masonryof tha) e s ide walls

5.0 **ALUMINIUM DOORS /WINDOWS/CURTAIN WALLS**

All aluminum doors, windows etc shall be procured from an approvedmanufacturer. Aluminum section Shall be extruded hollow sectionsconforming to latest IS Specifications including IS, 1948 and 1.S. 733. Allsections have been approved by Employer/Consultant before placing theorder. All extruded sections shall have approved IS specification withthickness The aluminum section; shall be anodized color and with micronthickness as specified in the schedule of quantities or as per approved ISspecification.Open able windows shall be double weather-stripped. One weather stripshall be provided in the other frame and other weather strip in the shutterframe. The weather strip shall be extruded neoprene and of a size to makethe windows completed .weather tight. The weather-strip shall be dovetailedin the window sections.

The hinges of operable windows shall be strong. Pin of the hinges shall bestainless steel with nylon/PVC washers. In case the windows are projectedtype, these shall be provided with brass pivots sliding on stainless steel guides.Concealed type friction stays shall be provided to keep the windows open inany desired position. The window shall be provided with the handle (or twopointlocking or single point locking as required and directed. The glass usedshall be 4mm thick or 5.0mm sheet glass of first quality and approved make,free from scratches, waviness, bubbles, etc. all as shown drawing or aspecified and directed. Sliding windows wherever used should have tilesliding tracks, rollers, pins and the locking clamps as directed by theEmployer/Consultant. General fabrication shall be as earlier given for steelwindows and doors.

6.0 **Method of Measurements**

61 **Steel Windows**

Shall be measured in sq. m. up to two decimal places, the height and widthbeing measured correct to 0.5 cm between out-to- out of frame.

6.2 **Rolling Shutter**

Shall be measured net in sq.m. Up to two decimal places, the width beingmeasured overall out-to-out of guide towards channels and height taken asclear opening height, all measurements correct to 0.5 cm

6.3 **Collapsible gate**

Shall be measured In sq m. up to two decimal places. the width being measured In fully stretched position and height taken as between out to out as top runner, all correct to 0.5 cm.

6.4 **Grills/railings etc:**

Shall be measured Nett in kg up to three decimal places, the sectional weights being taken as per IS Codes up to three decimal places. No extra will be entertained for welding etc.

6.5 **Aluminum windows/Doors**

Shall be measured in sq. cm up to two decimal places, the height and width being measured correct to 0.5 cm. between out - to -out of frame.

SECTION –I

SPEIFICATION FOR WATER PROOFING

1.0 DAMP PROOF COURSE (D P C)

DPC shall be of thickness as shown in drawing or in the schedule of quantities unless otherwise mentioned, proportion shall be 1 parts of cement 2 parts of sand and 4 parts of aggregate mixed with approved water proofing compound as per manufacturers specification. Before laying the concrete the top surfaces of the wall shall be thoroughly cleaned of all dirt and loose particles, mortar droppings and laitance, if any, scrubbing with coir or steel wire brush or by hacking, if necessary. The surface is then thoroughly wetted and the concrete is placed. The concrete shall be laid in every case for the full width of the plinth or as shown in drawing. The top surface shall be kept rubbed or rough or double-chequered for adhesion of mortar for brick work. Proper curing shall be done before starting the brick work over DPC.

2.0 BRICK COBA WATERPROOFING

The treatment shall be got executed by approved specialist firms and a guarantee of 10 years in the approved format is to be submitted along with a back-to-back separate guarantee by the main contractor. Moreover, in case of variations between specifications given below and the specification of the manufacturer, the latter shall prevail.

a: Terrace

The roof surface shall be thoroughly cleaned and prepared to receive waterproofing treatment. Construction joints, if any, are raked and cleaned. Cement slurry with resinous admixtures of Specialist firm is spread to penetrate into the structure and to fill cracks and other porous areas. 15 mm thick cement mortar 1:4 (1 cement: 4 coarse sand) with resinous admixtures of specialist firm is laid over the prepared surface. A layer of brick bats (Coba) is laid over the mortar layer giving the required gradient for adequate drainage (A slope of 1 in 120 is considered adequate). The joints between the brick bats shall generally be kept between 15-25 mm wide. Those joints are filled with cement mortar (1:4) with resinous admixtures of specialist firm. Curing is done for two days. The top is finished smooth with 20 mm thick cement mortar (1:4) with resinous admixtures of Specialist firm and marked with 300 mm x 300 mm false squares. Curing is done for two weeks.

b: Sunk Slabs

any existing covering on slab is removed and surface is prepared. Construction joints if any, are raked and cleaned. Cement slurry with resinous admixtures of Specialist firm is spread which penetrates into the structure. This fills cracks and other porous areas. 20 mm thick cement mortar 1:4 (1 cement: 4 coarse sand) with resinous admixtures of Specialist firm is laid over the prepared surface. A layer of brick bats (Coba) is laid over the mortar layer giving the required gradient for adequate drainage. The joints between the brick bats are generally kept between 15-25 mm wide. These joints are filled with cement mortar (1:4) with resinous admixtures of Specialist firm. Curing is done for two days.

The top is finished smooth with 20 mm thick cement plaster (1:4) with resinous admixtures of Specialist firm. Curing is done for two days. Existing covering, if any, is removed and surface is prepared up to the required height (A height of 150 mm above upper floor level is considered adequate). A cement slurry coating with resinous admixtures of Specialist firm is given.

The side wall is provided with cement plaster (1:4) 20 mm thick with resinous admixtures of Specialist firm up to the height specified. A vatta (Gala) of specified design is made in cement mortar (1:4) with resinous admixtures of Specialist firm. Curing is done for two weeks.

c. **Method of Measurement**

The measurement for the complete work as per specification shall be taken clear between the walls. No separate measurements for "Golai" treatment to vertical surfaces shall be made.

SECTION-J

1.0 WOODWORK AND JOINERY

1.1 TIMBER

- i) Unless otherwise specified all timbers for frames and shutters for doors/windows, ventilators, cupboards, etc. shall be free from knots, snakes, fissures, flaws, sub-cracks and other defects. The planed surface shall be smooth and free from blemishes and discolorations.
- 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 one month to allow for any shrinkage that may take place. The preparation of timber for joinery is to commence simultaneously with H 12 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.
- iv) Paneled shutter may be obtained from factories approved by Consultants/ Employer provided the contractor can ensure proper quality control to the satisfaction of Consultant/Employer.
- v) Paneled shutters shall be manufactured after taking correct measurements of openings so as to ensure that the dimensions of rails/ styles are not reduced than that indicated in schedule/drawing.

1.2 Workmanship and Constructions

- A) The workmanship shall be first class and to the approval of the Representative of Employer/Consultant. 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 framed together and securely fixed 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 tenured shouldered, wedged, pinned, braced etc. and properly glued with approved quality glue to tile; satisfaction of the representative of Employer/Consultant
- 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 size specified except where described as finished in which case they shall hold to the full dimensions
- D) **Protection:** All edges of timber frames shall be protected from being damaged during construction by providing rough timber casing securely fixed and other adequate protective measures.
- E) If it is decided by the representative of Employer/Consultant to provide ant termite treatment, the buildings contractor shall co-ordinate his work suitably as directed by the representative of Employer/Consultant.
- F) Door/Window frames shall have cut rebate. Planted rebates shall not be permitted unless shown in drawings.

- G) wooden cover, moulds of sizes shown in drawings shall be provided allround painted or finished as in doors. This will be paid as a separate Item as described in Schedule of Quantities.

- 1.3 **Holdfasts:** Three holdfasts shall be fixed to each post of the door frame. The MS holdfasts shall be of the size 37 cm x 10 mm x 3 mm or 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 holdfast shall be fixed into jambs with 1:2:4 P.C.C of dimensions as directed. Ends of holdfast will be fish tailed. Whenever the frames are abutting to concrete surface approved metal expansion as directed shall be provided for frame, hangers rough grounds. The rates quoted for woodwork and joinery shall exclude the cost for all types of holdfasts or Raw Plugs or other frames shall be out and shall not be used as holdfasts,

The items of holdfast, metal fasteners etc. shall be paid as a separate item as described In Schedule of Quantities The rate for holdfasts shall include forcement grouting and fixing to frame work with screws etc. The rate for metal fasteners shall include for nuts etc. as required.

2.0 **Door/window Frame**

Specified timber shall be in the direction of grain and truly straight and square shall be used. The scanting shall be planed smooth and accurate to the full dimension, rebates, rounding & moulding as shown in the drawing before assembling. All joints shall be mortice and Tenon type, simple near strong the joint shall be glued framed put together and pinned with timber.

2.1 **WOODEN FLUSH SHUTTER (SOLID CORE TYPE)**

Wooden flush shutters shall be of solid core type: and obtained from approved manufacturer pressed and phenol formaldehyde synthetic resin shall also be provided with external lapping fixed to shutter with synthetic adhesives & head-less pins

2.2 **Paneled Shutters:**

Where specified in the Schedule of quantities Shutters shall be manufactured from Kiln Seasoned and chemically treated commercial hardwood of approved quality Thickness and sizes of styles rails and panels etc. shall be as specified in the Schedule of Quantities and/or drawings Panel shall be in a single width piece. Shutters shall be manufactured conforming to the relevant IS Specification and an approved sample shall be kept in the site office of the representative of Employer/Consultant.

2.3 **Teak wood glazed shutters :**

The general specifications for glazed shutter shall be similar to that for paneled shutters described. Styles and rails in the glazed shutters shall be rebated 5/8" x 1/2" (16 mm x 12 mm) to receive the glass unless otherwise specified. Sash bars shall be of full thickness of the shutter and of width as shown in the drawings. These shall be molded and rebated miter on side to receive the glass as per drawing unless otherwise specified glass panels shall be fixed by means of molded teak beads and suitable G.I screws. Finished thickness of the shutter shall be as mentioned in the schedule of quantities. The rate shall be for the completed work fitted and fixed in position. An approved sample should be kept in the office of the representative of Employer/Consultant at the site for reference. The glass shall conform to specification as described under head glazing. The thickness of glass shall be mentioned in the Schedule of Quantities

3.0 **Method of measurements**

Door shutters shall be measured in square meter upto two decimal places The height and width shall be clear height and width of shutter. Frames shall be measured along the centre line, no extra being allowed for embedment in floors.

2.1 WODDEN FIUSH SHUTTER (SOLID TYPE)

Wooden flush shutters shall be of solid core type and obtained from approved manufacturers as listed, Shutters shall be hot pressed and phenol formaldehyde synthetic resin shall also be provided with external lapping fixed to shutter with synthetic adhesives & head-less pins.

2.2 Paneled Shutters:

Where specified in the Schedule of Quantities Shutter shall be manufactured from Kiln Seasoned and chemically treated commercial hardwood of approved quality, Thickness and sizes of styles rails and panels etc shall be as specified in the Schedule of Quantities and/or drawings 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 representative of Employer/Consultant.

2.3 Teak Wood And Glazed Shutters:

The general specifications for glazed shutters shall be similar to that for paneled shutters described. Styles and rails in the glazed shutters shall be rebated $5/8" \times 1/2$ (16 mm x 12 mm) to receive the glass unless otherwise specified. Sash bars shall be of full thickness of the shutter and of width as shown in the drawing. These shall be molded and rebated mitre on side to receive the glass as per drawing unless otherwise specified glass panels shall be fixed by means of molded teak beads and suitable G.I. screws. Finished thickness of the shutter shall be as mentioned in the schedule of quantities.

The rate shall be for the tile completed work fitted and fixed in position. An approved sample should be kept in the office of the representative of Employer/Consultant. The glass shall conform to specification as described under head glazing the thickness of glass shall be mentioned in the schedule of quantities.

3.0 METHOD OF MEASUREMENTS

Door shutters shall be measured in square metre up to two decimal places. The height and width shall be clear height and width of shutter. Frames shall be measured along the centre line, no extra being allowed for embedment in floors

SECTION "K"

ANTI-TERMITE TREATMENT

1.0 GENERAL

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

2.0 SOIL TREATMENT SHALL CONFORM TO THE FOLLOWING

2.1 **Chemicals:** The treatment of the area shall be carried out by applying of chlorpyrifos chemical 20% EC at 1% or Endosulfan (30% EC) with 0.5% concentration. The chemicals shall be obtained from approved manufacturer.

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. The record book shall be property of the representative of Employer/Consultant.

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 representative of Employer/Consultant.

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 para for various operation should be followed. This specifications represent the minimum rates of application of each operation and the contractor shall actually apply chemicals at rates that they may consider necessary for effectiveness during the 10 years guarantee period. In other words responsibility of applying adequate amounts of chemical as required to sustain the 10 years guarantee shall be that of the contractor but in no case shall actual rates of application be less than specified in the technical specifications.

2.4. TREATMENT OF JUNCTION OF WALL AND THE FLOORS

Special care shall be taken to establish continuity of the chemical barrier on the inner wall surface from ground level. To achieve this a small channel of 30mm x 30 mm shall be made at the junction of walls and columns with the floor and rod holes made in the channel up to ground level 150 mm apart and the iron rod moved backward to break up the earth and chemical emulsion poured along the channel at the rate of 7.5 litres per square metre of the vertical wall or column surface so as to soak the soil right to the bottom

2.4.2 TREATMENT OF TOP SURFACE OF PLINTH FILLING

The top surface of the consolidated earth within plinth wells shall be treated with chemical emulsion at the rate of ~ liters per square metre of the surface before the sub-grade is laid. If the filled earth has been well rammed and the surface does not allow the emulsion to seep through, notes up to 50 to 70 mm deep at 150 mm centre both ways may 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 solid 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 similarly treated for a distance of over 300 mm unless they stand clear of the walls of the building by about 75mm.

2.4.4 Treatment of soil along External Perimeter of Building:

After the building is completed the earth along the external perimeter of the building should be rotted 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 backup the earth and chemical emulsion poured along the wall at the rate of 7.5 lit res per square meter of vertical surfaces. After the treatment, the earth should be tamped back into place. Should the earth outside the building be graded on completion of the building, this treatment should be carried out on completion of such grading.

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

2.5 Treatment Shall not be made if the soil or fill is excessively wet or immediately after heavy rains to avoid surface flow of toxicant from application site. Unless the treated areas are to be immediately covered, percolation shall be taken to prevent distribution 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 Performa attached. The guarantee shall be signed by the main contractor and the specialized who have executed the work. In the unlikely event of any treatment becoming necessary subsequently during the guarantee period, required inspection and treatment shall be carried out free of cost.

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

2.8 Stages of Payment: The work has to be carried out in stages according to the progress of works.

2.8.1 The contractor shall have to furnish a guarantee on non-judicial stamp paper for 10 years as per the Performa. In the unlikely event of any treatment becoming necessary subsequently during the guarantee period, required inspection and treatment shall be carried out free of cost by the contractor.

2.8.2 Payment will be made on the plinth/floor area measurement and the rates should include to cover treatment to parts of structure as detailed out subject to deduction 1 for retention money, payment will be made in stages as under

- a) On completion of treatment at junction and Floor & Ceiling..... 75%
- b) On completion of treatment of all parts of structure required and pipes, waste conduits etc. etc.100%

SECTION – X

TECHNICAL SPECIFICATION FOR SANITARY AND PLUMBING WORK

INDEX

SECTION I SANITARY FITTINGS

SECTION II SOIL, WASTE PIPES AND FITTINGS

SECTION III WATER SUPPLY PIPES AND FITTINGS

SECTION IV SEWERS AND DRAINS

LIST OF APPROVED BRAND AND MANUFACTURERS

SECTION – I

TECHNICAL SPECIFICATIONS FOR SANTARY FITTINGS

1.0 **SANITARY AND ALLIED FITTINGS**

All sanitary wares with their allied fittings must be first quality (best) of approved make and brand.

2.0 **SQUATTING PATTERN W.C. PAN (INDIAN TYPE)**

The W. C. Pan shall be of white vitreous China of specified size and pattern (Orissa or long pattern as specified) with an integral flushing rim. It shall have the flushing horn in the back unless it is not possible to accommodate cistern to suit this design. The pan shall be of approved quality. It shall have 100 mm C. I. Of porcelain trap 'P' or 'S' type with minimum effective seal of 50 mm and 50 vent ann.

2.1 **Fixing of W.C. Pan**

The Squatting type W. C. Pan shall be sunk in floor sloped toward the pan in a workmanship like manner, care being taken not to damage the pan in the process of fixing. If damaged it shall be replaced at Contractor's cost. It shall be fixed on a proper cement concrete base of 1 : 3 : 6 proportion taking care that the cushion is uniform and even without having any hollows between the concrete base and pan and finished just below level of rim of pan to receive the specified thickness of the floor finishing. No extra for concrete bed shall be paid for.

The joint between the pan and the trap shall be made with cement mortar 1 : 1 and shall be leak proof.

3.0 **PEDESTAL WASHDOWN SYPHONIC (SINGLE OR DOUBLE TRAP) WATER CLOSET (EUROPEAN TYPE)**

The W. C. pan shall be of white vitreous China unless otherwise specified of one piece construction of wash down type with integral P or S trap as required. It shall be of approved quality and pattern.

3.1 **Installation**

The weight of the fixture and user arc supported on the floor and not on the drainage pipe and this should be done in standard approved method.

3.2 **Seat and cover**

The double solid seat with lid shall be of well plastic seat as specified in the schedule with rubber buffers and shall be fixed in position by using Chromium plated brass hinges and screws. It shall be non-absorptive and free from crack and crevices in the materials, The plastic seat and cover, where specified, shall conform to I.S. Specifications, and shall be of white colour unless otherwise specified.

3.3 **Flushing**

The flushing of the Squatting and pedestal w.c. Pan shall be done by 10w level' valueless siphonic flushing cistern of approved quality and capacity, as specified. In the former case, the connection between the flush pipe of the cistern and w.c. pan shall be made by using Rigid PVC pipe connection as specified. The other specification will be as for Squatting pattern w.c. Pan.

The Hush pipe shall be fixed to wall by using holder bat clamps or embedded, as required. As specified, low level Cisterns of specified capacity shall be with all internal fittings, brackets and C.P. brass flushing handle, and connected to the w.c. pan by means of 40 mm diameter Chromium Plated brass bend and rubber or any other, as specified.

4.1 BRACKETS

The cistern shall be fixed on Cast Iron Of rolled steel cantilever brackets Nylonbraced of required strength which shall be firmly embedded in the wall or fixed by using wooden plug and screws, to the satisfaction of the Consultant/Employer. Depending on (the characteristics of work any type of sanitary fixtures, the fixing of cistern should vary in quality of material and design also. Or it may be installed in other ways like placing on the top at the back of the w.c.

4.2 OVERFLOW

The Cistern shall be provided with 20 mm pipe with fittings which shall terminate into mosquito proof coupling secured in a manner that will permit it to be readily cleansed or renewed, when necessary.

4.3 FLUSH PIPE:

Unless otherwise stated in the schedule of quantities, the outlet or flush pipe from the low level cistern shall be of 40mm rigid PVC/ brass chromium pipe minimum thickness of 2.6 mm as specified or PVC pipe as directed by the consultant/employer which shall be connected to the W.C pan by means of an approved type of joint adapts. The flush pipe shall be fixed to wall by using holder bat clamps or embedded as require.

4.4 PAINTING C.I. CISTERN

Inside Of cisterns and fittings shall be painted with approved bitumastic paint and outside of the cisterns, if required, brackets, overflow and ibis pipes, if required shall be painted, with 2 coats (If synthetic enamel paint of approved primer to give an even appearance. The cost of such painting shall be include in the rates quoted for concerned items.

5.0 STANDING URINALS

5.1 Bowl Urinal

The urinal shall be flat back or angular pattern lipped front basin of required dimensions of white vitreous china and one piece construction with internal flushing box rim of an approved make as specified. It shall be fixed in the position by using wooden plug embedded in the wall with screw of proper size, Each urinal shall be connected to a 40 mm dia, waste lead pipe unless otherwise specified, which shall discharge into a channel or a floor trap, or as specified.

5.2 Half Stall Urinals

The urinal stall and its screen shall be of white vitreous China of approved quality and manufacturer, The stall shall be 114 cm high and 46 cm wide and 40 cm deep. The stall shall be provided with 84 cm x 36 cm division plates. In case of two or more urinals there shall be further division plates similar to end screens, the range shall have 15 cm deep tread plates of first class quality unless otherwise specified,

5.3 FLUSHING

Where not specified the stall shall be provided with white glazed vitreous China automatic flushing cistern of proper capacity with 6 mm minimum hotly thickness unless otherwise specified. The cistern shall be complete with fittings and brackets which shall be fixed to the wall the cistern shall be connected to the stall through standard size C.P. brass flush pipe with spreader arrangement and damp unless otherwise specified. Where cistern have not been specified it will be from distribution line through Brass C.P. connector and spreaders.

5.4 Outlet

Each of Half stall shall be provided with C.P. brass outlet grating of size 32mm for each half stall and then through PVC pipe to urinal channel.

6.0 SQUATTING URINALS

6.1 SQUATTING PLATES

The urinal plates shall be of white glazed vitreous China with integral flushingrim of size 600 mm X 350 mm or as specified. There shall be white vitreouschannel with stop and outlet pieces in front. The plate and channel shall heof approved quality.

The joint between the urinal plate and the flush pipes shall he made withputty or white lead mixed with chopped hemp.

6.2 Outlet

The squatting plate or a range of squatting plates shall be provided with a 65mm dia. standard urinal C.I trap with vent arm having 65 mm C.P. brass outlet grating or as specified.

6.3 Walling

The squatting plate shall have 1.22 M high wall in front and on either side,these shall be lined as specified.

7.0 CISTERN

7.1 Material

If not specified a high level cistern is intended to operate with minimumheight of 191 cm and a low level cistern with a height of 60 cm approx. from the floor finish and the underside of the cistern.

The body thickness of' an earthenware cistern 1.3 cm. The cistern withinternal parts shall be free from manufacturing faults and other defects andoperate smoothly and efficiently. The cistern shall be considered mosquitoproof only if there is no clearance anywhere which would permit a 1.6 mmwire to pass through coupling in the permanent position (i. e. flushing orfilling) or the cistern. The outlet tilting of each cistern shall he securelyconcern to the cistern. In the case die outlet shall he fix low level 40 mm dia.Nominal bore). The outlet of flush pipe from the cistern shall be connected tothe pan by means of putty or cement and for E.P.W.C. with rubber joint andputty. The Wish pipe shall he fixed 10 wall by using holder hat clamps.

The discharge rate of cistern shall be about 5 liters in 3 seconds whenconnected to an appropriate flush pipe and there shall be no appreciablechange in the full discharge. The cistern shall have discharge capacity of5,10, 12.5, and 13 liters with tolerance b) of +/- 0.5 ltr.

7.2 CAPACITY OF CISTERNS AND THE SIZE OF FLUSH PIPE FOR FLAT BACK (BOWL) URINAL

Capacity: The capacity of the flushing cistern and the Size of the Hush pipefor the number of urinals in a range will be as follows

Number of urinals range	in Capacity of flushing cistern	size of pipe	
	Main	ditribution	
1	5 liters	20 mm	15 mm
2	10 liters	20 mm	15mm
3	10 liters	25 mm	15 mm
4	15 liters	25 mm	15 mm

The joint between the urinal basin flush and waste pipe shall be means ofputty of white lead mixed with chopped hem, or as specified in case of PVCpipe.

7.3 For Squatting Plate Urinal

Capacity : The capacity of the Hushing cistern and the size of the flush pipe for the number of squalling place urinals in a range will be as follows

Number of urinals In range	capacity of flushing cistern	size of flushing pipe Main distribution
1	5 liters	25mm20mm
2	10 liters	25mm20mm
3	15 liters	32mm20mm
4	15 liters	32mm 20mm

The cistern shall be fixed on R.S. C.I. cantilever brackets of requisite strength which shall be embedded or fixed to the wall by means of wooden plugs and screws.

8.0 WASHING BASINS

8.1 **BASIN:** The wash basins shall be of white or colored vitreous China as specified and of approved quality, make and pattern. It shall be one piece construction with an integral combined overflow. The size of the basin shall be as specified.

8.2 **FITTINGS:** Each wash basin shall be provided with 15 mm C.P. brass pillar taps as specified, 32 mm C.P. waste - chain and rubber plug, unions, joint') etc. complete in all respects of approved quality.

8.3 **FIXING:** The basin shall be supported on a pair of M.S. or C.I. Cantilever or Nylon type brackets of requisite strength embedded or fixed in position by means of wooden cleats and screws. These metal brackets shall be painted to the required shade including a coat of anticorrosive paint. The wall plaster on the rear shall be cut to overhang the top ~ of the basin.

8.4 WASTE CONNECTION :

The waste shall discharge into a floor trap leading to a gully trap on ground floor and on upper floor may be connected to waste stack. Where specified wash basins shall be provided with a 20 mm G.I. puff pipe terminating with a brass perforated cap screwed on to it on the outside of the wall or connected to antisiphon stack. When the waste pipe discharge freely into a channel or floor trap and is of short length without all bends, no puff will be necessary

9.0 KITCHEN SINKS

Unless otherwise mentioned, the kitchen sink with drain board shall be of stainless steel and (If approved quality, make and pattern . It shall be one piece construction with an integral combined overflow the size of the sink and drain board shall be as specified,

9.1 Fittings

Each sink shall be provided with 15 mm brass C.P. long body bib cock, 40/32 mm waste, chain and rubber plug, unions, joints etc. complete in all respects as specified and of approved quality.

9.2 Fixing

The sink shall be supported on a pair of M.S or C.I cantilever brackets of requisite strength embedded or fixing in position by means of wooden cleats and screws. The brackets shall be painted to required shade including a coat of anticorrosive paint.

9.3 Waste Connection

The waste shall discharge into a floor trap leading to a gully trap, OJ) groundfloor and on upper floor it may be connected to waste pipe stack with bottle trap P.v.c. waste pipe.

10.0 TOILET REQUISITES

10.1 Mirror

The mirror shall be of approved make glass with beveled edges. The size and shape of the mirror shall be as specified. It shall be mounted on an asbestos sheet back and provided with fiberglass frame.

10.2 Shelf

The shelf shall be of glass of approved quality with edge rounded off or of vitreous China (colored or white) of approved make. The size of the shelf shall be as specified. The shelf shall have C.P. brass or aluminum guard rail with rubber washers on positions resting on 11 class plate and C.P. brass or aluminum brackets which shall be fixed with c.p. brass or aluminum screws. 10 wooden plug firmly embedded in the wall.

10.3 Towel Rail

The towel rail shall be of C.P. brass or aluminum with two C.P. brass or aluminum brackets. The size of the rail shall be as specified. The bracket shall be fixed by means of c.p. brass or aluminum screws to wooden cleats firmly embedded in the wall which will project 75 mm from wall surface,

10.4 chromium plated stop cock, taps, bib cocks, shower set, gun metal peets valves If not mentioned otherwise in schedule, cocks and taps are to be of brass standard head chromium plated of approved make and pattern. They must be capable to withstand at least 10.5 kg per sq.cm. pressure applied for 5 minutes without leakage. The valve are to be of peel type gun metal valves. Other conditions remain same as cocks and taps.

10.5 Liquid Soap Holder

This shall be glass or P.V.C. or C.P. brass as specified. It shall be fixed in position by means of c.P. brass screw to wooden cleats embedded in the wall. The liquid soap holder shall be of approved make,

10.6 Toilet Paper Holder

The paper holder shall be of C.P. brass or vitreous china as specified. The rolled wooden paper holder shall be made of well seasoned teak wood. This should preferably be recessed type.

SECTION-II

SOIL, WASTE, RAIN WATER PIPES & FITTINGS

UPVC SWR (soil, waste, rain water) drawings system provides a range of pipes and fittings for soil, waste, vent, sewer and rain water drainage application and are extremely light in weight.

SWR drainage system is designed to carry discharge from toilets, baths and basins. It consists of a range of pipes and injection molded fittings which are required to connect the waste and vent from each fixture to the sewer drain.

All traps are to be supplied with either inlet (socket end) of 125 mm or 110 mm and outlet (spigot end) of 110 mm only. The traps with 125 mm inlet are commonly used to the Indian w.c. pan. All traps have smooth / glazed inside.

Clean the outside of the pipe's socket end and the inside of the scaling groove of the fitting. Apply the lubricant supplied by us uniformly to spigot and sealing ring and pass the spigot end into the socket containing scaling ring only fully home. Make a mark on the position of the socket edge with the pencil or felt-tip pen on the pipe, then withdraw the pipe from the socket by approx. 10 mm (towards thermal expansion gap).

With horizontal runs, the pipe clips should be spaced at intervals of no more than ten times the outside diameter of the pipes. Vertical lines are spaced at an interval of one meter to a maximum of two metres according to pipe diameter.

The man / concrete slots should allow for a stress-free installation. Pipes and fittings to be inserted into the slots without a cement base have to be applied with a thin coat of pvc solvent cement followed by sprinkling of dry sand (medium size). Allow it to dry. This process gives a sound base to cement fixation. This process is repeated while jointing PVC material to CI/AC material. The Supreme UPVC SWR drainage system can be put to use immediately after installation, as no waiting time is required for joints to be set and direct.

However, for testing, seal hermetically all openings below the top of the section to be tested. The water level shall then be raised to a height of not less than three meters above highest point of the section being tested or as directed in the inspection. Officer may direct every 10 min shall be carefully examined for leaks.

SECTION-III

TECHNICAL SPECIFICATIONS FOR WATER SUPPLY PIPES & FITTINGS

1.0 G.I. PIPES AND FITTINGS

1.1 General

All galvanized iron pipes are to be of mild steel continuously welded, screwed & socketed tubes, medium quality of Miss TAT A, Jamshedpur make. The pipes and sockets shall be cleanly finished when galvanized in and out and free from cracks surface flaws, lamination, and any other defects. The threads shall be well cut and clean. 1 be details of pipes and sockets regarding nominal bore, thickness, and weight in kg/m are given below. All G.I. fittings shall be of approved brand or make as specified. The pipes and fittings are to be screwed conforming to British Standard gas thread. In joining the pipes, threaded portion of both pipes and sockets shall be oiled and rubbed over with white Zinc and fine spun yarn wrapped round the screwed end of the pipe which then shall be screwed home to the socket with a pipe wrench. Care must be taken that all pipes and fittings are kept at all times free from dust and dirt during fixing. Any thread remaining exposed after jointing shall be painted.

The zinc coating or galvanised tubes is to be 6% heavier than Black tubes. Every length or tube is to be hot stamped at manufacturing stage with TATA symbol and letter M.

Approx dia in mm			nominal		screwed and socketed		sockets approx minimum	
light	medium	heavy			out side dia.mm	length mm		
21.3		15	0.961	1.220	1.46	27	37	
26.9		20	1.42	1.570	1.991	32.5	39	
33.7		25	2.03	2.430	2.99	39.5	46	
42.4	32	2.61	3.130	3.87	4.9	51		
	48.3	40	3.29	3.600	4.47	56	51	
60.3	50	4.18	5.100	6.24	6.8	60		
	76.1	65	5.92	6.540	8.02	84	69	
88.9	80	6.98	8.530	10.3	9.8	75		
114.3	100	10.2	12.500	14.7	12.4	87		
139.7		125	16.400	18.3	15.1	96		
165.1	150	19.500	21.8	17.8	19.6			

1.2 Laying of pipes

The layout of the mains and service pipes will be according to the drawings. The Contractor is to work out the exact position of flanges and (the exact run of all the pipes and must ascertain from the Consultant/Employer that these are approved, before commencing the work.

Where pipes are to be cut and rethreaded, ends shall be carefully filed so that no obstruction to the bore is offered.

All cutting holes, chases, trenches etc, at any place necessary in connection with the work as per items of this tender and subsequent mending damages are to be included in the rates and not to be paid extra unless otherwise specified.

1.3 External Line

Where the pipes run underground these must be fixed at least 45cm belowground level, The galvanized iron pipes and fittings shall be laid in trenches, the width and depth of the trenches for different dimensions of the pipes shall be as given below :

<u>Dia. Of pipe</u>	<u>width of trench</u>	<u>depth of trench</u>
15 mm to 50 mm	30 cm	60 cm
65 mm to 100 mm	45 cm	75 cm

At joints the trench width shall be widened where necessary.

The pipe shall be painted with two coats of anticorrosive bit mastic paint of approved quality. the pipes shall be laid on a layer of 7.5 mm sand and filled up to 15 mm above pipes and the remaining shall then be filled with excavated earth with proper ramming as described in Excavation and refilling. Pipes shall not be hid so as to pass through manhole, catch pit drain under any circumstances. Where it is unavoidable, the pipe shall be carried in sleeve MS/GI pipe as approved by the Consultant/Employer, cost of which should be included in the item rate. Where the service pipe will enter the building below ground level a sleeve pipe is to be provided. The underground water service pipe should be kept at a sufficient distance apart from sewer line, at least 30 cm above where it will cross over the sewer pipe or in common trench. The rates for all above work should be included in item of pipes.

1.4 **internal work**

Where the pipes run along walls these are to be fixed at 25 mm away by clamps fixed at a distance not exceeding 1.80 m apart and both sides of turning point. Where the pipe lines are chased in wall as shown in the drawing or specified in the bill of quantities the pipes are to be secured to wall by hook fixed at an interval of 1 M and hooks at all sides of the branches and turning point. Where the pipes cross RCC/masonry wall, column, beam or pillar, these must pass through the appropriate higher sizes of GI/GI sleeve pipe and arc to be included in the rates. No extra claim will be entertained.

In case the pipe is embedded in walls and floors, it should be painted with anticorrosive bit mastic paint of approved quality and the pipe shall be wrapped in burlap or hessian cloth impregnated with bitumen. The wrapping shall be made to fit tightly over the pipe and where wrapping with a new piece it shall overlap the old one and the joint shall be tied with M.S. wire or nylon thread.

It should not come in contact with lime mortar or. Lime concrete as it is corroded by lime. All pipes should be fixed truly horizontal and vertical, Under the floor the pipes shall be laid till a layer of sand filling done under concrete floors.

For pipes 15 mm to 50 mm diameter the holes in the walls and Floors shall be made by drilling with chisel or jumper and not dismantling the brick work or concrete. After fixing, the holes shall be made good with cement mortar 1:3 and properly finished to match the adjacent surface. Union is to be provided in each of the vertical riser or drop on and from water tank one each near the petcocks valve. The long screw fittings are to be fitted at an interval of 3 meters for long horizontal line and inside the lavatory/kitchen/laboratory etc after 2 meters,

1.5 Testing the Joints and Lines

After laying and jointing the pipes and Linings shall be inspected under working condition of pressure and flow. Any joint found leaking should be removed and replaced without extra cost. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6 kg/sq.cm. (60 metre or double the design working pressure whichever is more) for internal work and for CI water main a pressure of 7 kg. per sq.cm. The pipes shall be carefully charged with water allowing all air to escape and voiding all shock or waterhammer. As water comes out of taps, stop cocks shall then be dosed and specified hydraulic pressure shall be applied gradually. Pressure gauges should be accurate and preferably should have been tested. The test pressure should be maintained without loss.

1.6 Painting (Exposed)

On completion of the test the exposed pipes and are to be painted with two coats of _____. - synthetic enamel paint. or approved colour over coat of priming and the pipes running underground shall be painted with two coats of anticorrosive bitumastic paint with sand bed all round.

Measurement

The length shall be measured in running metre correct to 2. decimal places for the finished work, which shall include the GI pipes and fittings such as bends, tees, elbows etc. but excludes brass or gun metal fixtures like taps, cocks, valves, PVC connectors, etc. The length shall be taken along the centre line of the pipes and fittings as mentioned above. All pipes and fittings shall be classified according to their diameters, method of jointing and fixing substance, quality and finish. T.I.C diameter shall be the nominal diameters of the internal bore.

2.0 BALL VALVE

2.1 Material

The ball valve shall be of high or low pressure class as mentioned in the schedule of quantities and shall be obtained from approved and reputed manufacturer. The nominal size of a ball valve shall be that corresponding to the size of pipe for which it is used. Unless otherwise specified the ball valve shall be of brass or gun metal and the float for low pressure in polythene and for high pressure in copper. Details of an associated components and their materials are to be best available quality.

The ball valve shall generally conform to IS-1703-1968. The weight of ball cock and the size of the ball shall be as per table given below:

Dia.	Total weight in gms.	
	H.P.	L.P
15	524	481
20	986	867
25	1549	1411
32	2120	1873
40	2646	2303
50	4454	3959

The ferrules for connection with CI main shall be obtained from the approved manufacturer as specified. It shall be non-ferrous material with a CI bell mouth cover and shall be of nominal bore as specified. The ferrule shall be fitted with a screw and plug or valve capable of complete shutting off the supply to the connected pipes as and when required. For fixing ferrule the empty main shall be drilled and tapped at 45 degree to the vertical and ferrule screwed in. The ferrule must be so fitted that no portion of the screw shall be left projecting within the main to which or valve it is fitted.

DIAMETER OF IN AND OUT OPENINGS

DIA IN	DIA OUT	DIA IN	DIA OUT
1/8"	1/2"	1/2"	1/2"
1/4 "	1/2"	3/4"	3/4"
3/8 "	1/2"	1"	1"

4.0 BRASS GUN METAL. NON-RETURN VALVE (CHECK VALVE)

The non return valve shall be of brass or gunmetal as specified and shall be of horizontal or vertical flow type and of the size as listed. The Valve shall be approved quality heavy type and shall be obtained from the approved manufacturer and shall have the following weights with a tolerance of 5 percent.

Dia in mm	horizontal type n kg.	vertical type in kg.
15 0.	30	0.25
20 0.	55	0.25
25 0.	90	0.75
32 1.	25	0.90
40 1.	70	1.20
50 2.	90	1.45
65 5	.25	2.15
80 7.	70	4.10

5.0 FOOT VALVE

This is generally placed at the lower end or the suction pipe of centrifugal or other pump to prevent the suction pipe from emptying. When the pump is first started it does not have to exhaust the air from the suction with pipe, the result is that prompt starting of the pump is secured. Foot valve is particularly useful when the suction lift or vertical height of the pipe is considerable.

6.0 SLUICE VALVE

The sluice valves is used in a pipe line for controlling or stopping flow of water, This should be of inside screw, non-rising spindle type, sluice Valves from 50mm to 300 mm sizes with hand wheel for operation usually. These shall be obtained from the approved listed manufacturer. Sluice valve shall be of two classes and the test pressure and maximum working pressure are as follows:

Body	Seat	Test Pressure		Maximum Working Pressure
		Kg/cm ²	Kg/cm ²	
Class PN I		15	10	10
Class PN 1.6		24	16	15

The bodies, domes, covers, stuffing box, thrust plates, hand wheel, wedges, gland shall be of cast iron and spindle shall be machines from rolled, extruded or forged high tensile brass or aluminum bronze. The tensile strength of the rolled, extended or forged metal shall be less than 44 kg/m² with a minimum elongation of 20 percent on a gauge of 5cm. The rings and spindle nut may be of non-ferrous or ferrous metal.

MINIMUM FINISHED WEIGHT OF SLUICE VAVE
(all dimensions in millimeter)

SI no.	particulars	weight in kg of nominal size (mm)
1.	weight of valve Excluding cap Or hand wheel	
	Class pn I	20 22 30 43 55 70 120 175 240
	Class 1.6	24 27 36 55 67 185 150 225 300
2.	weight of cap Class pn 1	1.3 1.3 1.3 1.3 1.3 1.3 1.5 1.9 2.4
	Class 1.	6 1.3 1.3 1.3 1.3 1.3 1.3 1.5 1.9 2.4

The test shall be conducted under constant pressure for a period of time sufficient for a thorough inspection of the valve but not less than 2 minutes for each test. For sluice valves above 300 mm size should conform to relevant IS specification.

Air Valves

They are placed at every summit in the pipe to permit the escape of air when main is filled and afterwards air, if any is carried into the main (They were also placed on long stretches of nearly level main).

Scour Valves

These are placed at the bottom of all depressions for emptying the main or letting out sediment.

Reflux Valves

These are fixed on the ascending parts of the main which open in the direction of flow but automatically close if a burst occurs and the water flows back. They diminish the damage done by the escape of water at a burst.

Safety or relief valves

These are fixed at the downstream end of long lengths of mains: and where water hammer may take place so as to reduce to the normal any excessive pressure that may occur.

7.0

WATER METERS

7.1

WATER METERS (Domestic Type)

The water meter body shall be of bronze, gunmetal or brass and marked to read in liters complete with registration box, cap and lid. The water meters shall be provided with strainers. Strainers shall be of material which is not susceptible to electrolytic corrosion. They shall be rigid, easy to remove and clean and shall be fitted on the inlet side of water meter. It shall be possible to remove and clean the strainer in such the way as not to permit disturbing the registration box for cleaning, and shall be fitted with an additional external strainer on the inlet side and rates quoted by contractor shall include for same. The nominal sizes of Domestic meter are 15, 20, 25, 40 and 50 mm and denote the nominal bore of its inlet.

The meter casting shall be fitted in the pipe line by two conical or cylindrical nipples or tail pieces with connecting nuts. Water meters should be made of the same materials as specified for body.

7.2 WATER METERS (Bulk type)

This shall be of size 50 mm to 500 mm. Water meter may be either vane wheel type ranging from 50 mm to 300 mm of Helical type ranging from 50 mm to 300 mm. In vane wheel type meter runner or impeller is mounted (In a vertical spindle which has several vanes symmetrically spaced around the axis. In helical meter running is provided with nos. of vanes forming a multi threaded helix.

7.3 Marking

Each meter have be marked with the following information

- (a) Nominal size
- (b) Direction of flow
- (c) I.S.I. certification mark
- (d) Manufacturers name and trade mark.

7.4 General

Water meter and their parts, especially parts coming in continuous contact with water, shall be made of materials resistant to corrosion and shall be nontoxic. Use of dissimilar metals in contact under water shall be avoided as far as possible to minimize electrolytic corrosion. The drop in pressure, in feet of water in passing through the meters (of all sizes) should be stated specifically.

7.5 Body

The body of the meter shall be made from cast iron or non-ferrous metals but not aluminum alloy, where made of cast iron, the quality of cast iron shall conform to Grade 20 of LS. 210-1 Y62: where made of non-ferrous metals, it shall be made from bronze, brass or any other corrosion resistant metal having physical properties not less than Grade 2. The body shall be made free from all manufacturing and processing defects such as blow holes and spongy structure and shall not be repaired by plugging, welding or by the addition of the materials. The internal shape shall ensure easy dismantling.

7.6 Connection

The meter casing shall be fitted into pipe line by means of a double flange, the internal diameter of which shall be equal to the nominal size of the meter. Flange shall be machined flat, that is without raised joint face.

7.7 Screws, Studs and Nuts

Screws, studs and nuts shall be of mild steel, brass or other corrosion resistant material of approved type and quality.

7.8 Cap

The cap shall be of same material as those specified for body or shall be made of brass or approved type and quality.

Cap may be made of suitable aluminum alloy where so desired. The edge shall lap over the circumference of the registration box in order to prevent the penetration of dirt. The transparent window which covers the dial shall be inserted from inside into the cap. The protective lid shall be secured by a robust hinge or other suitable method of robust construction. The provision shall be such that it may be conveniently operated from the top. Where the provision is designed for use in conjunction with pad locks the hole provided for pad locks shall be of a diameter not less than 4 mm. Where so required, for dry type water meters, the transparent window covering the dial shall be provided with a wiper on the inner side for wiping of condensed water.

8.0 BRASS BID COCK AND STOP COCK

A Bib Cock is a draw off tap with a horizontal inlet and side outlet and Stop Cock is a valve with a suitable means or connection for insertion in a pipe line for controlling or stopping

the flow. The handle shall be of screw down type. The closing device should work by means of disc, carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angles to the axis of the threaded spindle which operates it. The handle shall be either crutch or butterfly type or standard head securely fixed to the spindle. Valve shall be of the loose leather seated pattern.

The cocks shall open in anti-clock wise direction: The bib cock and stop cock shall be polished bright, if chromium plated. Finish must be of approved type. Finished weight of the bib taps and stop taps are as follows :

Size in nun	Minimum finished Weight in. Kg	
	Bib taps	Stop taps
15	0.40	0.40
20	0.75	0.75
25	1.25	1.36
32		1.80
40		2.25
50		3.85

In finish and appearance the plated articles when inspected shall be free from plating defects such as blisters, pits, roughness and unplated areas and shall not be stained or discolored. Before a fitting is plated, the washer plates shall be removed from the fittings.

The gland packing shall be protected from the plating solution.

8.1 **Gunmetal Bib Cock and Stop Cock**

These shall be of gun metal screw down patterns. So far as the general requirements or materials are concerned these shall be similar to those as described above. The weights are also same.

9.0 **BRASS FULLWAY VALVE**

Full way valve is a valve with suitable means of connection for insertion in a pipe for controlling or stopping the flow. The valve shall be of brass tilted with a cast iron wheel and shall be of gate valve type opening full way and of the size as specified.

The valve shall be of best quality of approved make as listed and shall have the following approximate weights with tolerance of 5%.

Dia. (in mm)	flanged end (kg)		screwed end (kg)	
15	1.021	(provisional)	0.567	(provisional)
25	1.503	"	0.680	"
32	3.232	"	1.077	"
40	4.082	"	1.559	"
50	6.691	"	3.232	"
65	10.149	"	6.804	"
80	13.381	"	8.845	"

9.1 **Gun Metal Full Way Valve with Wheel**

This shall be of the gun metal fitted with wheel and shall be of gate valve type opening full way. This shall generally be of approved make as listed.

10.0 **Water Tank**

Installing, hoisting of readymade PVC, mild steel, galvanized iron pressed steel, Asbestos cement water tanks constructing the RCC tanks shall be carried out with proper care, using

best quality materials, care being taken that no part of the tank or of the structure is damaged during operation. the tanks shall be installed to level and drawing. Steel tanks of capacity up to 1800 liters (Mildsteel or galvanized iron as specified) shall be 1.6 mm thick shed riveted to 32mm x 32 mm x 6 mm angle iron frame complete with stills' cover with locking arrangement including providing pads of sizes as required for inlet and outlet pipes. GI overflow pipe piece of specified size with mosquito net coupling and with backing nut of required sizes shall also be provided. Support for tank shall be provided as specified and shall be measured and paid for separately. P.S. tanks, details and arrangements, installation should be as per manufacturers' specification.

10.1 **Pipe Inserts/Puddle Piece**

GI pipe inserts or MS/CI puddle pieces to be kept in position for outlets, washout and interconnection of tanks while casting RCC/masonry tank shall be of the specified size and diameter and shall be threaded throughout its length. For GI Pipe insertion a 50 mm x 150 mm MS plate 6 mm thick shall be welded centrally on to the threaded body of pipe as directed. Rates quoted shall include for the same.

SECTION – IV

TECHNICAL SPECIFICATIONS FOR SEWERS AND DRAINS

1.0 STONEWARE PIPES

1.1 Materials

The S. W. Pipes with spigot & socket ends and fittings should be Grade 'A' and shall be obtained from approved manufacturer listed in the tender. The pipes shall conform to IS 651-1955.

These shall be sound and free from visible defects such as fire crack or hair crack and Haw or blister, The pipe shall give a sharp clear note when struck with a light hammer and should be perfectly salt glazed. The approximate thickness of 60 cm, Long pipes shall be as given in the table below:

1.2 S. W pipes

Internal diameter of the pipe in mm.	Thickness of the barrel & socket in mm,	weight of each pipe per meter in kg
100	12	14
150	15	22
200	16	33
230	19	44
250	20	52
300	25	79

The length of pipes shall be 60 cm exclusive of the internal depth of socket

1.3 EXCAVATION OF TRENCHES

The gradient is to be set out by means of sight and bonning rods and the required depth be excavated at any point. The trench shall be excavated as directed by the consultant/employer. The depth of the trench shall not be less than 1 meter measured from the top of the pipe to the surface of the ground under roads and less than 0.75 m elsewhere. The width of the trench shall be nominal diameter of the pipe plus 40 cm but it shall not be less than 80 cm in case of all kind of soil excluding rocks and not less than 55 cm. in case of work.

The bed of the trench, if in soil or made up earth, shall be well watered and rammed before laying the pipes and the depressions if any shall be properly filled with earth ahead consolidated in 20 cm layers.

If rock is met with, it shall be removed to 15 cm below the level of the pipe and the trench will be refilled with excavated materials and consolidated. The excavated materials shall not be placed within 1 (one) meter or half of the depth of the trench whichever is greater from the edge line of the trench,

The materials excavated shall be separated and stacked so that in refilling they may be re-laid and compacted in the same order to the satisfaction of the Consultant/Employer. After the excavation of the trench is completed, foundation of cement concrete (1 : 3 : 6) or lime concrete as specified of proper width and thickness to be laid with proper level all along under the length of the pipe with hunching as per drawing.

1.4 Laying, Jointing, & launching of the pipe and fittings

The rain pipes shall be laid in straight lines and to even gradients as shown on the drawings. The socket end of the pipes shall face upstream. Adequate care shall be exercised in getting out and determining the levels of the pipes and the contractor shall provide suitable instruments, templates sight rails, bending rods and equipment as necessary for the purpose. Joints are to be kept wet until the cement joints are properly

set with wet bag. The cement mortar joints shall be cured at least for seven days. In case of S. W. Pipes joint" (socket and spigot), they should be caulked first with tarred jute (spun) soaked in cement slurry of requisite diameter, almost quarter depth of the socket, at which cement mortar (1:1) is pushed in with wooden chisel and finished beveled at outside at 45 degree. Instead of jute or hemp rubber gasket of proper size may also be used. In case of pipes less than 25 cm dia. joints should be made at ground level with 3 pipes at a time and for larger ones 2 pipes at a time and after curing they should be rolled in foundation with the help of ropes. Pipes should be properly launched and/or provided with chair as per drawing. Details of the foundation and covering etc. are to be taken from the drawing provided. Where the pipes are crossing the building or road around concrete 1:4:8 is to be done to 15 cm thick over the barrel of the pipe.

Any treasure-trove, coin or object or antiquity which may be found on the site shall be molded over the Employer.

4.0

R.C PIPES

4.1

MATERIAL

RCC pipes should usually be NP2 class' if not specified otherwise and shall be obtained from approved manufacturer as listed. These should be (If best quality, true to shape, straight, perfectly sound, free from cracks and flaws, and densely packed. The internal and external surface of the pipes shall be smooth and hard. The approximate thickness and weight of R.C.C. Pipes NP-2 are given below:

R.C.C.	Spun	pipes		NP2		Class	
Inside (Nominal) dia. of pipe	Thickness of wall	Min. thickness of collar	Min. thickness of collar	Min. length of collar	No.	Longitudinal reinforcement	Spiral reinforcement
mm	mm	mm	mm	mm		Wt, Kg./m	Kg./m
100(100)	25	13	25	150	6	0.86	0.17
150(100)	25	13	25	150	6	0.86	0.22
200(200)	25	13	25	150	6	0.86	0.46
250(250)	25	13	25	150	6	0.86	0.71
300(300)	30	16	30	150	8	1.00	1.29
350(350)	32	16	32	150	8	1.00	1.75
400(400)	32	16	32	150	8	1.00	2.25
450(450)	35	19	35	200	8	1.25	2.75
500(500)	35	19	35	200	8	1.25	3.22
600(540)	45	19	40	200	8		4.90
700(680)	50	19	40	200	8	1.7X	6.05
800(790)	50	19	15	200	8	1.7R	10.10

4.2

HANDLING AND LAYING OF PIPES

Reasonable care shall be exercised in loading, transporting, avoid impact and sorting out the broken and defective ones. Pipes shall be carefully lowered true to line and grade specified and always proceeded up grade of a slope. The socket end shall face upstream. In the loose collar joint, the collar shall be slipped on before the next pipe is laid.

Adequate and proper expansion joint shall be provided where necessary. The sections of the pipe shall be joined together in such a manner that there shall be as little unevenness as possible along the inside of the pipe.

If the foundation conditions are unusual i.e. in proximity of trees or poles, under manholes, etc. the pipe shall be encased in low strength concrete bedding as mentioned in S. W. Pipes.

4.3 Condition of laying

For the purpose of laying R.C. Pipe, conditions stipulated in relevant is. Code are to be followed.

4.4 Trench Condition .

Where a trench is excavated and refilled after laying the pipe, settlement of the earth in the filled trench takes place. The filling above the top of the pipe settles relevantly more than the side of the trench, thereby developing fractional resistance. The contractor is required to take special pre-conception against the while refilling the trenches, procedure for backfilling as stipulated earlier should be strictly followed.

4.5 Bedding

In cases where natural foundation is inadequate the pipes shall be laid either in concrete cradle supported on suitable structures as per drawing. If a concrete crate bedding is used the depth of below the booms of the pipe shall be at least $\frac{1}{4}$ of the internal diameter and shall extend up the sides of the pipe least to a distance of $\frac{1}{4}$ th of the outside diameter for pipes 300 mm dia. and over. The pipe shall be laid in this concrete bedding before the concrete has set. Pipes laid in trenches in earth shall be bedded wetly and firmly and as far up the haunches of the pipe as to safely transmit the load expected from backfill through the pipe to the bed. This shall be done either by excavating the around the curve of the pipe to form an even bed.

- a) When the pipes are laid completely above the ground the foundation shall be made even and sufficiently compacted to support the pipeline without any material settlement. Alternatively the pipeline shall be supported on P.C.C saddle blocks similar argument shall be made to retain the pipe line in proper alignment, such as by shaping the top of the support to fit the lower part of the pipe. The pipe shall be supported shall in on the joints. In no case shall the joint come in certain of the span.

4.6 jointing of pipes

A few skeins of spun yarn soaked in neat cement slurry be inserted in the groove at the end of the pipe and two adjoining pipes.

Object of the yarn is to centre the two ends of the pipes within the collar and to prevent the cement mortared the joint penetrating into the pipes.

Cement mortar 1:1 (1 cement : 1 sand) or as & specified shall be slightly moisture and must on no account be soil or sloppy, shall be inserted carefully by hand into the joint. It shall then be crammed with a caulking tool. More cement mortar shall be added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall be finished off neatly outside the collar on both sides at an angle of 45°, Any surplus mortar projecting inside the joint is to be removed and to guard against any such projections sack or gunny bags shall be drawn past each joint after completion. The cement mortar joints shall be cured at least for 7 days.

4.7 Testing

Same as that for S. W. pipe drain except that the head of water for testing shall be 2 meters above the top of the highest pipe between two manholes.

4.8 Measurement

The measurement for providing, laying & jointing S.W. pipes and R.C.C. pipes and their fitting shall be taken along their centre lines. The measurement shall be taken from mid of one manhole to inside of the other manhole.

5.0 CHAMBERS/MANHOLES**5.1 Size**

At every change of alignment, gradient or diameter of a drain there shall be a manhole or inspection pit. The maximum distance between manhole chamber shall be 30 M for road, 15 M within compound.

5.2 Size

All manholes shall have internal dimensions as shown on drawings. The depth of invert shall be according to the gradient.

5.3 Foundation

The base concrete shall be 15 cm thick and with 1:4:8 cement concrete laid over the brick flat soling. The slab shall be finished 75 mm beyond the external face of the brick work.

5.4 Brick Work

The brick work shall be in cement sand mortar in the proportion 1:5 and 250 mm thick or as mentioned in the tender. The joints shall be raked out.

Plaster

Inside walls and bottom of pit shall be plastered as specified in the item and shall be finished with floating, coat of neat cement. In wet ground, 20 mm thick plaster shall be done on the exterior surface of the walls also and this plaster shall be waterproof with the addition of approved water proofing compound :15 per manufacturer's specification,

Pointing

In dry ground pointing shall be done in 1:2 cement mortar to the outside surface.

5.5 Hunching and construction

On the top or the base slab from half pipe channel longitudinally at the centre, the channel is to be hunched up with concrete slopping towards from the edge of channel to meet the side of the chamber at gradient of 1:6. The channel and the benching arc to be floated to smooth hard surface with a coat of cement mortar. Extra cement. Sewers are unequal sectional area shall not be joined at the event in a manhole unless it is unavoidable. The branch sewers should deliver sewage in the hole in the direction of main flow and the junction must be made with heel rest bend at the bottom of drop connection. C. J. shall be provided with heel rest bend at the bottom and bend with access door at the top for cleaning purposes.

5.6 Channel

Channel for drains coming from side of the manhole chamber shall be curved to meet the main drainage channel. The channels and bench shall be done in cement concrete 1:3:6 and rendered smooth with neat cement.

The depth of channels and benching shall be as follows :

Size of drain top of channel at the depth of benching of

In mm center above side walls above bed

Bed concrete (cm) concrete (in cm)

100	15	20
150	20	30
200	25	35
250	30	40
300	35	45

350	40	50
400	45	55
450	50	60

the brick work in shallow manhole shall be corbelled to the required size for the cast iron manhole cover and frame.

Footrest

C. I. foot rests or MS. Foot rest with rods of 20 mm dia shall be embedded in masonry. They shall be fixed 225 mm apart vertically and 300 mm horizontally in staggered fashion and projecting 125 mm from the wall face. Foot rest shall be painted with bitumen as directed. First footrest shall be 450 mm from top.

6.0 CUTTLNG HOLES, chases, etc, repairing the same:

Holes and chases to be cut into walls, slabs, etc. must be of the minimum size and extent required to run the service and in no case superfluous cutting is to be resorted to. After the services are laid, the chases and holes must be made good in cement concrete with suitable Finish. These repairs must be done very carefully so that the finished surface is uniform and harmonious with the rest of the adjoining surface. No extra claim will be entertained in this respect.

7.0 **RCPC AND POLYELASTOMER STREET MANHOLE COVERS AND FRAMES:**

- 7.1 Unless otherwise mentioned the covers and frames shall be at IS 2592. Unless otherwise mentioned the covers and frame shall be of IS 2592 Part 1 and Part 11 obtained from approved manufacturer and shall be of approved make and brand as listed. Covers and frames shall be cleanly cast, they shall be free from air and sandholes, cold shut and wrapping which are likely to impair the utility of the casting. All casting shall be free from voids whether due to shrinkage, gas inclusion or other causes. The covers shall be gas tight and water tight with proper seal arrangement, but can be easily opened and closed and it shall be fitted in the frame in workmanship like manner. The cover used for sewer line should bear sewer engraved on top of casting. Similarly for storm line it shall be marked 'storm'. Size and dimensions are given below with weight. 2.5 variations in weight shall be permissible. Size of cover shall be the clear internal dimensions of frame. Covers shall have raised chequered design to provide an adequate non-slip grip. The covers and frames shall be coated with anticorrosive paint of bituminous composition. The frame of manhole cover shall be firmly embedded to correct alignment and levels in R.C.C. slab or plain concrete as the case may be.

8.0 **GULLY PIT**

To be of the standard size 1.06 m x 0.90 m and to be built in cement mortar (3:1) as specified in strict accordance with the drawings. The internal side and the floor are to be finished with 12 mm cement plaster to be fitted with a 150mm C.I. overflow pipe with hinged cover and handle 0.90 x 0.45 C.I. gully grid of the standard weight, 15 cm siphon. The gully grid and frame are to be of rcpc bearing capacity 20 M.T. size grating 700 x 525 x 70 mm and frame 820 x 670 x 165 mm.

S.W. GULLY TRAP

S. W. Gully trap of specified sizes and quality shall be fixed on 15 cm thick cement concrete 1:3 :6 bedding and tile gully outlet of the branch drain shall be joined similar to joining of S. W. pipes. A brick masonry chamber 30 cm x 30 cm internally shall be constructed half brick masonry with 1 :6 cement mortar and the space between the trap and the wall filled up with cement concrete 1:4 :~ and the upper portion of the chamber finished internally with 1:3 cement mortar and finished with neat cement, the corners and the bottom of the chamber shall be rounded off so as to slope towards the grating. In addition the chamber shall have a C.I. grating with frame 30 cm x 30 cm (inside) with machined seating faces, fixed on the top of the brick with cement concrete 1:2:4 and rendered smooth. The weight of grating shall not be less than 4.53 kg. and that of frame 2.72 kgs.

SANITARY AND PLUMBING WORKS

LIST OF APPROVADE BRAND AND MANUFACTURERS

1. SANITARY FIXTURE(FIRST QUALITY VITREOUS CHINA)
M/S PARRY INDIA LTD,M/S HINDUSTAN SANITARY WARES.M/S
MADHUSUDAN CERAMICS
2. FOR stainless steel sink: M/S EID PARRY INDIA LTD,M/S SAIL,M/S JYOTI
INDUSTRIES(NIRALI) JAYNA BRAND
3. PVC FLUSHING CISTERNS – SLIMELINE/COMMANDO/DUROLITE
4. CHROMIUM PLATED BRASS FITTINGS: ESSCO, Jaquar
Kingston, MARE, ESSESS,
5. a) UPVC(SWR). SOIL, WASTE RAIN WATER PIPE AND FITTINGS -IS 13592
SUPREME,PRINCE,ORIPLAST .
b) HCl son, WASTE PIPE AND FITTING IS 1729 : ALC, BIC, AMC,
6. GALVANISED IRON PIPES –IS 1239 :TATA ,NEZONE JINDAL I
8. G.I. FITTINGS: IS:879 'R' Brand manufactured by M's R.M. EngineeringLtd.,
Ahmedabad, 'SUN' Brand, NMC, AA, I-B, Nil
9. GUNMETAL VALVE & COCK: IS:778-84
'Leader' Jallundhr, M/s Bombay Metal & Alloy Mfg. Co.(J) Ltd., Zoloto
Industries, Jallandhar.
10. R.C.C. DRAIN PIPES - IS:458
NP2 class pipe manufactured by: M/S
Hindustan Concrete Pipe, M/S
M/S BHAGIRATHI HUME PIPES: SONALI
BRAND,DURGAPUR M/S WEST BENGAL CONCRETE
INDUSTRIES Pvt. LTD
11. GLAZED STONEWARE PIPE & FITTING IS-651/1955
M/s LIND CERAMICSLTD.
12. WHITE REGID PVC PIPES & FITTING IS 4985 SQR SUPRIM, PRINCE, ORIPLAST.
13. H.D.P.E. PIPE & FITTINGS IS 4984 ORIPLAST, EMCO BRAND.

TECHNICAL SPECIFICATION FOR ELECTRICAL WORKS Contents

Chapter - 1	WIRING DEVICES
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Chapter - 7	EARTHING SYSTEM
Chapter - 8	LIGHTNING PROTECTION SYSTEM
Chapter - 9	LUMINAIRES (LIGHT FITTINGS) AND LAMPS
Chapter - 10	11 KV DISTRIBUTION TRANSFORMER
Chapter - 11	MAINS FAILURE STANDBY GENERATING SYSTEM (D.G. SETS)
Chapter - 12	POWER FACTOR CORRECTION EQUIPMENT
Chapter - 13	ELECTRICAL GENERAL PROVISIONS
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Chapter - 15	ACCEPTABLE MAKES OF MATERIALS – ELECTRICAL

Chapter 1. **WIRING DEVICES**

PART 1 – GENERAL

1.1. WORK DESCRIPTION

- A. The drawings for the lighting and power points indicate approximate positions of all lighting fittings, switches, power outlet points, isolating switch points and the like. The actual positions of all fittings, switches, the wiring details and cable routes shall be co-ordinated with other trades on site and submitted for the approval of the Engineer. All time and cost required adjusting the layout or adjusting the completed installation to Engineer satisfaction and to suit site co-ordination is included in the Contract.
- B. During the exact positioning of lighting and power points, due consideration shall be given to the operational requirements of the installation, the selection of the most accessible routes for wiring and the convenience of switching.
- C. No additional cost will be entertained should the final positions be relocated within the same room or not more than five (5) metres away from the original locations due to any requirement.
- D. For the purpose of this Specification and related Drawings, each lighting and small power point circuits shall in general be coded with a prefix to indicate the corresponding distribution board number; details on the circuit way and phase shall be submitted for the approval of Engineer.
- E. Certain types of electrical equipment or systems involving sudden changes, or low frequency or of direct electric current such as fluorescent lamps, contactors, etc. shall be fitted with radio and television interference suppression components suitable to meet the levels specified in BS 800 "Limits of Radio Interference".
- F. This section included the specification of the following :
 - 1. Distribution boards
 - 2. Miniature circuit breakers
 - 3. Earth leakage circuit breakers
 - 4. 6A Switch Socket Outlet
 - 5. 16A Switch Socket Outlets
 - 6. Shaver Outlets
 - 7. Isolating Switches
 - 8. Conduit Boxes
 - 9. Contactors
 - 10. Dimmers Switch
 - 11. Time Switch
 - 12. Cooler Control Units
 - 13. Water Heater Switches
 - 14. Bell Push Switches

1.2. STANDARDS

- A. The complete wiring installation shall be engineered according to manufacturer data and constructed in accordance with the latest revision of the IS and the appropriate BS/IEC
- B. In the adoption of standards and requirements, the Contractor shall take the following precedence:
 - 1. Engineer's decision;
 - 2. Local codes of practice;
 - 3. Drawings;
 - 4. Specification;
 - 5. International standards and requirements.

1.3. SUBMISSION

- A. All technical submissions shall be approved by the Engineer prior to the respective stages of construction.
- B. As a minimum requirement, the submission shall include the following:
 - 1. Equipment catalogues submission with manufacturer's data;
 - 2. Sample submission include all wiring accessories;
 - 3. Shop Drawings of the lighting and power positions, circuit numbers, cable routings, switching arrangement, mounting height, etc. The positions and mounting heights shall be coordinated with other services. Fixing details of all wiring accessories shall also be included.
 - 4. Drawings showing the installation details.
 - 5. Labeling system
 - 6. Builder's works requirement.

PART 2 – PRODUCT

2.1. LIGHTING POINT INSTALLATION

- A. The various types of light fittings to be supplied and installed are described in the drawings and the Schedule of Lighting Fittings on Drawing
- B. Surface mounted light fitting shall terminate at a junction box having entries appropriate to the run of conduit and shall be complete with porcelain/ PVC connector suitable for the size and number of connections to be made at the point and the wiring required to connect the specified fitting. Wiring to the light fittings within the false ceiling spaces shall be by means of heat resistant (butyl or silicon rubber insulated to BS 6500) cables i.e. between the junction box and the lamp holder/terminal blocks, in flexible conduits.
- C. At every light fitting an approved type earthing terminal shall be provided for connection of the circuit protective conductor of the final circuit.
- D. Ferrous metalwork shall be of minimum thickness of 1mm. treated against corrosion by galvanizing after welding or be lead primer or other approved process. Metalwork shall be painted with one priming coat, one under-coat and two top coats finished stove-enamelled matt white, unless otherwise specified.
- E. Cables used for internal wiring of the lighting fittings shall be of appropriate type and size and number. Conductor shall be of size not less than 1.5 sq.mm. single core or the

equivalent. The insulation of the cables shall be able to withstand throughout the life of the fitting the maximum temperature to which it will be subject in normal use without deterioration which could affect the safety of the fitting.

- F. Cables within the lighting fittings shall be neatly bundled by nylon self locking cable ties; wiring shall be properly routed and secured away from control gear etc. wherever possible.
- G. All cable terminations within the light fittings shall be suitably shrouded to the approval of the Engineer.
- H. All lighting fittings shall be self-supporting complete with the appropriate fixing accessories such as clips, supporting brackets, suspension sets, nuts, washers, screws etc. for the proper installation of the fittings on different types of ceiling panels. Suspension sets shall be of adjustable type suitable to carry the weight of the lighting fittings and unless otherwise stated or indicated on Drawings, the suspension sets shall be generally 900 mm in length; exact lengths required shall suit site situations.
- I. All lamps complete with control gear necessary in operational condition shall be provided together with the lighting fittings as specified.

2.2. SWITCHES

- A. Lighting switches, unless otherwise specified, shall be single pole, quick make and slow-break, silent switch action type with solid silver alloy contacts and totally enclosed switch action for flush or surface mounting as required.
- B. Lighting switches shall be suitable for indoor or outdoor service according to location, housed in standardized purpose manufactured galvanized steel boxes completed with conduit knockouts made up into single or multi-gang units employing a grid switch system of fully interchangeable components at standardized fixing centres of matching switches of different types and ratings but of identical dimensions, push buttons, neon indicator lamps, blanking units, grids, steel boxes and plates all capable of integration into standard composite assemblies in any combination as required.
- C. Grids shall be adjustable for variation in depth of plaster and for squaring errors and of the same type for surface or flush mounting.
- D. Switches in mechanical plant rooms and electrical sub-stations and switch rooms shall be of the metal clad type approved by the Engineer, mounted in flush or surface conduit boxes as specified elsewhere.
- E. Switches located on brick or concrete walls shall be mounted in horizontal arrangement in plaster depth steel boxes or in galvanized steel boxes using box suspension straps and cover plates. Countersunk screws shall be provided for fixing to the conduit boxes.
- F. Switches for external use shall be of weatherproof construction with IP65 rating, unless otherwise specified.
- G. Samples of all switches, conduit boxes and plaster depth boxes shall be submitted to the Engineer for approval prior to installation.
- H. Samples shall be rated for 6 Amps (minimum light switch rating 6A), 16 Amps or 20 Amps as determined by circuit load which for inductive lighting circuit shall be assessed at twice the steady state connected load current, one way or two ways as indicated on the drawings and fixed generally at a height of 1200 mm from floor level and where located in rooms the switch shall, where possible be located on the inside of the room on the handle side of the door as close to the door as is practicable.

- I. An earthing terminal, connected to the earth continuity terminal shall be provided and connected to the circuit protective conductor at every lighting switch positions.
- J. Single pole switches shall be connected to break the phase wire of the supply; the neutral wire shall not be routed through switch boxes.
- K. Switches which are mounted in the same location shall be of multi-gang type, of the maximum number of gangs available.
- L. All switches used shall be of approved or prescribed items as required by local Authorities.
- M. Circuit from different phase and circuit from emergency power should have separate switch plate.

2.3. ISOLATION SWITCH

- A. Isolating switches shall be of the current ratings and number of poles (generally double pole for single phase and 4-pole three phases) as indicated on the Drawings.
- B. Isolating switches shall be of the totally enclosed pattern, metal-clad or polycarbonate with positive quick-make and quick-break action.
- C. Switches shall be capable of passing and also interrupting their full rated current safely and without damage.
- D. Ferrous materials shall be galvanised, switch handles shall be interlocked to prevent opening the cover with the switch "ON".

2.4. 6 AMP SWITCH SOCKET OUTLETS

- A. Switch socket outlets shall be as per BS1363 single pole 6 Amp 3 round pin shuttered outlets, one or two gang for indoor service except otherwise specified and either surface or flush mounting according to location.
- B. Switches shall be of the quick-make slow break type with silent, totally enclosed switch action and solid silver alloy contacts. Switched socket outlets for indoor use shall be housed in suitable galvanized steel boxes to BS 4662 with conduit knockouts. Types and finishes of socket plates shall match those for the lighting switches.
- C. Generally switch socket outlets shall be positioned 300 mm above floor level except in plant rooms, kitchen, etc. where they shall be positioned 1400 mm above floor level or 150 mm above counters or benches whichever is suitable.
- D. Switch socket outlet in all mechanical plant rooms, electrical switch rooms shall be of the metal clad type, with recessed or protected switch dolly, mounted in flush or surface conduit boxes as specified elsewhere.
- E. All switch socket outlets used shall be of an approved quality.

2.5. 16 AMP SWITCH SOCKET OUTLETS

- A. 16 Amp switch socket outlets shall be 3 pin round type to BS 546 shuttered, of a finished similar to 6 Amp switch socket outlets and flush mounted in galvanised steel conduit boxes to BS 4662 requirements.

2.6. WEATHERPROOF ISOLATOR

- A. Weatherproof enclosure shall be of the high impact, water resistant to IP65. The isolator provided shall complete with lockable device. Isolators shall be double-pole, 4-pole as specified.

2.7. LIGHTING DIMMERS SWITCH

- A. Lighting dimmer switch shall be the solid state, variable load, Thyristor controlled type suitable for controlling fluorescent and or incandescent lighting circuits operating at $230V \pm 6\%$ 50Hz single phase AC supply.
- B. Dimmer switch shall be manufactured to eliminate TV and radio frequency interference in compliance with IS.
- C. The ratings of the dimmer units shall be suitable for lighting circuit specified on Drawing.

2.8. TIME SWITCHES

- A. Time switches shall be self-contained units suitable for mains operation. All units shall have a self-starting synchronous motor with a single-pole fuse in the motor circuit, a 3-way terminal block and a thirty-six (36) hours spring reserve complete with an automatic solar dial.
- B. When fitted, the solar dial shall be capable of switching ON at sunset and OFF at sunrise throughout the year by control of a secondary calendar dial with month and day settings, and the automatic switching time shall be adjustable.
- C. Time switches shall be encased in a dust-tight metal casing have a hinged front cover with a clear Perspex window. The casing shall be effectively earthed.
- D. A manual bypass switch shall be incorporated with the time switch to facilitate maintenance of the latter.

2.9. MINIATURE CIRCUIT BREAKER

- A. The MCB shall be suitable for manual closing and opening and automatic tripping under overload and short circuit. The MCB shall also be trip free type.
- B. Single pole/three pole versions shall be furnished as required.
- C. The MCB shall be rated for 10 KA fault level.
- D. The MCB shall be suitable for its housing in the lighting boards and shall be suitable for connection at the outgoing side by tinned cable lugs and for bus-bars connection on the incoming side.
- E. The terminal of the MCBs and the open and close conditions shall be clearly and indelibly marked.
- F. The MCB shall generally conform to IS: 8828.

2.10. EARTH LEAKAGE CIRCUIT BREAKER

- A. ELCB shall be 4 pole 415 volts 50Hz, 30-300mA sensitivity. These shall be of approved make. The rating of the ELCB shall be as required. These shall be suitable for manual closing and opening and automatic tripping under earth fault circuit of 30-300mA as specified in item of work.
- B. The enclosure of the ELCB shall be moulded from high quality insulating material. The material shall be fire retardant, anti tracking, non-hygroscopic, impact resistant and shall withstand high temperature.
- C. All parts of switching mechanism shall be non-greasing, self lubricating material so as to provide consistent and trouble free operation.
- D. Operation of ELCB shall be independent of mounting position and shall be trip free type.

2.11. LIGHTING/SMALL POWER DISTRIBUTION BOARDS

- A. Distribution boards shall be of standard make with MCBs as per approved make given. Distribution boards shall be constructed out of steel sheet all weld enclosure with double door IP42 protection and shall be powder coated.
- B. Ample clearance between the conductors of opposite pole, between conductors and sheet steel body shall be maintained in order to obviate any chance of short circuit. Removable conduits entry plates shall be provided at top and bottom to facilitate drilling holes at site to suit individual requirements.
- C. Also on additional/separate adopter box of suitable length and size shall be provided to accommodate wires and cables. No. of conduits etc. and nothing shall be payable on this account.
- D. The MCBs shall be mounted on high grade rigid insulating support and connected by electrolytic copper bus bars.
- E. Each incoming MCB isolator shall be provided with solder-less cable sockets for crimping.
- F. Phase separation barriers made out of arc resistant materials shall be provided between the phases. Bus bars shall be colour coded for phase identification.
- G. Distribution boards shall be recessed in wall niche or if required mounted on the surface of the wall with necessary clamp bolts etc.
- H. The mounting height shall not exceed 1200mm from finished floor level. Distribution board shall be provided with proper circuit identification name plate and danger sticker/plate as per requirements.
- I. All the distribution boards shall be provided with engraved name plates with 'lighting', 'power' or 'UPS' with DB Nos., as the case may be.
- J. Each DB shall be provided with a circuit list giving details of each circuit. All the outgoing circuit wiring shall be provided with identification ferrules giving the circuit number & phase.
- K. Each distribution board shall have a separate neutral connection bar and a separate earth connection bar mounted within the DB each having the same number of terminals as the total number of outgoing individual circuits from the distribution board. Conduit & cable armouring shall be bonded together & connected to the distribution board earth bar.
- L. Where oversized cables are specified due to voltage drop problems, it shall be contractors responsibility to ensure that satisfactory terminal arrangements are provided without an extra cost.

2.12. TELEPHONE OUTLETS

- A. Telephone outlets where called for shall be single or twin of the flush mounted type suitable to receive the plug-in telephone cable lead to the approval of the Telecom. The finishes of the telephone outlet plates at various areas shall be as specified for lighting switches.

2.13. WATER COOLER DRINKING FOUNTAIN SWITCHES

- A. Water cooler switches shall be flush-mounted having double pole AC switch rated at 20 amps and marked "water cooler".
- B. Associated connector units shall be provided next to the water cooler.
- C. The switches and the connector shall be IP65 waterproof rating.

2.14. BELL PUSH SWITCHES

- A. Bell push switches shall be flush-mounted having a single-pole AC switch rated at 6 amps and marked with bell symbol.

2.15. SHAVER OUTLETS

- A. Shaver outlets shall comprise a 20VA continuously rated double wound isolating transformer to provide an earth-free AC supply at mains frequency, complete with self resetting thermal overload device fitted in the primary circuit an insulated voltage selector switch to provide either 115 or 230 volt output, one ON-OFF switch and one universal socket outlet suitable for British, American, Continental and Australian razor plugs, all contained in a recessed sheet steel box with insulated moulded front plate suitable for flush, mounting and suitably inscribed to give a clear indication of the voltages available at the outlet and the service of the outlet.

2.16. COOLER CONTROL UNITS

- A. Cooler Control Units shall be flush mounted having a double pole AC switch rated at 30 amps complete with pilot indicating lamps and a self adhesive plastic identification label mounted on a removable chassis contained within steel box finished aluminium stoved enamel provided with conduit knockouts and earthing terminals. The cover plates shall be of the same finish as those specified for the lighting switches.
- B. Associated connector units shall be provided adjacent to the cooler units.
- C. Wirings between the cooler control units and associated connector units shall be provided in concealed conduits.

2.17. WATER HEATER SWITCHES

- A. Water heater switches shall be flush mounted having double pole AC switch rated at 20 amps fitted with pilot lamp and marked "water heater". The cover plates shall be of the same finish as those specified for the other switches. Associated connector units shall be provided next to the water heater units.

2.18. POWER SUPPLY FOR LIGHTING AT WET CONDITION

- A. Residual Current Circuit Breakers shall be provided individually for each circuits serving lighting subject to wet condition.

Chapter 2. WIRES AND CABLES

PART 1 – GENERAL

1.1. WORK DESCRIPTION

- A. The design manufacture, testing and supply of single core PVC insulated 1.1 KV grade stranded twisted wires under this specifications shall comply with latest edition of following standards.
 - IS-3961: Current rating for cables.
 - IS-5831: PVC insulation and sheath of electric cables.
 - IS-694: PVC insulated cables for working voltage up to and including 1100 volts.
 - IEC-54 (I): PVC insulated cable.

- B. Copper/Aluminium stranded twisted conductor PVC insulated wires shall be used in conduit as per item of work. Aluminium for power cables and copper for control cables shall be used.
- C. The wires shall be colour coded R Y B, for phases, Black for neutral and Green for earth.
- D. Progressive automatic in line indelible, legible and sequential marking of the length of cable in meters at every one-meter shall be provided on the outer sheath of cable.
- E. The design, manufacture, testing and supply of the cable under this specifications shall comply with latest edition of following standards:
 - IS: 8130: Conductors for insulated electric cables and flexible cords.
 - IS: 5831: HRPVC/HR PVC insulation and LSZH sheath of electric cables.
 - IS: 3975: Mild steel wires, strips and tapes for armouring cables.
 - IS: 3961: Current rating of cables.
- F. The routing and the minimum rated current carrying capacity of the LV power cables shall be as indicated on the Drawings. The Contractor shall consider the manufacturer data and engineering the cable sizing to ensure it suit the conditions, viz grouping, ambient temperature etc., and for making any necessary adjustment to the Engineer's approval.
- G. All LV cables for normal power/control circuitries within buildings shall be copper conductor with XLPE insulated and PVC sheathed, denoted as XLPE/PVC cable or copper conductor with PVC insulated, denoted as PVC cable as specified.
- H. All LV cables for emergency power circuitries serving emergency lightings, Building Management System (BMS), Fire Protection System, Security Systems, emergency communication systems, and sump pump system and fire lifts etc. with back-up from standby generator sets or UPS systems or incoming and outgoing from the Emergency Main Switchboard shall be fire resistant cables as required.
- I. Cablings in service ducts, open trenches, direct-laid underground in soil shall be by means of armoured cables. Non-armoured cables shall be laid in conduits, trunkings or tray/ladder for mechanical protection.

1.2. STANDARDS

- A. Complete cabling shall be manufactured and constructed in accordance with the latest revision of the following standards :

1.	IS: 694:	HRPVC/XLPE insulated (heavy duty) electric cables for working voltage up to and including 1100 volts.
2.	IS:424-1475 (F-3):	Power cable-flammability test.
3.	IS:7098 (I):	Specification for cross-linked polyethylene insulated LSZHPVC sheathed cable for working voltage up to 1.1 KV.
4.	IS:1554:	Specification for PVC insulated (heavy duty) electric cables for working voltages up to and including 1100 volts.
5.	AS TMD:2863:	Standard method for measuring the minimum oxygen concentration to support candle-like

		combustion of plastics (Oxygen Index).
6.	ASTMD:2843:	Standard test method for measuring the density of smoke from the burning or decomposition.
7.	IEEE:383:	Standard for type of tests Class-IE, Electric cables, field splices and connections for power generation station.
8.	ASTME:662/IEC: 754(x):	Standard test method for specific optical density of smoke generated by solid materials
9.	IS:1041 8:	Cable drums.
10	IS-1081 0:	Testing method of cable.
11.	IS-6121:	Cable glands.
12.	IS-9537:	Rigid steel conduit.

- B. The manufacturing of the cable shall also conform to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in this Specification and Drawings, whichever is the more stringent and acceptable to the Engineer.
- C. In the adoption of standards and requirements, the Contractor shall take the following precedence:
1. Engineer's decision;
 2. Local codes of practice;
 3. Drawings;
 4. Specification;
 5. International standards and requirements.

1.3. SUBMISSION

- A. All technical submissions shall be approved by the Engineer prior to the respective stages of construction.
- B. As a minimum requirement, the submission shall include the following:
1. Equipment submission with manufacturer's data
 2. Sample submission
 3. Shop Drawings of the cable routings showing the co-ordinated routing of cables, arrangement on cable trays, methods of fixing of cable trays and cables, etc. All conduits including concealed conduit routing drawings shall also be included
 4. Cable test reports and IS Certification
 5. Builder's works requirement
 6. Cable schedule indicate the following data include:
 - a. Cable code and type and installation method
 - b. Cable feed from and serve to
 - c. Cable route length and voltage drop

- d. Cable capacity and
- e. Upstream protection breaker rating The cable schedule shall be prepare in according to the cable manufacturer's data..

PART 2 – PRODUCT

2.1. LV CABLES

1. The cables shall be suitable for laying in racks, ducts, trenches conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.
2. They shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating condition.
3. The aluminium/copper wires used for manufacturing the cables shall be true circular/sector in shape before stranding and shall be of uniformly good quality, free from defects. The conductor used in manufacture of the cable shall be of H2 grade.
4. The cable should withstand 2.5 KA for 1 Sec. with insulation armour insulated at one end. Bidder shall furnish calculation in support of capability to withstand the earth fault currents. The current carrying capacity of armour and screen (as applicable) shall not be less than the earth fault current values and duration.
5. The fillers and inner sheath shall be of non-hygroscopic fire retardant materials and shall be suitable for the operating temperature of the cable. Filler and inner sheath shall not stick to insulation and outer sheath.
6. Progressive automatic in line indelible, legible and sequential marking of the length of the cable in metres at every one metres shall be provided on the outer sheath of all cables and at every 5 metre 'LSZH marking in case of 'LSZH cables.
7. Strip/Wire armouring following method (b) mentioned in IS: 3975 shall only be acceptable. For single core cable aluminium wire armouring shall be used.
8. Allowable tolerance on the overall diameter of the cables shall be + 2mm.
9. The normal current rating of all HRPVC/XLPE insulated cables shall be as per IS: 3961.
10. A distinct inner sheath shall be provided by pressure extrusion process for all multicore armoured and unarmoured cables as per IS: 5831.
11. Outer sheath shall be provided by extrusion process as per IS: 5031.
12. The breaking load of armour joint shall not be less than 95% of that armour wire. Zinc rich paint shall be applied on armoured joint surface.
13. In plant repairs to the cables shall not be accepted.
14. All the cables shall be supplied in non-returnable drums as per IS: 10418.
15. In Case of LSZH Cables
 - The outer sheath of cables shall have an oxygen index of not less than 29 as per ASIMD : 2863.
 - The maximum acid gas generation by weight as per IEC:754 (i) shall not be more than 20% for outer sheath material of all cables. Bidder shall also guarantee the maximum theoretical acid gas generation with 20% by weight of outer sheath.
 - The cables outer sheath shall meet the requirement of light transmission of 40% (minimum and shall be tested as per ISTMD:2843). In case the test for light

transmission is conducted as per ASTM E:662. The bidder shall furnish smoke density values as per this standard and shall co-relate the anticipated light transmission when tested as per ASTM D:2843.

- The cable shall pass the fire resistance test as per SS:42, 41, 475 (I) and flammability test as per IEEE:383.

A. Inspection:

All cables shall be inspected on receipt of the same at site and checked for any damage during transit.

B. Joints in Cables:

The contractor shall take care that the cables received at site are distributed to various locations in such a manner as to ensure maximum utilization and avoidance of cable jointing. Cable shall be rechecked before cutting in lengths, where the joints are unavoidable, and the location of such joints shall be got approved from the Owner/Consultant. The joints shall be done by qualified jointer strictly in accordance with manufacturer's instruction/drawings.

C. Joint Boxes for Cables:

The cable joint boxes shall be of appropriate size suitable for type of cable of particular voltage rating.

D. Cable Joints:

1. All cable joints shall be made in suitable, approved cable joints boxes, on the jointing of cables in the joint box and the filling in of compound shall be done in accordance with manufacturer's instructions and in an approved manner. All straight through joints shall be done in epoxy mould boxes with epoxy resins. Straight through joints shall not be permitted unless the length of run is in excess of cable drum.
2. End terminations of cables more than 1.1 KV grade shall be done with epoxy mould boxed and epoxy resin. Cable glands shall be 1.1KV grade double compression type and made to tin plated heavy-duty brass casting and machine finished. Glands shall be of robust construction capable of clamping cable and cable armour, firmly without injury of cable.
3. All washers and hardware shall be made of brass tinned. Rubber components used in the glands shall be made of neoprene of tested quality.
4. Cable lugs shall be tinned copper/aluminium solder less crimping type conforming to IS: 8309 suitable for aluminium or copper conductor.
5. Crimping of terminals shall be done by using Corrosion inhibitory compound, with crimping tool.
6. Fire resistant paint has to be applied 1 Meter on either side of cable joint.
7. The contractor shall liaise fully with all other contractors to achieve an efficient and properly coordinated installation where equipment has to be re-positioned due to lack of site liaison; no extra cost shall be incurred by the client.

2.2. H.T. CABLE (XLPE) (33 KV)

- A. The cross linked polyethylene (XLPE) cable shall be aluminium conductor PVC outer sheath steel strip armoured over inner sheath construction. XLPE cable shall conform to testing in accordance with IS:7098 (Part-I) 1977 and (Part-II) 1973. The screening shall be

done on individual cover. The armouring applied over the common covering shall be flat steel wires. Each and every length of cable shall be subjected to routine test.

- B. The termination and jointing techniques for XLPE cables shall be by using heat shrinkable or push on cable jointing kits.
- C. While laying underground cables in ducts care should be taken so that any underground structures such as water pipes, sewerage lines etc. are not damaged. Any telephone or other cable coming in the way shall be properly protected as per instructions of the Engineer-in-charge. The H.T. cable shall be laid at least 1200mm for cable upto 33 KV(E) below the ground level in a trench 450mm wide.
- D. After laying and jointing work is completed a high POT test shall be performed in presence of Engineer and test results submitted for approval in order to ensure that they have not been damaged during or after the laying operation. In case, the test results are unsatisfactory, the cost of all repairs and replacement and all extra work of removal and relaying will be made good by the contractor without any extra cost. Note: All other procedure will be followed as per L.T. cables.

PART 3 - EXECUTION

3.1. ERECTION OF CABLES

- A. Notwithstanding the cable routes indicated on the Drawings the Contractor shall be entirely responsible for the supply of correct lengths of the cables to be installed and for all allowances for connecting and terminating the cables to the switchgears and transformers respectively
- B. The Contractor shall submit proposed cable routes including details of supports for the cables for approval before installation. The cable shall not be run in places other than corridor, passageway, electrical riser or other designated areas subject to the Engineer's approval. The cost of support shall be deemed to have included in the Contract.

3.2. CABLE PULLING

- A. Winching of cables through ducts/pipes shall only be carried out with the approval of the Engineer in which event a pulley eye shall be attached to the conductors. Cable shall be run in neat and orderly manner to allow space for future cabling and maintenance and under no circumstances and cable shall be run diagonally across a room, cable basement, corridor, etc.
- B. A cable sheath stocking may be employed on cables where no undue stress in the sheath is likely to occur.
- C. Care shall be taken to ensure that the draw strain is applied to the armouring and protected during drawing against damage.

3.3. CABLE LAYING

- A. The cable drum shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming links. At all changes in directions in horizontal & vertical places, the cable shall be bent with a radius of bend not less than 8 times the diameter of cable.
- B. The cable of 1.1KV grade shall be laid not less than 750mm below ground level in a 375mm wide trench (throughout), where more than one cable is to be laid in the same trench, the width of the trench shall be increased such that the interaxial spacing between the cables except where otherwise specified shall at least be 150mm minimum or as per

site requirements or as approved by the Engineer-in-charge. Where single core cables are used in multiphase systems, the cables shall be installed in trefoil where possible.

- C. In case the cables are laid in vertical formation due to unavoidable circumstance the depth per tier shall be increased by 200mm (minimum). Cable shall be laid in reasonably straight line, where a change in direction takes place a suitable curvature shall be i.e. either 20 times the dia meter of the cable or the radius of the bend shall not be less than twice the diameter of the cable drum or whichever is less. Minimum 3 meter long loop shall be provided at both sides of every straight through joint & 3 meters at each end of cable or as directed at site.
- D. Greater care shall be exercised in handling the cable in order to avoid forming 'Kinks'. The cable drum shall in-verbally conveyed on wheels and the cable unrolled in right direction as indicated on the drum by the manufacturer. The cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains.
- E. Cables laid in trenches in single tier formation, 10 cms. All around sand cushioning be provided below and above the cable before a protective cover is laid. For every additional vertical tier. The 30cm of sand cushion be provided over the initial tier. The cable shall be protected by 2nd class bricks of size not less than 230x115x75mm, stone tiles/RCC curved channel be placed on top of the sand breadth wise for the full length of the cable and where more than one cable is to be laid in the same trench the brick shall cover all cables and project at least 8 cms over the outer sides of the end cables.
- F. Filling of trenches shall be done after the sand cushioning and laying of tiles or bricks are carried out to the satisfaction of the Engineer-in-charge (Refer drawing). Back fill for trenches shall be filled in layer not exceeding 150 mm. Each layer shall be properly rammed & consolidate before laying the next layer.
- G. PVC pipe shall be provided for all road crossing. The size of the pipe shall be according to the cable and a minimum 100mm dia. pipe shall be provided. The pipe shall be laid in ground with special arrangement and shall be cement jointed and concreting with 1:5:10 shall be made as per relevant IS with latest amendment. Nothing extra shall be paid on this account. Location of cables laid directly underground shall be indicated by cable marker at an interval of 30 meters & with change of direction. Aluminium strip cable tag of 20mm wide with engraved tag no. shall be provided at both ends of cable.
- H. Where the cables are to be laid in ducts (pucca trenches) in side the building, they will have to be laid on MS rack/ on MS cable trays grouted in walls trenches. Cables sizing through floors shall be protected from mechanical damage by a steel channel to a height of one meter above the floor where cable pass through wall they shall be sleeved with PVC/steel conduit.
- I. Where the cables are laid in open (in building) along walls, ceiling or above falseceiling, cable rack (ladder type) or cable tray shall be provided. The size of the cable tray or rack shall depend on the number of cables to pass over that rack. Cable tray/rack shall be properly supported through wall/ceiling according to the site conditions. Cable laid on tray & riser shall be neatly dressed & clamped at an interval of 1000 mm & 750mm for horizontal & vertical cable run respectively either side at each bend of cable. All power cables shall be clamped individually & control cables shall be clamped in groups of three or four cables. Clamps for multicore cables shall be fabricated of 25x3 GI flats. Single core power cable shall be laid in trefoil formation & clamped with trefoil clamps made of PVC/fibre glass.

- J. Cable openings in wall/floor shall be sealed by the contractor suitably by hession tape & bitumen compound or by any other proven to prevent ingress of water.
- K. After the cables are laid, shall be tested as per IS and the results submitted to Architects/Engineer and in case the results found unsatisfactory, all the repairing/ replacing of cables will be done by the contractor free of charge.

3.4. INTERNAL WIRING

- A. All the wiring installation shall be as per IS:732 with latest amendment. PVC insulated copper conductor cables as specified in bills of quantity shall be used for sub-circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be twisted copper conductors with thermoplastic insulations of 1100 volts grade. Colour Code for wiring shall be followed.
- B. Looping system of wiring shall be used, wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of the consultant. No reduction of strands are permitted at terminations. No wire smaller than 1.5 sq.mm shall be used and shall be as per B.O.Q. Wherever wiring is run through trunkings or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indicating the circuit and DB number shall be used for submains, subcircuit wiring. The ferrules shall be provided at both end of each submain and sub-circuit.
- C. Where single phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain the wiring fed from more than one phase. In any one room in the premises where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply. Circuits fed from distinct sources of supply or from different distribution boards or through switches or MCBs shall not be bunched in one conduit. In large areas and other situations where the load is divided between two or three phase, no two single phase switches connected to different phase shall be mounted within two meters of each other.
- D. All splicing shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.
- E. Industrial sockets shall be of polycarbonate and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have self adjustable spring loaded protective cap. Socket shall have MCB/ELCB/RCCB as specified in the schedule of work.

3.5. Fire Seal System

- A. All the floor/wall opening provided for cable crossing shall be sealed by fire seal system.
- B. The fire proof sealing system shall fully comply with the requirements of relevant IS/BS:476 Part-B. The fire proof seal system shall have minimum one hour fire resistance rating.
- C. The fire proof seal system shall be physically, chemically, thermally stable and shall be mechanically secured to the masonry concrete members. The system shall be completely gas and smoke tight, antirodent and anti-termite.
- D. The material used in fire proof seal system shall be non-toxic and harmless to the working personnel.
- E. Type of fire proof seal system shall be foaming type or flamemastic type compound or approved equivalent.

- F. After laying and jointing work is completed, high voltage test should be applied to all cables to ensure that they have not been damaged during or after the laying operation and that there is not fault in the jointing.
- G. Cables for use on low and medium voltage system (1.1KV grade cables) should withstand for 15 minutes a pressure of 3000V DC applied between conductors and also between each conductor and sheaths. In the absence of pressure testing facilities it is sufficient to test for one minute with a 1000V insulation tester. In case the test results are unsatisfactory the cost of repairs and replacements and extra work of removal & laying will be made good by the contractor.
- H. Cable shall be installed so that separations shown in the table below are observed.

1. HV Cable (33 KV)	- HV Cable (33 KV)	50 mm
2. ELV & LV 230 V/433 V	- ELV & LV cable 230 V/433 V	50 mm
3. HV cables (33 KV)	- ELV & LV cables 230 V/433 V	300 mm
4. LV cables 433 V	- Telephone/Instrument cable	350 mm
5. All cables	- All hot pipe work	200 mm

3.6. FACTORY TESTS

- A. Each type of cable specified shall be fully type tested according to IEC 502 and the appropriate British Standards. The types and sizes of cables required are shown on the Drawings.
- B. Should the Engineer require it, the Contractor shall submit reports issued by a national or international testing authority on type test that have been successfully performed on the cable for his approval.
- C. The type test shall include the following test:
 - 1. Partial discharge test;
 - 2. Bending test, plus partial discharge test;
 - 3. Tan d measurement as a function of the voltage and capacitance measurement;
 - 4. Tan d measurement as a function of the temperature;
 - 5. Heating cycle test plus partial discharge test ;
 - 6. Impulse withstand test, followed by a power frequency voltage test;
 - 7. Medium-voltage alternating current test;
 - 8. Type test (non-electrical) as stipulated in IEC 502, Table VI.
- D. Cable routine test shall be conducted at factory in accordance with IEC 502 for the following tests: Measurement of the electrical resistance of conductors. Partial discharge test, 4-hour MV test.

3.7. SITE ACCEPTANCE TEST

- A. The Contractor shall supply all necessary testing equipment for site testing. When required, these testing equipment shall be calibrated at the expense of the Contractor at a recognized national laboratory.
- B. The Contractor shall engage an Authorised Medium Voltage Testing Engineer who is recognised by SEB to perform all site tests.

- C. In addition to SEB's requirements and those recommended by the manufacturer, the following tests shall be carried out:
1. Continuity test,
 2. Earth test,
 3. Polarity test,
 4. Insulation resistance test,
 5. DC high voltage test. The test voltage shall be in accordance with SEB's requirements and Engineer's approval.

Chapter 3. **BUS DUCT**

PART 1 – GENERAL

1.1. DESCRIPTION

- A. This section specifies the supply, installation, testing, commissioning and setting to work of a totally enclosed, non-ventilated type of housing, low impedance insulated Aluminium bus duct system.
- B. Bus duct shall be of totally enclosed with independent copper earth bar, low impedance having minimum rating as indicated in the Drawings and Specification with all necessary fittings, tap-off units, supporting devices and manufacturer recommended accessories to complete the installation as a whole.
- C. Ratings and the indicative routings of bus duct shall be as indicated on the Drawings. It is solely the responsibility of the Contractor to carry out site survey, co-ordinated and check the location of these facilities and make any necessary adjustment modifications to the Engineer's approval.

1.2. STANDARDS

- A. The bus duct shall be low impedance solid rectangular bus bars/ Trunking made of totally enclosed extruded aluminium housing with electro-tin plated hard drawn high conductivity copper to BS 1433 to BS 1432.
- B. The bus duct shall be type-tested assemblies (TTA) as defined in BS 5486: Part 1 (IEC439-1), manufactured and tested by a specialist bus duct manufacturer to BS 5486: Part 2 (IEC 439 – 2) or UL 857.
- C. Material and installation shall comply with BS7671, SEB regulations and any other recommended practices, Standards of ANSI, IEEE, NEMA and UL.
- D. BS: 381C/BS4800 - Specification for colours for identifications, coding & special Purpose
- E. BS: 1432 - Specification for copper for electrical purposes, High conductivity Copper rectangular conductors with drawn or rolled edges.
- F. BS: 2757 -Methods for determining the thermal classification of electrical insulation.
- G. IEC: 60529/EN60529 -Specification for degrees of Protection Provided by enclosure (IP code)
- H. IEC: 60439/EN60439 Part: 1 Section for low voltage switchgear & control gear assembled. Specification for type tested & partially type tested assemblies.
- I. IEC: 60947/EN 60947- 1-2, 3-4 Specification for low voltage switchgear & control gear etc. Technical & installation Requirements.
- J. The bus duct and associated equipment shall be certified for the category of duty specified hereafter, in particular, with regards to fault conditions and temperature rise limits.
- K. The manufacture of various components and accessories, including the plug-in units, shall be as recommended by the bus duct manufacturer to ensure compatibility of the components.
- L. The bus duct shall be of SEB approved type and the Contractor is required to submit project reference list for the Engineer's review.

1.3. SUBMISSION

- A. All technical submission shall be approved by the Engineer prior to the respective stages of construction.
- B. As a minimum requirement, the submission shall include the following:
 - 1. Equipment submission with manufacturer's data such as resistance per metre, reactance per metre, mV/A/m, contact resistance per joint, etc.;
 - 2. Test certificate for short circuit capacity and IP rating;
 - 3. Shop drawings for construction details of bus duct arrangements, spring hangers, wall flanges, floor flanges, plug-in boxes, etc.;
 - 4. Bus duct routing drawings showing the co-ordinated routing of the bus duct, setting out lines of the bus ducts relative to building grids, locations of bus duct joints, suspension and fixing units, etc.;
 - 5. Weight of equipment
 - 6. Builder's works requirement.

PART 2 – PRODUCTS

2.1. GENERAL

- A. Bus duct shall be factory fabricated epoxy insulated totally enclosed, vermin and insect proof, non-ventilated type suitable for three phase four wire system with full sized Busbar for phases and neutral.
- B. Bus duct complete with plug-in units shall be type-tested to National Electrical Manufacturer's Association (NEMA) Standard (No. BU-1972) and U/L 857 and shall be able to withstand a short circuit condition equivalent to 50 kA 3 sec or not less than the type-tested short circuit capacity of the corresponding switchboards.
- C. Bus duct shall be insulated to Class B i.e. 85°C temperature rise above ambient temperature of 45°C but maximum operation temperature should not exceed 95°C.
- D. Eddy current heating shall be taken into account while designing the enclosure.
- E. A complete bus duct assembly shall comprise the following:
 - 1. Cable and box
 - 2. Hangers
 - 3. Plug-in/feeder Busbar
 - 4. Plug-in/tap-off box
 - 5. Elbow
 - 6. Off set
 - 7. Transposing unit
 - 8. End cap
 - 9. Fire barrier
 - 10. Expansion joints
 - 11. Integral earth
- F. Fire resistance bus duct shall be insulated with double layers of mica and silicone rubber on the bus bars. All jointing parts shall be protected with fire protective enclosure. Test certificate for fire resistant bus duct shall be submitted to the Engineer for approval. Fire

resistance bus duct shall be provided for all circuit incoming and outgoing from the Emergency Main Switch Board.

- G. All bus duct and the associated fittings shall be minimum IP44 rating within Electrical room and Electrical riser. At car park, outdoor or plant room areas shall be weatherproof type to IP 65 in accordance to IEC 529. Weatherproof bus duct shall incorporate gaskets; drain holes, etc. suitable for outdoor use. All the plug-in, joint and accessories shall be special box-up to manufacturer detail to the same IP rating as the bus way.
- H. Minimum 2 nos. of hanger/support shall be provided for every 2m run of bus duct. Extra number of hangers will be required for joints. The bus duct shall be so supported that no visible stress shall be apparent from either unbalanced plug-in units. Vertical floor support shall be complete with spring hanger.
- I. All joints shall be the one-bolt removable/isolating type with through-bolts that can be checked for tightness without de-energizing the system. It shall be possible to make up a joint from one side in the event the bus duct is installed against the wall or ceiling. The joint shall be so manufactured so as to allow removal of any length without disturbing adjacent lengths. Belleville spring shall be provided to give positive pressure over complete contact area. Plug-in feeder shall use identical parts.
- J. The bus duct system shall be capable of being mounted in any position without de-rating. Plug in and feeder sections shall be interchangeable without the use of special adapter joint covers.
- K. The complete bus duct system shall be capable of withstanding the short circuit capacity of the electrical installation without damaging by the electrical, mechanical and thermal stress under fault condition of a service voltage of 440V 50Hz.
- L. Bus duct shall have rated insulation voltage and rated operating voltage of 650V respectively.

2.2. BUSDUCT

- A. The bus duct shall be of integrated one (single circuit) up to 2500 A and inter living type (Double circuit) above 2500 Amps.
- B. The bus duct conductor shall be Aluminium with 99.999 purity as per BS-1432. Adequately rated & supported by non-tracking moulded insulator spaced at suitable intervals. The complete assembly shall be capable of withstand the maximum mechanical stresses to which it may be subject to under fault conditions.
- C. The bus bar connections shall be constructed in accordance with the requirement of IEC-60439-1 or EN-60439-1 forgoing Part of switchboards & on current carrying capacity & limits of temperature rise.
- D. The current density of bus bars shall be considered as 0.8 Amps/ Sq.mm.
- E. The clearances between phase and neutral shall be as per BS 162; Bus bars shall be separated & supported with approximate clearances in air in addition to the requirements of providing full insulation. The material for phase identification shall be non-colour fading and adhesive label shall not be used.
- F. The bus duct shall be provided with three phase or three phases and neutral as indicated on drawing and BOQ.
- G. Non-deteriorating neoprene type gaskets shall be provided. The gaskets used for outdoor portion of the bus duct shall be non-deteriorating due to hostile climate conditions and direct exposure to sunlight.

- H. Bus bar supports shall be made of high quality insulating material such as FRP/DMC, SMC/Fibre glass araldite etc. The insulating material shall be treated against fungus. Surface of insulators shall be highly glazed and treated to minimize accumulation of dust.
- I. Flanged ends shall be provided to facilitate connection of bus ducts both at the transformer and switch gear end & switch gear to switchgear end. All hardware such as bolts, nuts, spring and plain washers shall be supplied along with bus duct to connect it at both ends.
- J. Reinforcement/stiffeners shall be provided for the covers from inside on which supporting lugs are provided.
- K. Flexible connectors shall be provided at the end terminations, both at transformer end and switch gear end and at intermediate places depending upon length and configuration of the bus duct. The connectors shall preferably be laminated to cater for linear expansion of bus bars. The material of flexible shall be same as bus bars. If different materials are used care shall be taken to prevent bimetallic corrosion.
- L. Earth bus of size made of Aluminium as mentioned in B.O.Q shall be fitted outside the bus duct throughout the length of the bus duct Two Nos. of terminals shall be brought out at ends of the earth bus to facilitate connection of earthing lead externally.
- M. A cross over chamber with sufficient number of links and supports shall be provided in accordance with system required. The cross over chamber shall effect change of phase sequences to match with respective phase sequences in the end equipment. The links, insulators and fasteners shall be located such that across the replacement/ tightening is available for all parts.
- N. Suitable fabricated adapter box with flexible links shall be provided wherever specified to interface with the termination arrangement on the end equipment connection. Bidder shall design the adapter box to suit exact requirements of the end equipment with adequate clearance and accessibility for end connections. All necessary links, supports, fasteners and washers shall be included in the scope of supply.
- O. The bus duct enclosure shall be fabricated for CRCA sheet steel of minimum size of 2mm.
- P. Bus bars and insulating supports shall withstand successfully thermal and dynamic stresses resulting from the circuit currents mentioned in the Data Sheets for the duration, so specified. Bus duct shall be able to withstand short circuit level of 50 KA for 1 sec.
- Q. The bus duct assembly enclosure shall be dust and vermin proof with IP-44 protection & IP-65 for outdoor installation. Adequate access shall be available for inspection/ replacement/ Tightening of bus bars and their support/fish plate etc.
- R. All steel fabrication work shall be powder coated of approved shade.

PART 3 – EXECUTION – TESTING & COMMISSIONING

3.1. GENERAL

- A. Store bus duct in clean dry area. Bus duct shall not be delivered or installed until building is enclosed and dry.
- B. Clean conducting surfaces and install bus in accordance with manufacturer's installation instructions. Torque all connections. Adjust spring hangers to equally distribute load.
- C. Provide 10 cm high concrete curb around bus duct floor penetrations.
- D. Provide a spring suspension hanger at each floor and not more than every 4 vertical meters.

- E. Provide expansion fittings in accordance with manufacturer's recommendations.
- F. Provide listed fire stop fittings at floor and wall penetrations.

3.2. DRAWINGS AND DOCUMENTS

- A. Fully, dimensioned, scale drawing showing general arrangement, assembly, installation, configuration, clearance, creepage distances and interfacing details at both ends shall be submitted for approval.
- B. Calculations for bus bar capacity to carry rated current with specified maximum operating temperature.
- C. Short time thermal and dynamic withstand capacity under specified fault level, Heat loss calculations & Voltage drop calculations.

3.3. TEST

- A. The bus duct shall be tested and inspected at fabrication shape in accordance with the relevant IS/ BS requirement for type and routine tests.
- B. After installation the following tests shall be performed before energising the bus duct.
 - High voltage withstands test for 1 min.
 - Megger test

3.4. INSPECTION

- A. The Purchaser reserves the right to witness all routine tests at manufacturer's works prior to despatch to prove compliance with Specification. All expenses for conducting these tests shall be borne by the Bidder .Metering/testing equipment of approved range and accuracy class shall be arranged by the Vendor.

3.5. BASIS OF MEASUREMENT

- A. The bus duct unit rate shall be based on per meter length basis measured along the longitudinal axis from flange to flange (centre line measurement} irrespective of horizontal/ vertical runs, bends, crossover chamber and adapter panel. The per meter rates shall be inclusive of bend, crossover box and adapter box flexible end coupler etc.

3.6. QUALITY ASSURANCE

- A. Quality Assurance shall follow the requirements of Owner documents as applicable. QA involvement will commence at enquiry and follow through to completion and acceptance thus ensuring total conformity to Purchaser's requirement.

3.7. DEVIATIONS

- A. Deviation from specifications must be stated in writing at the quotation stage.
- B. In the absence of such a statement, it will be assumed that the requirements of the specifications are met without exception.

Chapter 4. **PANEL BOARDS**

PART 1 – GENERAL

1.1. WORK DESCRIPTION

- A. This specification covers the 'General Requirements' for the design, manufacture, supply performance, inspection, testing and commissioning including supply of indoor type low voltage switch boards up to 1000 V including necessary termination, cabling and bus work required for satisfactory operation .
- B. The Panel boards included, distribution boards and control panels shall be built in accordance with IEC 439 "Factory Built Assemblies for Low Voltage" or BS 5486 "Factory-built Assemblies of Switchgear and Control Gear for Voltage up to and including 1000 AC and 1200V DC.
- C. All factory built assemblies subject to rain or wet conditions or located outside electrical switch room shall be weatherproof constructed to IP 65, able to withstand high impact strength of 60 KN/m² (min.), temperature resistant, flame retardant and corrosion resistant.
- D. Specific requirements shall be in accordance with single line diagram/specification & BOQ.
- E. The technical parameters of switchgear equipments, transformers etc. shall be referred.

1.2. STANDARDS

- A. All equipment, material and components shall comply with the requirements of the latest editions of Indian Standards with updated amendments. Standards and Regulations applicable in the area where equipment is to be installed shall also be followed.
- B. The equipment offered complying with other standards, these standards shall be equal to or superior to those specified and full details of the differences shall be furnished along with the tender.
- C. The Panel boards shall be engineered and constructed in accordance with the latest revision of the following Indian and British standards:
 - 1. IS 13947 : A.C. Circuit Breakers
 - 2. IS 3427 : Metal enclosed Switchgear & Control Gear
 - 3. BS 162 : Safety Clearances
 - 4. IS 2705 : Current Transformers
 - 5. IS 3156 : Voltage Transformers
 - 6. IS 3202 : Code of Practice for climate proofing of electrical equipment
 - 7. IS 375 : Marking & Arrangement for Switchgear Bus Bars, main connections and auxiliary wiring.
 - 8. ARE 722 : A.C. Electric Meters
 - 9. IS 1248 : Direct acting Electrical Indicating Instruments
 - 10. IS 3231 : Electrical Relays for Power System Protection
 - 11. IS 2544 : Epoxy Cast Resin Insulators
 - 12. IS 5082 : Electrolytic Copper/ Aluminium

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| 13. IS 5792 : | High Voltage HRC fuses |
| 14. BS 88 : | Cartridge fuses for voltages up to and including 1000V AC and 1500V DC. |
| 15. BS 89 : | Direct acting electrical indicating analogue electrical measuring instruments and their accessories. |
| 16. BS 142 : | Electrical protective relays |
| 17. BS 159 : | Busbar and Busbar connection |
| 18. BS 1433 : | Copper for electrical purposes. Rods and bars. |
| 19. BS EN 60898 : | Circuit-breakers for over current protection for household and similar installations. |
| 20. BS 3938 : | Current transformers |
| 21. BS EN 60947-2 : | Low-voltage switchgear and control gear, Part 2 circuit-breakers. |
| 22. BS 4794 : | Control switches (switching devices, Part 1 including contactor relays, for control and auxiliary circuits, for voltages up to and including 1000V AC and 1200V DC). General requirements. |
| 23. BS 5419 : | Air-break switches, air-break disconnectors, and fuse combination units for voltages up to and including 1000V AC and 1200V DC. |
| 24. BS 5420 : | Degrees of protection of enclosures of switch Part I great Part I and control gear for voltages up to and including 1000V AC and 1200V DC. |
| 25. BS 5424 : | Control gear for voltages up to and including 1000V AC and 1200V DC – Part 1 Contactors. |
| 26. BS 5486 : | Low-voltage switchgear and control gear Part 1 assemblies. Part I: Requirement for type tested and partially type tested assemblies. |
| 27. BS 5685 : | Electricity meters – Part I: Class 0.5, 1 and 2 single phase and poly phase, single-rate and multi-rate watt-hour meters. |
| 28. BS 5992 : | Electrical relays |
| 29. BS 6004 : | PVC insulated cables, (nonarmoured), for electric power and lighting. |
| 30. BS 6231 : | PVC insulated cables for switchgear and control gear wiring. |
| 31. IS 3043/ BS7430 : | Earthing |
- D. BS/IEC or IS not mentioned above but are applicable to this installation shall also apply.

1.3. SUBMISSION

- A. Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout and earthing layouts, including equipment installation and cable termination details etc. prior to start of work.

- B. Such drawings shall show the proposed method of construction of the cubicles, method of supporting equipment and Busbar, full details of Busbar layout, method of support, electrical control wiring diagrams, equipment weight, colors, and surface treatment.
- C. The drawings shall also incorporate a full list of proposed materials. The construction shall not commence until the drawings are approved for construction.
- D. Factory and site testing procedures and report formats shall also be included.
- E. Preparation of bill of materials for Different Items as mentioned in Schedule of Quantities.
- F. Lighting/power panel schedule.
- G. Interconnection drawing.
- H. Protection co-ordination drawings/tables for complete power system.
 - I. Shop inspection and testing procedures.
 - J. Field testing and commissioning procedures.
- K. Preparation of as built drawings for the services the contractor is rendering. Any other work/activity which is not listed above; however is necessary for completeness of electrical system.

PART 2 – PRODUCTS

2.1. PANEL BOARD

- A. The switch boards shall be cubicle type, suitable for indoor installation, floor mounting and free standing. The design shall be totally enclosed, dust - tight, damp-proof and vermin proof offering degree of protection not less than IP-42.
- B. Separate segregated compartments shall be provided for circuit breakers, bus bars, cable box, voltage transformers, wire ways, relays, and instrument and control devices. Switchgear cubicles/ modules shall be provided with hinged doors in front with facility for padlocking door handles.
- C. Vent openings shall be covered with grills so arranged that hot gases cannot be discharged through them in a manner that can injure the operating personnel. These vent openings shall be vermin proof.
- D. All panels shall be of same height, width and depth. Panels shall be bolted together to form a continuous flush front switch board, suitable for front of board operation.
- E. The switchgear cubicles shall be rigid and robust in design and construction, fabricated out of CRCA sheet steel. Cubicles shall be made from rigid welded structural frames made of structural steel sections or of pressed/formed sheet steel of not less than 3mm thickness. The frames shall be enclosed by sheet steel of at least 2mm thickness, smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary.
- F. All doors, panels, removable covers shall be provided with non deteriorating (neoprene) gaskets all around the perimeter.
- G. All doors shall be removable and supported by concealed type hinges. The hinges shall be strong and braced to ensure freedom from sagging, bending and general distortion of panel or hinged part.

- H. Floor mounted cubicles shall be provided with a 75mm high channel base frame. The total height of the cubicle shall not exceed 2400mm, keeping in view the operating height of top switch should not exceed 1750mm from FFL including base channel.

2.2. BUSBARS & BUSBAR CHAMBER

- A. Three phase bus bars shall be of high conductivity electrolytic Aluminium as stated in B.O.Q.
- B. The bus bars shall be air insulated and housed in a separate compartment, segregated from all other compartments.
- C. Bus bars & bus bar connections shall be of uniform cross section shall be suitable for carrying rated current continuously and short circuit current for specified duration without overheating. The bus bars connections shall be adequately supported on insulators to withstand dynamic stresses due to short circuit current specified. Normal operating temperature for bus bars shall be 85 Deg C. Short circuit rating of the bus bars shall be 20 to 50 KA for 1 sec as per BOQ.
- D. All bus bar joints and bus tap joints shall be silver or tin plated. Joints shall be bolted type and shall be insulated. Spring/Lock washers shall be provided to ensure good contact on the joints.
- E. Direct access to accidental contact with bus bars and primary connections shall be avoided by providing shrouds. All apertures and slots shall be protected by barriers to prevent accidental shorting of bus bars. To provide a tight seal between cubicles, bushings or insulating panels shall be provided for bus bars crossing from one cubicle into another.
- F. All insulating materials used shall be non-hygroscopic and shall be treated for preventing fungus growth. Surface of insulators shall be highly glazed and treated with silicone compounds to minimize accumulation of dust, condensation and tracking.
- G. All bus bars shall be color coded as per IS:375.

2.3. CURRENT TRANSFORMERS (CTs)

- A. Current transformers shall be of suitable ratio, burden & class/accuracy as specified in Single Line Diagram.
- B. Current transformers shall conform to latest edition to relevant standards. The Current transformers shall be epoxy resin cast with bar Primary or ring type.
- C. The design and construction shall be sufficiently robust to withstand thermal and dynamic stresses due to the maximum short circuit current of the circuit.
- D. The current transformer shall preferably be capable of being left open circuited on the secondary side with primary carrying rated full load current, without overheating or damage. Short time current rating and rated withstand time shall be same as corresponding C.B.
- E. CT core laminations shall be of high grade silicon steel.
- F. Secondary terminals of CT shall be brought out to a terminal block which will be easily accessible for testing and external connections. Facility shall be provided for short circuiting and earthing of CT secondary leads through a removable and accessible link with provision for attaching test link.
- G. Rating plate details and terminal markings shall be according to the latest edition of relevant Indian Standard specification.

- H. Current transformers (core) shall be used for metering and protection.

2.4. POTENTIAL TRANSFORMERS (PTs)

- A. Potential Transformers shall conform to latest edition of relevant standards.
- B. Potential transformers shall be dry, cast epoxy resin type. The PTs shall be of single phase construction.
- C. The PTs shall be capable of operating continuously at 110% of the rated voltage without any damage. When star - star connection is required in non-effectively or ungrounded system, the PTs shall be suitable for continuous operation with a persistent phase to ground fault.
- D. Maximum temperature rise of the transformer at rated burden and with rated primary voltage and frequency shall not exceed 40 Deg's above an ambient of 45 Deg's.
- E. HRC Fuses shall be provided secondary side. It shall be possible to replace PT fuses easily without having to de-energise the main bus bars. Prospective interrupting current rating of the fuses shall be same as the system fault level.
- F. Voltage transformer ratio, output and class shall be as specified in the drawing & BOQ. Name plate as per relevant standards shall be provided on the PT.

2.5. PROTECTIVE RELAYS

- A. Relays type and numbers shall be in accordance with the protective scheme specified or as per drawings and B.O.Q.
- B. Relays shall be enclosed in rectangular shaped cases, suitable for flush mounting only, dust tight covers projecting from the front cover panel. The case shall be dust tight, damp proof and tropicalised.
- C. Relays shall be accessible for setting from the front. Access to setting devices shall be possible only after removal of front cover.
- D. Protective relays shall be draw out type. Where it is not possible to provide protective relays of the draw out pattern, fixed type relays with facilities for plugging in a portable test plug shall be provided. Necessary test plugs shall be furnished along with the relays.
- E. Relays shall be provided with positive action self reset type with indicator. The indicator/s shall be visible from the front.
- F. Relays conform to relevant standards in all respects.
- G. Relays shall be provided with minimum two pairs of self or hand reset type contacts as specified. Auxiliary relays shall have the number of NO and NC contacts as specified in data sheet.

2.6. SAFETY/ PROTECTION & INTERLOCKS/FEATURES

Following interlocks and features shall be incorporated for equipment protection and personnel safety under mal-operation. No deviations on these interlocks and safety features are allowed. These interlocks and safety features shall be fail-safe, positive and full-proof.

- A. It shall not be possible to plug-in or isolate a closed circuit breaker. An attempt to do so shall trip the breaker. (In case of breakers with vertical isolation, this will apply to raising and lowering). There shall be a positive locking facility to prevent closing of circuit unless it is in Service or Test position.

- B. Closing and opening operations shall be possible only in discrete, well defined Test and Service positions and not in any position midway. An extension adapter cable with plugs and sockets shall be preferably be provided so that the closing and opening operation of the circuit breaker can be done in fully withdrawn position outside the cable.
- C. Slow operation of circuit breakers shall be possible only in the circuit breaker in Test or Isolated position.
- D. Isolating switches if provided shall be interlocked with respective circuit breakers to prevent them making or breaking the current.
- E. 1 no. bus earthing truck shall be supplied with each panel to earth the out going cable of the VCB breaker.
- F. Automatic safety shutters for all openings which will lead to access to the live parts of the switchgear upon withdrawal or any operation the switchgear components/parts shall be provided, preferably with a padlocking facility.
- G. Spring of motor operated spring charged mechanism shall not discharge until they are fully charged and charging means are fully disconnected.
- H. Where key interlocking is employed, tripping of a closed circuit breaker shall not occur if any attempt is made to remove the trapped key from the mechanism.
- I. Any other interlocks which manufacturer may deem to be required for safety and specifically specified separately required for the system shall be included.
- J. All terminals, connections which may be live and exposed for accidental contact shall be adequately shrouded.
- K. Components within cubicles shall be properly labeled to facilitate testing.

2.7. EARTHING

- A. The switch board shall be provided at the bottom throughout its entire length with an earth bus of copper of adequate size to carry the fault current for the duration same as short time rating of the circuit breaker. Earth bus shall have two earthing connection facility at its both ends of earthing conductor.
- B. All non-current carrying metal parts, frames and equipment mounted in the switch board shall be bonded to earth bus.
- C. Earthing of moving carriage of draw out equipment shall be achieved by scraping earthing device. The earthing device shall maintain positive earth continuity in all Service Test and Isolated positions.
- D. It shall be possible to connect each circuit or set of three phase bus bars to earth either through earthing trucks or through the circuit breakers.
- E. One earthing trolley suitable for earthing of cables & bus bars for all circuit breakers of the same type/rating shall be provided.

2.8. INSTRUMENT & METERS

- A. Electrical indicating instruments shall be digital type with zero adjustment, probe from outside the cover.
- B. Multi function meter of CL 1.0 accuracy with RS 485 port shall be provided.
- C. Instruments/meters shall be suitable for flush mounting on the panel with flanges protecting outside the panel.

- D. All meters shall be industrial grade with accuracy of class 1.0 unless specifically indicated.

2.9. CONTROL WIRING

- A. All wiring for control, protection, alarm and indicating circuits on all equipment shall be carried out with at least 650V grade, PVC insulated, stranded, copper, 1.5 Sq.mm conductors.
- B. All wiring shall be run on the sides of the panels and shall be neatly bunched and cleared without affecting access to equipment mounted in the panel. Where wiring enters or passes through compartments containing HT apparatus then they shall be in earthed metallic conduits or ducts.
- C. All wiring shall be taken to terminal blocks without joints or tees in their run.
- D. All wiring shall be colour coded as follows:
- Instrument Transformer AC circuit - Red, Yellow & Blue determined by the Phase with which the wire is associated.
 - AC Phase Wire - White
 - AC Neutral - Black
 - DC Circuits - Grey
 - Earth connections - Green
- E. Engraved core identification ferrules, marked to correspond with the wiring diagram shall be fitted to each wire. Ferrules shall fit tightly on the wires, without falling off when wire is removed. Ferrules shall be of white colour with black lettering. Each wire shall be identified by letter to denote its function followed by a number to denote its identity at both ends.
- F. All wiring for external connections shall be brought out to individual terminals on a readily accessible terminal block.
- G. All unused auxiliary contacts of the circuit breaker and relays shall be wired up to terminal block.

2.10. FITTINGS AND ACCESSORIES

A. Indicating Lamps

1. LED type indicating lamps shall be provided everywhere except where low voltage filament type with series resistor called for.
2. Lamp covers shall be provided with interchangeable coloured lenses of Perspex or equivalent unbreakable material. The lenses shall not discolour in course of time due to heat of the lamp.
3. Bulbs and lenses shall be interchangeable and replaceable from the front.
4. Following colours shall be used for the function indicated:

Red	-	Circuit Breaker 'ON'
Green	-	Circuit Breaker 'OFF'
White	-	Continuous trip supply supervision
Amber	-	Auto trip

Blue	-	Spring charged
R.Y.B	-	Potential indication

B. Push Buttons

1. All push buttons shall be push to actuate the contact type.
2. Start & Stop push buttons shall be colored green and red respectively. Reset push buttons shall be yellow in color and test push buttons shall be blue in color. All other push buttons shall be black in color.
3. Emergency stop push buttons shall be lockable in the operated position, i.e. push to operate and key to release type. Push buttons for emergency stop shall be recessed/shrouded type to avoid accidental operation.

C. Control & Selector Switches

1. Control and Selector switches shall be of rotary type, having enclosed contacts accessible only after removal of cover.
2. All control and selector switches for circuit breakers and instruments shall be mounted on the front of the panel. Control switches for space heater/s and control supplies shall be mounted inside the panel.
3. Circuit Breaker control switches shall be provided with pistol grip handles. Selector switches shall be provided with round, knurled handles. All handles shall be black in color. Properly designated escutcheon plates clearly marked to show the operating positions shall be provided on all switches.
4. Circuit breaker control switches shall normally have three position close - Normal - Trip with spring return to normal position. Switch operating mechanism shall prevent the switch from being operated twice successively in the same direction. Circuit breaker control switch shall have one NONC contact along with other contacts as required.
5. All other instruments and selector switches shall have stay put contacts.
6. Contacts of all control and selector switches shall be rated for 10 Amps at 240V AC or 20 Amps at 220V dc (inductive break). Switch for space heater supply and control voltage supply shall normally be two pole rated for 25A A.C.

D. Control Terminal Blocks

1. Box - clamp type, 650V grade line up terminals of minimum 2.5 Sq.mm size shall be provided. Connection to terminals shall be from front.
2. Not more than one wire on each side shall be connected on any terminal. Where duplication of terminals block/s is necessary, suitable solid bonding links shall be incorporated.
3. Terminal blocks at different voltage shall be segregated into groups and distinctly labelled.
4. Current transformer secondary leads shall be brought to terminal blocks having facility for short circuiting and grounding the secondary.
5. Terminals shall be numbered for identification and grouped according to function. Engraved back on white PVC labels shall be provided on the terminal blocks describing the function of the circuit.
6. Separate terminal stems shall be provided for internal and external wiring.

7. Control terminal blocks shall be so located that control cables are fully segregated from power cables. Suitable insulated or earthed metal race ways shall be provided for control wiring. Separate unrolled removable gland plate shall be provided for the control cables at the bottom of each panel.
8. Minimum 10% of total number spare terminals shall be provided for future use.

2.11. NAME PLATES AND LABELS

- A. One Name plate giving designation of the MV switchboard shall be affixed prominently on top of the switch board. Details of designation will be specified.
- B. Labels giving following details shall be affixed on each feeder panel: i. Feeder No. ii. Equipment reference no. & Description iii. Rating (HP/KW/KVA/Amp.)
- C. All components whether mounted inside or on the door shall be permanently and clearly labelled with reference number/letter or their function. Rating of fuse shall be part of fuse designation. Paper labels, stickers or labels fixed with adhesives are not acceptable. All labels shall be properly fixed by screws with provision to prevent distortion due to expansion.
- D. All labels shall be non-corroding, preferably laminated plastic or rear engraved Perspex with white letters on black background.
- E. Labels for feeder panel designation fixed on front side shall be fitted with chrome plated, self tapping, and counter sunk head screws. These labels shall be of identical size to permit interchange.

2.12. SPACE HEATERS

- A. Adequately rated anti-condensation space heaters shall be provided in each cubicle.
- B. Space heater/s shall be trip type, rated with operation voltage of 240V, 50 Hz. AC supply.
- C. Each space heater shall be complete with a 2P MCB, 10KA and a control thermostat.
- D. The space heater shall be rated for maintaining the panel inside temperature 10 Deg.C above outside ambient temperature.

2.13. CUBICLE LIGHTING

- A. Each cubicle shall be provided with interior lighting by means of CFL light fixture. An ON/OFF switch/door switch shall be provided. The lighting fixture shall be suitable for operation from a 240V single phase, 50 Hz. A.C. supplies.

2.14. AUXILIARY SUPPLY

- A. Auxiliary supply for control, indication, space heater etc. shall be made available at one point on the switch board. Vendor shall provide suitable auxiliary supply in the switch board.

2.15. FUSES

- A. Fuses shall be HRC cartridge link type (Diazed Fuses are not acceptable) and shall be provided with operation indicator which shall be visible without removal of fuses from service.
- B. Fuses shall be pressure fitted type and shall preferably have ribs on the contact blades to ensure good line contact.
- C. It shall be possible to handle fuses during off load conditions with full voltage available on the terminals. Wherever required fuse pullers shall be provide. The fuse bases shall be so

located in the modules to permit insertion of fuse pullers and removal of fuse links without any problems.

- D. Mounting of fuse fitting shall ensure adequate dissipation of heat generated and shall facilitate inspection and easy replacement of fuse.

2.16. CONTACTORS

- A. The contactors shall be air break type, equipped with three main contacts and minimum 2 NO + 2 NC auxiliary contacts. The main contacts of a particular contactor shall have AC 3 ratings for unidirectional motors & AC 4 for reversible motors.
- B. The auxiliary contacts shall be rated for minimum 5 Amps at 240V AC and 1.3 Amps at 110V DC (Inductive load).
- C. Unless specified otherwise, the coil of the contactor shall be suitable for operation on 240V, + 10% and – 15% 1 PH, AC supply. The contactor drop off voltage shall be between 15% to 65% of the rated coil voltage.

2.17. SINGLE PHASING PREVENTOR (SPP)

- A. Unless specified otherwise SPPs shall be provided in all motor starter modules with contactor rating of 200 Amps and above. The SPP shall be of the current operated type and shall operate on the principle of sensing negative sequence component of current.
- B. In case of single phasing, the SPP shall operate after a time delay of 2 to 3 secs. The relay shall be of the hand reset type and visual indication of the relay operation shall be available.
- C. The SPP shall be suitable for protection of the non-reversible and reversible motors. The relay operation shall be independent of the loading and RPM of the motor prior to the occurrence of single phasing.

2.18. CABLE TERMINATION

- A. The switch board panel shall be complete with suitable cable end termination for XLPE insulated cables. Cable and sealing box shall preferably be mounted inside the panel. For XLPE cables adequate space and clearances shall be made for heat shrinkable termination e.g. Raychem or cold flowing stress grading joints.
- B. Two earthing terminals shall be provided in each panel in cable box/cabling chamber for earthing armour/screen.
- C. Where more than one core is terminated on each phase, links suitably designed and properly supported shall be provided to avoid unnecessary bending of cable cores without decreasing the length of insulated cable tail. Electrical clearances which would normally be required when using one core per phase shall be maintained.
- D. Where core balance type current transformers are provided on switchgear feeder circuit cable/s for earth fault protection sufficient space, clearance and support, mounting arrangement shall be provided for the CT.

PART 3 – EXECUTION

3.1. TESTING AND COMMISSIONING

- A. All panel boards shall be inspected & tested in the presence of Owner/ Consultant's representative and certified by the installation Engineer that it is safe before supply is energized, and that all the equipment comply with the requirements of the Specification.
- B. Generally such tests in the factory and repeated at site are as follows:

1. All routine tests specified in relevant Indian/British Standards shall be carried out on all circuit breakers.
 2. Test for protective relay operation by secondary injection method.
 3. Operation of all meters.
 4. Secondary wiring continuity test
 5. Insulation test with 1000 Volts mugger, before and after voltage test.
 6. HV test on secondary wiring and components on which such test is permissible (2 KV for one minute)
 7. Simulating external circuits for remote operation of breaker, remote indicating lights and other remote operations, if any.
 8. Measurement of power required for closing/trip coil of the breaker.
 9. Pick up and drop out voltages for shunt trip and closing coils.
 10. CT Polarity test.
 11. Power frequency voltage withstand test.
 12. Earth continuity tests;
 13. Check of clearance and creep age distances;
 14. Tests to prove correct operation of controls, interlocks, tripping and closing circuits, indications, etc.;
 15. Interfacing test with BMS control function
 16. All other tests required by the Engineer to verify compliance with the Specification.
- C. Triplicate sets of all principal test records and test certificates are to be supplied for all the tests carried out in accordance with the Specification to the Engineer for approval before dispatch from the factory.
- D. All costs, materials, equipment, labour, etc. necessary for the execution of the testing shall be included in this portion of work.

3.2. DRAWINGS AND INFORMATION

- A. The Vendor shall furnish following drawings/documents in accordance with enclosed requirements:
1. General Arrangement drawing of the Switchboard, showing front view, plan, foundation plan, floor cut-outs/trenches for external cables and elevations, transport sections and weights.
 2. Sectional drawings of the circuit breaker panels, showing general constructional features, mounting details of various devices, bus bars, current transformers, cable boxes, terminal boxes for control cables etc.
 3. Schematic and control wiring diagram for circuit breaker and protection including indicating devices, metering instruments, alarms, space heaters etc.
 4. Terminal plans showing terminal numbers, ferrules markings, device terminal numbers, function etc.
 5. Relay wiring diagrams. 6. Equipment List.

- B. Vendor shall furnish required number of copies of above drawings for Purchaser's review, fabrication of switch boards shall start only after Purchaser's clearance for the same. After final review, required number of copies and reproducible shall be furnished as final certified drawings.
- C. The information furnished shall include the following:
 - 1. Technical literature giving complete information of the equipment.
 - 2. Erection, Operation and Maintenance Manual complete with all relevant information, drawings and literature for auxiliary equipment and accessories, characteristics curves for relays etc.
 - 3. A comprehensive spare parts catalogue.

3.3. TOOLS

- A. One complete set of all special or non-standard tools required for installation, operation and maintenance of the switch board shall be provided. The manufacturer shall provide a list of such tools individually priced with his quotation.

3.4. SPARES

- A. The manufacturer/tendered shall also supply a complete list of commissioning spares and tools. The same shall be included in the bid price. No extra payment shall be made on account of non-availability of spares during commissioning.

3.5. TRANSPORTATION

- A. Panel boards are not allowed to be delivered to site until the electrical room or switch room is in a clean and acceptable condition with lockable doors.
- B. Panel boards, transported to site shall be fully covered with weatherproof covers and transportation eye bolts shall be provided for handling at site.
- C. Panel boards, which are poorly packed and result in signs of corrosion, will be rejected.
- D. All necessary measures to cover and protect the panel boards at site shall be provided. Such measures shall include a complete PVC blanket over the whole panel boards.

3.6. REJECTION OF PANELBOARDS

- A. Deviation from specification must be stated in writing at the quotation stage.
- B. In absence of such statement, it will be assumed that the requirements of the specifications are met without expectation.
- C. If any of the above tests fail to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site, the Engineer may reject the item or defective component thereof, whichever is considered necessary, and after adjustment or modification as directed by the Engineer, the Contractor shall submit that item for further inspection and/or test. In the event of the defective item being of such nature that the requirements of this Specification cannot be fulfilled by adjustment or modification, such item is to be replaced by the Contractor at his own expense, to the entire satisfaction of the Engineer. Delivery of panel boards on site

without significant cable connection (Say 80%) shall not entitle progress payment certified for material delivery on site.

Chapter 5. CIRCUIT BREAKER

PART 1 – GENERAL

1.1. SCOPE

- A. Circuit breaker including Air-circuit breaker (ACB), Moulded Case Circuit Breakers (MCCB), Miniature Circuit Breakers (MCB) and Residual Current Circuit Breakers (RCCB / RCD) shall be provided according to the specification.
- B. All breakers shall be capable of withstanding the electrical, mechanical and thermal stress of the prospective fault level experience. The prospective fault levels of the various breakers shall be verified according to result in short circuit/co-ordination study specified in specification Section 11002.
- C. The drawings, specification and BOQ complement each other and which is shown or called for one shall be interpreted as being called for on both. Material, if any, which may not have been specified but fairly required to make a complete assembly of switch gear as shown on the drawing, specifications shall be construed as being required and no extra charges shall be payable on this account.

1.2. STANDARDS

- A. All equipment, material and components shall comply with the requirements of the latest editions of Indian Standards with updated amendments. Standards and Regulations applicable in the area where equipment is to be installed shall also be followed.
- B. The equipment offered complying with other standards, these standards shall be equal to or superior to those specified and full details of the differences shall be furnished along with the tender.
- C. The Panel boards shall be engineered and constructed in accordance with the latest revision of the following Indian and British standards:
 1. IS/IEC: 60947-2 : Air circuit breaker/molded case circuit breaker.
 2. IS: 3156 : Voltage transformers.
 3. IS: 2705 Part-I, II & III 1964 : Current transformers for metering and protection with classification burden and insulation.
 4. IS: 9224 : Low voltage fuse and protection.
 5. IS: 3231 : Specification for electrical relays for power system protection.
 6. IS:8623 : Specification for factory built assemblies of switchgear and control gear for voltage upto and including 1000-V AC/1200 V-DC.
 7. IS: 4237 : General requirements for switch gear and control gear for voltage not exceeding gear.
 8. IS: 2147 : Degree of protection provided by enclosures for low voltage switch gear and control gear.
 9. IS: 1018 : Switchgear and control gear selection/ installation and maintenance.
 10. IS: 1248 : Direct acting electrical indicating instruments.

- 11. IS: 375 : Arrangement for switchgear, bus bars, main connections, auxiliary wiring and marking.
- 12. IS: 2959 : AC contactors for voltage not exceeding 1000V.
- 13. IS: 5578 : Guide for marking of insulated conductors.
- 14. IS: 11050 : Guide for forming system of marking and identification of conductors & apparatus terminal.
- 15. IS: 1248 : Direct acting indicating analogue electrical measuring instruments and testing accessories.
- 16. IS: 6005 : Code of practice for phosphating of iron & steel.
 - 1. BS EN 60898 IEC 898 : Circuit breakers for over current protection for household and similar installations. 2.BS EN 60947-
 - 2. IEC 947-2 : Low-voltage switchgear and control gear, Part 2 circuit breakers.
 - 3. BS 54193. : Air-break switches, air-break disconnectors, and fuse combination units for voltage up to and including 1000V AC and 1200 VDC.
 - 4. BS 5486 : Low-voltage switchgear and control gear Part 1 assemblies. Part 1 requirement for type tested and partially type tested assemblies.
 - 5. BS 4293 : Residual Current Circuit Breaker
- D. D. BS/IEC or other National standards not mentioned above but are applicable to this installation shall also apply.

1.3. SUBMISSION

- A. A component list and catalogues.
- B. Preparation of bill of materials for Different Items as mentioned in Schedule of Quantities.
- C. Factory and site testing procedures and report formats shall also be included.
- D. Protection co-ordination drawings/tables for complete power system.
- E. Shop inspection and testing procedures.
- F. Field testing and commissioning procedures.
- G. General Arrangement drawing of the Switchboard, showing front view, plan, foundation plan, floor cutouts/trenches for external cables and elevations, transport sections and weights.
- H. Sectional drawings of the circuit breaker panels, showing general constructional features, mounting details of various devices, bus bars, current transformers, cable boxes, terminal boxes for control cables etc.
- I. Schematic and control wiring diagram for circuit breaker and protection including indicating devices, metering instruments, alarms, space heaters etc.
- J. Terminal plans showing terminal numbers, ferrules markings, device terminal numbers, function etc.
- K. Relay wiring diagrams.
- L. Equipment List.

- M. Vendor shall furnish required number of copies of above drawings for Purchaser's review, fabrication of switch boards shall start only after Purchaser's clearance for the same. After final review, required number of copies and reproducible shall be furnished as final certified drawings.
- N. The information furnished shall include the following:
 - 1. Technical literature giving complete information of the equipment.
 - 2. Erection, Operation and Maintenance Manual complete with all relevant information, drawings and literature for auxiliary equipment and accessories, characteristics curves for relays etc.
 - 3. A comprehensive spare parts catalogue. Any other work/activity which is not listed above; however is necessary for completeness of electrical system.

PART 2 – PRODUCTS

2.1. AIR CIRCUIT BREAKERS

- A. Air circuit breakers shall be metal clad, flush mounted, horizontal draw out isolation, air break type complying to IS/IEC 60947-2. Air circuit breakers shall have a rupturing capacity of not less than short circuit current experienced at location of installation for 1 second certified by ASTA or other recognized testing authorities.
- B. The breaker shall be provided with variable microprocessor based releases for over load, short circuit and earth fault protection (and shall be compatible with PC) and shall be in conformance with this specifications.
- C. All air circuit breakers (ACBs) shall be of draw-out type encased in metal clad housings. The manufacturing of the breaker shall be such that there is no compulsory safety clearance imposed around the breakers, in order to optimise the switchboard space requirement.
- D. The ACBs shall be so manufactured that they comprise of main and arcing contacts of adequate ratings and housed in reinforced polyester casings, offering double insulation from the front face and ensuring no possibility of "Flashover" between phases. The main contacts shall have double-actions in each pole and all contacts shall be silver-plated and replaceable.
- E. Arc chutes with stainless steel filters shall be provided on each pole of the breaker as an efficient means of arc control. The filters must be effective to minimize the diffusion of ionized gas outside the breaker when the contacts open on short circuits. This manufacturing detail must be effective at all levels of current for which the breaker is manufacture to operate. Any arc created as a result of the opening of the breaker's contacts during fault conditions shall be completely contained in the chute without any possibility of a "Flashover" between poles or to adjacent earthed metallic parts.
- F. The draw out version of ACBs shall have three indicated positions as follows:
 - a. The breaker is fully racked-in with all the main & auxiliaries engaged.
 - b. Connected: The breaker is fully racked-in with all the main & auxiliaries engaged.
 - c. Tested: The breaker is racked out and with the main disconnected, but all auxiliaries are still connected.
 - d. Disconnected: The breaker is fully withdrawn and all circuits disconnected.

- G. A clear means of Positive Contact Indication (PCI) shall be provided by a mechanical flag marked "ON" or "OFF" to indicate the circuit breakers contact positions. The stored energy mechanism shall also have clear indications marked "CHARGE" or "DISCHARGE" to reflect its status.
- H. Safety shutters shall be provided to all draw out breakers in order to inhibit inadvertent access (degree of protection IP20) to the "live" clusters when the breakers are in the "Test" or "Disconnected" positions. It must be possible to padlock the safety shutters in the SHUT position.
- I. Auxiliary switches shall be equipped for each breaker for indication, alarm and control purposes. Auxiliary switches shall be robust, with double break-action, easily accessible for maintenance and having adequate current ratings to carry the connected load. Each breaker shall have provision for extending the number of auxiliary switches to cover future alarm or signalling circuit requirements. All auxiliary circuitry wiring shall be connected on the front face of the breaker on a set of disconnecting terminals to facilitate the automatic disconnection of auxiliary circuits when the breaker is in the "Disconnected" position.
- J. Circuit breakers shall be manufactured for optimum performance with minimum maintenance. The mechanical endurance (C-O cycles) without maintenance shall be at least 12500 cycles for breakers up to 1600A, 10000 cycles for breakers from 2000A to 4000A and 5000 cycles for 5000A and 6300A breakers. The electrical endurance (C-O cycles) at 440V without maintenance shall be 10000 cycles for breakers up to 1600A, 8000 cycles for breakers of 2000A, 5000 cycles for breakers of 2500A to 4000A and 1500 cycles for 5000A and 6300A breakers.
- K. The circuit breakers shall be equipped with electrical motor operating mechanisms for automatic charging of the stored energy spring mechanism. However, this shall not prohibit the breakers to be operated manually, if required. Closing operations can be initiated either from the local push button on the front face of the circuit breaker or by remote control. The closing coils shall be rated at 230 v AC. After closing, the stored energy spring mechanism shall immediately be recharged automatically by the motor, so as to be ready for next closing operation when the breaker trips.
- L. Normal manual opening of the circuit breaker shall be accomplished either from the local push button on the front face of the circuit breaker or by means of a trip coil. The trip coil must be capable of carrying continuous rated current, i.e. being permanently energized, for electrical interlocking purposes. The tripping mechanism shall be robustly built and stable without possibility of being inadvertently operated by shock or jerk. The trip coil shall be manufactured such that the plunger operates immediately when activated, without having undue delay for the building up of the coil's magnetic field. Regardless of all circumstances, the speed of closing and opening shall be independent of the operator.
- M. The operating mechanism, carriage and hinged panel shall be so interlocked that it is not possible to withdraw the circuit breaker while it is in the closed position. Closing of circuit breaker in between service and disconnected position is also not possible and vice versa.
- N. Provision shall be made so that it is possible to operate the circuit breaker mechanism when it is in the disconnected position.
- O. The main circuit breakers for the incoming supply and the bus-tie (couple) breaker shall be mechanically and electrically interlocked such that only two of the three circuit breakers can be closed at any one time. The mechanical interlock shall be achieved by means of Ronis keys and electrical interlock by means of a permanently energized coil. The system

shall be so arranged that the withdrawal of any one circuit breaker shall in no way effect the operation of the others.

- P. Pad locking facilities shall be provided for each breaker so that breaker operation can be locked in a particular position if so indicated.
- Q. The tests to verify the characteristics of circuit breaker shall include type tests, routine tests and special tests.
 - 1. Type test shall include:
 - a. Verification of temperature rise unit
 - b. Verification of dielectric properties
 - c. Verification of rated short-circuit making and breaker current
 - d. Verification of mechanical operation and endurance
 - 2. Routine test shall include:
 - a. Mechanical operation tests
 - b. Calibration of releases
 - c. Dielectric tests
- R. Other tests, which are to be carried out on request of the relevant authorities, shall be done on the Vendor's account. Vendors must submit type test certificates issued by ASEFA, ASTA or other recognized testing authorities together with the Technical documents or upon request.

2.2. MOULDED CASE CIRCUIT BREAKERS (MCCB)

- A. The MCCB shall comply with IS/IEC 60947-2. The MCCB shall be provided with over current protection by means of thermal and magnetic tripping element.
- B. All MCCB tripping mechanism shall be ambient temperature compensated. MCCB of frame sizes greater than 150 amps shall be equipped with continuously adjustable magnetic pick up setting. MCCBs used for incoming main feeders shall in addition be provided with continuously adjustable rated current settings in the range of 50 to 100% rated current.
- C. The MCCBs shall have quick make and quick break mechanism independent of the operating speed. The tripping mechanism shall be mechanically "trip free" from the handle so that the handle cannot be closed against fault conditions. All MCCBs should have isolation feature and line load reversibility.
- D. The MCCB shall be provided with door interlock handles. All handles shall be large and robust to carry out the switching operation with ease. The handle shall clearly indicate the "ON", "OFF" and "TRIP" positions. The handle shall be able to be locked in the "ON" or "OFF" positions. When locked in the "ON" position it shall still be possible for the handle to indicate "TRIP" when the MCCB has tripped. An interlock release mechanism shall be provided to enable the door to be opened when the MCCB is locked in the "ON" position.
- E. Multi-pole MCCB shall have a common-trip bar so that a fault condition on any one pole of the MCCB will cause all poles to trip simultaneously.
- F. The MCCB interrupting capacity shall be not less than that indicated on the drawings and back up discrimination/ cascading charts should be submitted of the OEM. G. MCCBs of ratings 200A and above shall be of Busbar termination type, adaptable for use with bolts and cable lugs.

- G. Automatic change over MCCBs shall be of the motorised type, fully withdrawable, with both mechanical and electrical interlock. The transfer operation shall be controllable by an adjustable time delay of between 0.1 to 30 sec. The actual transfer time of the MCCBs shall not exceed 2 sec. The motor mechanism shall utilise universal motor with electromagnetic clutch and shall be equipped with full handles to allow manual operation of the MCCB. All automatic change over MCCBs shall have a minimum mechanical life of 10,000 operations.
- H. MCCB when used for motor protection shall have characteristics suitable for the motor starting. Standard range MCCB shall not be substituted for motor protection circuits.
- I. All fully withdrawable MCCB shall have interlocks to prevent withdrawal when the MCCB is "ON".
- J. All main moulded case circuit breaker shall be provided with at least 2 pairs N/O and N/C auxiliary contact.
- K. Indicating lamps shall be of the panel mounting, LED type and shall have execution plates marked with its function wherever necessary. The colour of the lamp cover shall be red for 'ON' and green for 'OFF' indicating lamps shall be provided with series resistor.

2.3. MINIATURE CIRCUIT BREAKERS (MCB)

- A. MCBs shall comply with IEC 898:1995. They shall be of the current limiting type having a sealed ambient temperature independent thermal magnetic tripping mechanism providing overload and short circuit protection. All MCBs shall be of 35mm D/N symmetrical rail mounted type.
- B. The breaking capacity of MCBs shall be at least equal to the prospective fault level at the point installation, unless back-up by a current limiting upstream breaker of the same make.
- C. The MCB operating mechanism shall be mechanically trip free from the operating handle so as to prevent the contacts from being held closed against short circuit and overload conditions. It shall be of the automatic resetting type.
- D. The individual operating mechanism of each pole of a multi-pole MCB shall be directly linked within the MCB casing and not with the operating handles.
- E. The operating handle shall be of the toggle type with possibility for mounting of padlocking facility.
- F. Each pole shall be provided with bi-metallic thermal element for overload protection and magnetic element for short circuit protection.
- G. It shall be possible to fit on site auxiliaries like shunt-trip coil, under-voltage release, ON/OFF switch or alarm switch.

2.4. RESIDUAL CURRENT CIRCUIT BREAKERS (RCCB)

- A. RCCB shall comply with BS 4293 and shall be of the current operated type.
- B. The RCCBs shall be manufactured to trip within 0.1 second for 30 mA.
- C. The RCCBs shall be of 2-pole construction for single phase and 4-pole construction for 3 phases.
- D. All RCCBs shall be complete with test buttons.
- E. All RCCBs shall be batch tested and bear the appropriate test label of approval to SEB requirement.

- F. All RCCBs shall be of high sensibility type as appropriate and as specified in the drawing. They shall be of surge proof manufacture to prevent nuisance tripping due to transient over voltage.

PART 3 – EXECUTION

3.1. TESTING AND COMMISSIONING

- A. All Switch gears shall be inspected & tested in the presence of Owner/ Consultant's representative and certified by the installation Engineer that it is safe before supply is energized, and that all the equipment comply with the requirements of the Specification.
- B. All routine tests specified in relevant Indian/British Standards shall be carried out on all circuit breakers.
 - 1. Test for protective relay operation by primary or secondary injection method.
 - 2. Operation of all meters.
 - 3. Secondary wiring continuity test
 - 4. Insulation test with 1000 Volts megger, before and after voltage test.
 - 5. HV test on secondary wiring and components on which such test is permissible (2 KV for one minute)
 - 6. Simulating external circuits for remote operation of breaker, remote indicating lights and other remote operations, if any.
 - 7. Measurement of power required for closing/trip coil of the breaker.
 - 8. Pick up and drop out voltages for shunt trip and closing coils.
 - 9. CT Polarity test.
 - 10. Tests to prove correct operation of controls, interlocks, tripping and closing circuits, indications, etc.;
 - 11. Interfacing test with BMS control function.
 - 12. All other tests required by the Engineer to verify compliance with the Specification.
- C. Vendor shall provide all facilities such as power supply, testing instruments and apparatus required for carrying out the tests.
- D. Required copies of test certificates for all the tests carried out along with copies of type test certificates and certificates from Sub-Vendor for the components procured from them are to be submitted before dispatch of switch boards.

3.2. TOOLS

- A. One complete set of all special or non-standard tools required for installation, operation and maintenance of the switch board shall be provided. The manufacturer shall provide a list of such tools with his quotation.

3.3. SPARES

- A. The manufacturer/tenderer shall also supply a complete list of commissioning spares and tools. The same shall be included in the bid price. No extra payment shall be made on account of non-availability of spares during commissioning.

3.4. QUALITY ASSURANCE

- A. Quality Assurance shall follow the requirements of Owner/ Consultant as applicable.

- B. Quality Assurance involvement will commence at enquiry and follow through to completion and acceptance thus ensuring total conformity to Purchaser's requirements.

3.5. DEVIATIONS

- A. Deviation from specification must be stated in writing at the quotation stage.
- B. In absence of such a statement, it will be assumed that the requirements of the specifications are met without exception.
- C. If any of the above tests fail to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site, the Engineer may reject the item or defective component thereof, whichever is considered necessary, and after adjustment or modification as directed by the Engineer, the Contractor shall submit that item for further inspection and/or test. In the event of the defective item being of such nature that the requirements of this Specification cannot be fulfilled by adjustment or modification, such item is to be replaced by the Contractor at his own expense, to the entire satisfaction of the Engineer.

Chapter 6. CONDUIT SYSTEM, CABLE TRAY, CABLE LADDER AND TRUNKING INSTALLATION

PART 1 – GENERAL

1.1. WORK DESCRIPTION

- A. This section describes the supply and installation of wiring facilities systems include conduits, cable trays, cable ladder and Trunking system, c/w associated fittings and accessories.
- B. All cables run above the suspended false ceiling, concealed in walls, columns, or on surface shall be supported by conduits, cable tray and Trunking or cable ladder system. No free slinging cable is allowed.
- C. The cable routes as shown in the drawings shall be used as a guide only. Prior to the installation, the cable routes shall be coordinated with other services. Uncoordinated and inaccessible routes after other services are installed, shall be relocated at the expense of the Contractor.
- D. All conduits, trunking, cable trays and cable ladders shall be earthed in accordance to IS: 4043.

1.2. STANDARDS

- A. The complete wiring facilities system shall be manufactured, supplied, installed and tested in accordance with the latest revision of the India-Delhi standards and the appropriate BS/IEC include:
 - 1. Steel Conduit and Fitting Accessories IS:9537 (Part-II)/ BS4568 & BS731
 - 2. PVC Conduit and Fitting Accessories IS-9537/1983 (Part-III)/BS6099 & BS4607
 - 3. Cable Tray BS729
 - 4. Cable Ladder BS729
 - 5. Cable Trunking BS4678
- B. The complete wiring facilities system shall also conform to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in this Specification and Drawings, whichever is the more stringent and acceptable to the Engineer.
- C. In the adoption of standards and requirements, the Contractor shall take the following precedence:
 - 1. Engineer's decision;
 - 2. Local codes of practice;
 - 3. Drawings;
 - 4. Specification;
 - 5. International standards and requirements

1.3. SUBMISSIONS

- A. All technical submissions shall be approved by the Engineer prior to the respective stages of construction. Routing of installation Sample with proprietary factory-made accessories, elbows, risers, reducers, tees, crosses, etc.

PART 2 – PRODUCTS

2.1. STEEL CONDUIT AND ACCESSORIES

A. Steel Conduit

1. All conduits shall be of heavy gauge solid drawn ERW welded manufactured out of 16 (1.6mm) gauge MS Sheet up to 32mm dia and of 14 (2 mm) gauge for sizes higher than this.
2. Both inner and outer surfaces shall be smooth without burrs, dents and kinks.
3. Conduits shall be black stove enamelled inside and outside. The cross section of conduit shall be uniform throughout.
4. The welding shall be uniform such that welded joints do not yield when subjected to flattening test. Welded joint shall not break when threaded or bent at an angle.
5. Conduit shall conform to specifications of IS: 9537 (Part-II) and the capacity of conduits shall be in accordance with the standards and shall never be exceeded.
6. The minimum size of the conduit shall be 19/20mm dia.
7. Care shall be taken to ensure that all conduits are adequately protected while stored at site prior to erection and no damaged conduit shall be used.

B. Fittings

1. Samples of conduit fittings shall be submitted for approval prior to installation.
2. Fittings shall be those intended for use with screwed conduits and shall comply with IS 9537. However, bends, elbows and tees shall not be installed.
3. Boxes and cover plates that are installed outdoors shall have fixing lugs exterior to the box so that fixing screws do not enter the box interior.
4. Adaptors used with flexible conduits shall conform to IS: 9537.

C. Circular Boxes

1. Circular boxes shall be of malleable cast iron, galvanized and of standard pattern with spout(s). When used for connecting lengths of conduits, circular boxes shall be provided with cover plates of similar make that are complete with brass fixing screws.

D. Rectangular Boxes

1. Rectangular boxes (adaptable boxes) shall be of mild steel not less than 2.4 mm gauge and galvanized. When used as junction boxes, lids of the same gauge with brass fixing screws shall be used.

E. Boxes for Accessories

1. Boxes for accessories shall be suitable for surface mounting or recessed mounting according to the requirements. Surface mounted boxes and accessories shall be metal clad pattern. Recessed boxes and accessories shall be complete with insulated moulded type cover plates conforming to IS: 5133 Part I-1969.

F. Covers

1. All covers for boxes, etc shall be made of galvanized steel of 1.2 mm thickness.

2.2. PVC CONDUIT AND ACCESSORIES

A. PVC Conduit

1. All conduits shall be high impact rigid 2mm thickness PVC heavy duty type and shall comply with I.E.E. regulations for non-metallic conduit 2mm thick as per IS-9537/1983 (Part-III).
2. All sections of conduit and relevant boxes shall be properly cleaned and glued by using epoxy resin glue and the proper connecting pieces.
3. Inspection type conduit fittings such as inspection boxes, drawn boxes, fan boxes and outlet boxes shall be M.S. or otherwise mentioned.
4. Conduit shall be terminated with adopter/PVC glands as required.

B. PVC Conduit Accessories

1. Accessories used for conduit wiring shall be of an approved type complying to IS: 3837- 1966.
2. All accessories used shall be of standard white or black colour, identical to conduit used.
3. Plain conduits should be jointed by slip type of couplers with manufacturer's standard sealing cement.
4. All conduit entries to outlet boxes, Trunking and switchgear are to be made with adaptors female thread and male bushes screwed.
5. PVC-switch and socket boxes with round knockouts are to be used. The colours of these boxes and the conduits shall be the same.
6. Standard PVC circular junction boxes are to be used with conduits for intersection, Tee-junction, angle-junction and terminal. For the drawing-in of cables, standard circular through boxes shall be used.
7. Samples of accessories shall be submitted for approval prior to installation.
8. All jointing of PVC conduits shall be by means of adhesive jointing. Adequate expansion joints shall be allowed to take up the expansion of PVC conduits.

2.3. CONDUIT INSTALLATION

A. Layout

1. The conduit layout and conduit routes shall be submitted for approval. Allowance for adjustments due to site conditions shall be provided with no extra cost.
2. Conduit routes shall be chosen for easy, straight runs with a minimum of bends and crossings. Generally they shall follow the structure of building, running at right angles or in parallel to floors and ceilings. Conduits shall be kept within 300 mm of floors and ceilings when running parallel to them.
3. Outlet boxes for housing accessories shall be used as draw boxes. The total number of draw boxes shall be kept to a minimum and shall be provided so that conduit runs do not exceed 12 m or have more than two right angle bends.
4. All conduits shall be kept clear of gas and water pipes. In particular, conduits shall be at least 150 mm away from gas pipes. Where proximity to these pipes is unavoidable, they shall be effectually segregated e.g. using rubber or other insulating material to prevent appreciable voltage differences at possible points of contact. Segregation from

extra low voltage circuits and telecommunication circuits shall also apply unless these are wired to the same voltage requirements as lighting and power circuits.

5. Conduits from different distribution boards shall not be connected to the same junction box. Each run of conduit shall be assembled complete with draw-in-wires.

B. Joints and Terminations

1. Electrical and mechanical continuity shall be maintained throughout all conduit joints and terminations. Conduit threads shall be thoroughly cleaned and the conduits tightly screwed. The conduit system shall be watertight after installation.
2. Conduits shall be connected using couples or via boxes. With a coupler, the ends of the conduit shall butted close together and the running coupler is screwed tightly on and tightened by a locknut.
3. Conduits terminating into boxes provided with spouts shall be threaded so that there are no exposed threads. For boxes with no spouts, the termination shall be made using a brass bush and a coupler. The conduit is pushed through the knockout or drilled entry and the bush is screwed tightly onto its end. The coupler is screwed to butt firmly against the exterior wall of the box.
4. Where conduits are not jointed or terminated in boxes, they shall be terminated in a screwed brass bush.
5. In all joints and terminations, conduit threads shall not be exposed. Where this cannot be avoided as in a running coupler, the exposed threads shall be coated with red lead paint to seal against the ingress of water.

C. Bends

1. Conduits shall only be bent cold with an approved type of bending block or bending machine, without altering the dimensions of their sections.
2. All conduit bends shall be such as to permit compliance to the requirements for bends in cables to as stated in the BS 7671.
3. Bends shall be made with as large a radius as the position of the conduit within the building permits. Where the bend is more than 90 degree, circular or rectangular junction boxes are to be used for connecting conduits.

D. Cabling

1. The conduit system must be completely installed and free of obstructions and sharp corners before any cables are drawn in. Conduits shall be thoroughly swabbed to remove moisture and dirt immediately prior to the drawing in of cables.
2. Cables shall be drawn without crossing each other and shall not be pulled against the walls of the draw boxes. Slack cables shall left in all draw boxes.
3. Cables shall be continuous throughout conduit lengths and no joints are permitted. There shall be no kink in cables, neither any cut, abrasion or chink in the cable insulation.
4. The same conduit shall carry the lead and return conductors bunched together. However, the same conduit shall not house cables from different distribution boards.
5. Cables for power and lighting circuits and extra low voltage systems shall not be drawn into the same conduit. Lighting and power final circuits shall be run in separate conduits except, where an adaptable box is employed as final distribution point, a number of final circuits may be grouped together in larger conduits between the distribution board and the adaptable box provided that all final circuits in one conduit

are of the same phase. In the case of three phase circuits, all three phases including neutral, if any, shall be drawn into the same conduit.

6. Conduits shall not constitute the earth continuity path for the electrical circuit. A separate circuit protective conductor shall be installed within the conduit. The whole conduit system shall be effectively earthed.
7. Flexible conduits shall also have a separate earthing conductor installed within the tubing and connected at conduit ends. Flexible conduits in general shall not be used for more than 3m length.
8. Maximum number of PVC insulated 650/1100 V grade/copper conductor cable conforming to IS:694-1990

Nominal	20mm		25mm		32mm		38mm		51mm		64mm	
Cross- Sectional area of Conductor in Sq.mm	S	B	S	B	S	B	S	B	S	B	S	B
1	2	3	4	5	6	7	8	9	10	11	12	13
1.50	5	4	10	8	18	12	-	-	-	-	-	-
2.50	5	3	8	6	12	10	-	-	-	-	-	-
4	3	2	6	5	10	8	-	-	-	-	-	-
6	2	-	5	4	8	7	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	5	5	10	7	12	8
25	-	-	-	-	3	2	5	3	8	6	9	7
35	-	-	-	-	-	-	3	2	6	5	8	6
50	-	-	-	-	-	-	-	-	5	3	6	5
70	-	-	-	-	-	-	-	-	4	3	5	4

Note:

- i. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
- ii. The columns heads 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns heads 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.
- iii. Conduit sizes are the nominal external diameters.

E. Access and Drainage

1. The conduit system shall be rewirable, that is, draw boxes must be accessible for the purpose. Where boxes are concealed, their covers shall be flushed with the finished surface.
2. The need for accessibility notwithstanding, the conduit system shall be protected against the ingress of water and impurities. When installed, conduits shall be kept dry

and free of debris with approved pipe plugs or caps. Such plugging is especially essential prior to pouring concrete for concealed installation. As for boxes, they shall be covered by steel plates prior to concreting.

3. When installed outdoor, and in situations liable to condensation of moisture, conduits shall be arranged to be self draining, so that water may drain to low points which are fitted with a drain plug. Conduits laid under concrete floors shall have watertight floor-traps of approved detail for access of these drainage points.
4. Conduits run on surfaces other than structural steel members shall be secured using galvanized space bar saddles and brass fixing screws. Spacing of saddles shall not exceed 1.2 m for conduit sizes up to and including 25 mm and 1.8 m for sizes 32 mm and above.
5. Conduits run on structural steel shall be secured using girder clips or an approved clamp. These conduits and those run in the vicinity of structural steel shall be bonded to the steelwork using an efficient and permanent metallic connection. The conduits shall not in any way be under mechanical stress.
6. All conduit boxes except loop-in patterns shall be fixed direct to the building structure in addition to the support provided by the conduits.
7. Conduits terminating into surface boxes shall be secured by a minimum of 3 saddles at not less than 32 mm, 150 mm and 300 mm respectively from the box.
8. Conduits shall be painted with an approved paint to blend with visual environment. A zinc rich undercoat shall be provided before painting the final coat.

2.4. CABLE TRAY

- A. Cable tray shall be of perforated type and constructed a minimum 2.0 mm hot dipped galvanized mild steel for outdoor damp condition, and epoxy coated electro-galvanized mild steel for indoor installation. All cable trays shall be installed in a straight run parallel to walls where possible.
- B. Cable trays shall be supported by electro-galvanized 'U' channel with galvanized threaded rod for indoor suspended tray and hot-dipped galvanized for area subject to weather.
- C. All hangers shall be installed at 1 metre intervals and shall be primed and painted to match with the surrounding building finish approved by the Engineer.
- D. For cable tray that are exposed to the weather, a hot-dip galvanized covers of 1.5mm gauge steel, flush fixing type with gasket, shall be installed on top of the tray.
- E. Depending on the size of cable trays spare space of 25% shall be maintained for future expansion.
- F. Copper earth link bar shall be fixed at every joint of the cable tray run.

2.5. CABLE LADDER

- A. All cable ladders and accessories installed indoors shall be heavy-duty epoxy coated electro-galvanized mild steel type. All cable ladders installed outdoors shall be heavy-duty hot dipped galvanized hot rolled mild steel. Thickness of the mild steel shall not be less than 2 mm.
- B. Cable ladder shall have a 150 mm high longitudinal side member for ladders width of 800 mm or above and 120 mm high longitudinal side member for ladder width less than 800 mm.

- C. The rungs shall be at least 50 mm wide, with slots of 25 mm x 10 mm at 25 mm intervals covering the length of the rungs. The rungs shall be spaced at 300 mm apart along straight lengths of the ladder.
- D. All nuts, bolts and washers for clips and brackets shall be zinc plated. Each cable ladder shall be in standard manufacturer's length and supplied complete with coupling sets consisting of fishplates, spined bolts, nuts and locking washers.
- E. The complete cable ladder installation shall be provided with all necessary proprietary factory-made elbows, risers, reducers, tees, crosses, drop-outs, etc. and any site fabricated items will not be permitted.
- F. Separate flexible earth continuity connectors of at least 16mm² copper jumpers shall be installed between the ladder sections.
- G. All cable ladders shall be supported from the ceiling concrete slab, steel structures or sidewalls using a frame system, with overhead hangers, support channels, hanger rods or angle brackets, beam clamps and ceiling brackets.
- H. Fixings and supports shall be installed at regular intervals not exceeding 1000 mm and 150 mm from all bends, tees, inter-sections and risers.
- I. When cable ladder is required to install across structure expansion joints, the ladder shall be in two sections between supports installed on either side of the expansion joint.
- J. The ladder sections shall then be jointed with expansion joint fishplates, bolts, nuts and washers installed in elongated holes permitting a lengthwise movement of 25 mm from the initial fastening position.
- K. For cable ladder that are exposed to the weather, a hot-dip galvanized cover of 1.5mm gauge steel, flush fixing type with gasket, shall be installed on top of the ladder.
- L. Copper earth link bar shall be fixed at every joint of the cable ladder run.

2.6. CABLES TRUNKING

- A. Cable trunking shall be manufactured from 1.6 mm minimum electro-galvanized mild sheet steel to BS4678 finished in oven-baked electrostatically coated epoxy power coating with color to the Engineer's choice.
- B. All trunking shall have removable lids extending over their entire lengths. Lids shall be fixed at interval not exceeding 1 metre by means of brass steel screws which are protected against corrosion by a finish of zinc coating or equivalent to zinc coating.
- C. Factory-made bends, joints, elbow, riser, tee, reducer and accessories with same material shall be provided throughout the installation for trunking.
- D. Trunking space factor shall be in compliance with latest IS standards.
- E. Copper earth link bar shall be fixed at every joint of the cable trunking run. Note: All items mentioned in this section shall be manufactured to comply with the specifications of National Electrical Code (NEC) and National Electrical Manufacturer's Association (NEMA)

Chapter 7. EARTHING SYSTEM

PART 1 – GENERAL

1.1. WORK DESCRIPTION

- A. This section specifies the engineering, supply, installation, testing, commissioning and setting to work of the complete earthing network for individual earthing systems, circuit protective conductors and bonding conductors. A complete earthing network comprising cables, copper tapes, electrodes and earth bonding of all relevant necessary non-current carrying metal parts of equipments/ apparatus shall have connected as required.
- B. The system shall have a common earthing system as described in the Specification and as shown on the Drawings. Individual earthing systems shall be provided as follows as per drawing. Earth main MV/LV/Generator Electrical Earthing shall have 2 connection to the earthing system:
 - 1. MV Electrical Earthing
 - 2. LV Electrical Earthing
 - 3. Generator Earthing
 - 4. ELV Earthing
 - 5. Data Communication Earthing
- C. Sufficient numbers of electrodes interconnected by Cooper/ GI (as per BOQ) to form earthing mat so that the overall earth resistance shall be less than 1 ohm for each individual earthing mat.
- D. The number of earth electrodes of the earthing mat are indicated on the drawings as minimum. The Contractor shall test the resistivity of soil at site. Exact number of earth electrodes shall be determined by the Contractor to achieve the earth resistance value subject to Engineer approval. The complete earthing installation include earth plate, earth mat detail to achieve the earth resistance value shall be included in the Contract.
- E. The Contractor shall inform the Engineer or his representative before driving Plate/ pipe earthing into the ground so that he may supervise the operation. Driving shall be carried out only in the presence of the Engineer or the representative and all earthing plates/ pipes shall be submitted for the examination before use.

1.2. STANDARDS

- A. Complete earthing system shall be engineering and constructed in accordance with the latest revision of the following standards and the appropriate BS/IEC: 1.
 - 1. IS: 3043 : Earthing
 - 2. BS6651 : Lightning Protection System
 - 3. IEC 61024-1-2 : Lightning Protection System
- B. The detail of the Earthing System shall also conform to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in this Specification and Drawings, whichever is the more stringent and acceptable to the Engineer.

1.3. SUBMISSION

- A. All technical submissions shall be approved by the Engineer prior to the respective stages of construction.
- B. As minimum requirement, the submission shall include the following:

1. Shop Drawings and Sample Submission;
2. Builder's work requirements;
3. Testing procedures and report format for testing of the earth electrodes and/or earth strips;
4. Soil resisting test report with calculation report for the details of the earthing system detail including quantity and layout of earth electrodes and/or earth strips to achieve the required earth resistance. The report shall be endorsed by the Contractor's Installation Engineer who supervise and endorse the installation upon completion;
5. Proposed details of earthing system including quantity and layout of the earth electrodes and/or earth strips according to the calculation result.

PART 2 – PRODUCT

2.1. GENERAL

- A. The resistance between earthing system and the general mass of earth shall not be greater than 1 ohm.
- B. The earth loop resistance to any point in the electrical system shall not be in excess of 0.5 ohms in order to ensure satisfactory operation of protective devices.
- C. The resistance to earth shall be measured at the following:-
 1. At each electrical system ground or system neutral ground.
 2. At one point on each grounding system used to ground electrical equipment enclosures.
 3. At one point on each grounding system used to ground wiring system enclosures such as metal conduits and cable sheaths or armoured.
- D. All earthing conductors shall be of high conductivity copper/ G.I. as per B.O.Q. and shall be protected against mechanical damage. The cross-sectional area of earth conductors shall not be smaller than half that of the largest current carrying conductor. However, the contractor shall use the sizes specified in the bill of quantities of the Tender. Common earth mats of resistivity of less than one (1) ohm, shall be constructed below the lowest floor structure prior to any ground work construction. The earth mats shall comprise the complete earth electrodes, earth strips/grids, earth inspection chambers, earth leads, main earth terminals, earth test link boxes at ground level, etc. Each individual earthing system shall have earth leads connecting its main earth terminal directly to an earth electrode underground as specified.
- E. All earthing products/accessories shall be according to IS standards.

- F. The mating surface of all tapes at joints etc shall be cleaned before clamping and all joints shall be riveted, joint with proper connector or exothermic welded. All connections to electrical apparatus shall be made by a bolted connection in a visible and accessible position

2.2. PIPE EARTH ELECTRODE

- A. G.I. pipe shall be of medium class 100mm dia and 3m in length.
- B. G.I. Pipe electrode shall be cut tapered at bottom and provided with holes of 12mm dia drilled not less than 7.5cm from each other upto 2m of length from bottom.
- C. The electrode shall be buried in the ground vertically with its top not less than 20cm below ground level.
- D. Clamping of the earth leads to the earth rod shall be made by earth clamp. The clamps shall be capable of providing a high pressure contact between the earth rod and the earth leads to achieve a low contact resistance.
- E. When two or more electrodes are driven to form a group, the heads of the electrodes in the group shall be bonded to each other by means of a 25 mm x 3mm GI/ Copper strip, laid at a depth of at least 600 mm in soil.
- F. All earth electrode penetrations through basement water proofing membranes shall be provided with manufacturer's recommended water seal insert sleeve approved by Engineer. The installation of the water seal insert sleeve shall be under the supervision and endorsed by the manufacturer's representative to ensure the installation comply with the manufacturer installation detail.

2.3. PLATE EARTH ELECTRODE

- A. The plate earth electrode shall consist of copper plate or G.I. plate as per item of work. The plate electrode shall be buried in ground with its faces vertical and top not less than 4.5m below Ground level. The plate shall be filled with charcoal dust and common salt filling, extending 15cm around it's on all sides.
- B. A watering pipe of 50mm dia of medium class G.I pipe shall be provided.
- C. The top of the pipe shall be provided with a funnel and a G.I. mesh screen for watering the earth. In the case of pipe electrode a removable plug shall be provided.
- D. The earthing lead from electrode onwards shall be suitably protected from mechanical injury by a suitable dia medium class G.I. pipe in case of wire and size according to strip size.
- E. The overlapping of strips at joints shall done in approved manner
 - a. GI strips shall be riveted with rivets/ bolted and welded.
 - b. Copper strips shall be riveted with rivets/ bolted brass nuts, bolts and washers and brazed.
- F. The protection pipe within ground shall be buried at least 30 cm deep (to be increased to 60cm in case of road crossing and pavements).
- G. The portion within the building shall be recessed in walls and floors to adequate depth.
- H. In the case of plate earth electrode the earthing lead shall be securely bolted to the plate with two bolts, nuts, check nuts and washers.
- I. In case of pipe electrode, it shall be connected by means of a through bolt, nuts and washers and cable socket.

- J. Main earthing conductor is taken from the earth electrode with which the connection is to be made.
- K. No earth pit shall be fixed within 1.5 M of a wall of foundation. The location of the earth electrode will be such where the soil has reasonable chance of remaining moist. Effort shall be made to locate them in grass lawns or near flower beds or water taps.

2.4. EARTH INSPECTION CHAMBER

- A. Earth electrode shall be fitted with a heavy-duty pre-cast concrete inspection chamber/pit complete with heavy-duty cover as specified on drawings.
- B. For earth electrodes located outside or on the apron of the building, earth inspection chambers shall extend to a depth of not less than 300 mm below finished ground level and kept free of soil. For earth electrodes located inside building, earth electrodes shall be buried not less than 100 mm below the floor slab structure. Each earth electrode shall be clearly marked 'SAFETY ELECTRICAL EARTH CONNECTION – DO NOT REMOVE.
- C. The chamber and cover shall be heavy duty detail to consider the traffic load at the location of installation. The cover shall be recessed cover to receive the Architectural floor finish at the location of installation.

2.5. EARTH STRIP

- A. Earth strips/grids shall be of bare GI/ Copper strips of 25 mm x 3 mm as specified.
- B. Earth strips shall be riveted or joint with proper connector to earth electrodes underground below the floor slab structure, and shall be buried not less than 300 mm below the floor slab structure.
- C. In order to minimise the mutual inductance between strips, earth strips shall be positioned at a distance not less than 6m apart unless otherwise specified.

PART 3 – EARTH BONDING

3.1. CIRCUIT PROTECTIVE CONDUCTOR

- A. Circuit protective conductor (CPC) is a system of conductors joining together all exposed conductive parts and connecting them to the main earth terminal.
- B. The purpose of circuit protective conductor is to provide a path for earth fault circuit so that the protective device will operate to remove dangerous potential differences during a fault condition.
- C. The circuit protective conductors shall take the form of separate cable with a sheath in green/yellow color or copper tape of minimum size 25mm x 3mm.
- D. All exposed non-current carrying metal parts of light fittings, switchgears, motors, enclosures, etc. shall be effectively earthed by circuit protective conductors for earth continuity protection.
- E. For equipment where an earth terminal is provided, the earth continuity wire shall be firmly clamped. Where no earth terminal is provided, the exposed metal part shall be cleaned of paint and surface rust before welding the earth continuity lead. F. The minimum size of the principal protective conductors shall be in accordance with to the current edition of IS: 3043/ BS7671 and BS7430.
- F. The external earth terminal on the outside of the end panel of any switchboard shall be connected to the main earth bar provided in two independent points.

- G. Circuit protective conductors shall be provided in electrical and mechanical rooms and along the routes for the bonding of all exposed conductive parts and extraneous conductive parts. A suitably sized earth terminal shall be provided at each zone of the building for this purpose.
- H. All exposed conductive parts shall be effectively connected in an approved manner to the principal protective conductors. The circuit protective conductors shall be single core copper cables or high conductivity annealed copper tapes specified. Unless otherwise specified, the minimum cross sectional area of the circuit protective conductors shall be selected in accordance with IS:3043/ BS7671:

Chapter 8. **LIGHTNING PROTECTION SYSTEM**

PART 1 – GENERAL

1.1. WORK DESCRIPTION

- A. The work to be done under this section comprises the engineering, supply and installation necessary for the complete installation of the Lightning Protection System.
- B. The Lightning Protection System shall be installed generally in accordance with BS6651 and IEC 61024-1-2 and additional requirements of this specification. The system shall be of the Faraday-cage type and shall consist of air terminations, down conductors, joints and bonds, testing joints, earth terminations and earth electrodes. The general arrangement shall be as indicated on the Drawings.
- C. The lightning protection system shall comprise:- 1. Air Terminations; 2. Down Conductors; 3. Joints and Bonds; 4. Test Links 5. Earth Terminations.
- D. Lightning protection system employing steel structural and reinforcement system as part of the down conductors shall be adopted as per Drawing specified. All requirements in the specification included cast-in re-bar down conductors shall be applied unless otherwise specified.

1.2. STANDARDS

- A. Complete installation shall be engineering and constructed in accordance with the latest revision of the following standards and the appropriate BS/IEC : IS 2309 - Lightning Protection System BS6651 - Protection of Structures against Lightning AS 1768 - Lightning Protection BS 7671 - Electrical Installation IEC 61024-1- 2 - Lightning Protection System
- B. The detail of the lightning protection system shall also conform to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in this Specification and Drawings, whichever is the more stringent and acceptable to the Engineer.
- C. In the adoption of standards and requirements, the Contractor shall take the following precedence:
 - 1. Engineer's decision;
 - 2. Local codes of practice;
 - 3. Drawings;
 - 4. Specification;
 - 5. International standards and requirements.

1.3. SUBMISSION

- A. All technical submissions shall be approved by the Engineer prior to the respective stages of construction. B. As a minimum requirement, the submission shall include the following:
 - 1. Equipment submission with manufacturer's data;
 - 2. Sample submission;
 - 3. Shop Drawings showing the co-ordinate routing of air terminations, down conductors bonding to re-bar and foundation earth terminations, methods of fixing etc.
 - 4. Builder's works requirement.
 - 5. Proposal on testing procedures and report format for testing of the Lightning Protection System.

6. Detail of the Contractor's installation Professional Engineer who supervise and endorse the installation for occupation permit application.

PART 2 - PRODUCT

2.1. AIR TERMINATION

- A. The Contractor shall supply and install an air termination system consisting of continuous horizontal conductors.
- B. The conductors shall comprise of 25mm x 3mm GI/ Copper tape unless otherwise specified, located as shown on the Drawings and securely fixed in place to the building structure. Wherever possible, the horizontal conductors shall be continuous lengths.
- C. Where saddled to masonry, the fixing screws shall be set in expansion type plugs contained in properly formed holes.
- D. All roof conductors are to be secured at intervals not exceeding 900mm.
- E. The Drawings showing the various roof levels of the building indicate the general arrangement and layout of the air termination system. The Contractor shall ensure that the whole of the air termination system is installed over its total route of the roof areas maintaining absolute electrical continuity.
- F. Provision shall be made with suitable fittings to allow for expansion and contraction of the horizontal conductors.
- G. 500mm height vertical GI/ Copper air terminal shall be provided for the Air Termination network fixing next to masonry material at the highest points and any connection to down conductor.
- H. Air termination on the vertical side of the building above 45mm as required by BS6651 shall be provided with maximum 30m spacing and minimum 2 points. The Contractor shall co-ordinate the installation detail to allow for bonding of the curtain wall to the embedded down-conductor re-bar to Engineer satisfaction and comply with BS6651 requirement. All additional materials and installation as required shall be included in the Contract.

2.2. DOWN CONDUCTOR

- A. The down conductor routes shall be embedded in colour as indicate on drawing and shall be as direct as possible.
- B. The bonding conductor at roof conductor shall be of soft annealed GI/ Copper strip minimum size 25mm x 3mm. Where the conductors penetrate the roof, the holes shall be effectively sealed and waterproof with proprietary sealant to the approval of the specialist roofing contractor.
- C. All exposed metal running vertically external to the structure shall be bonded to the re-bar down conductor. This shall be included but not limited to curtain wall frame, pipes, ducts and other metal components running through the Buildings.
- D. The down conductors shall be run according to the route as shown in the Drawings or as required to BS6651 requirement.
- E. The Sub-Conductor shall ensure that the proper material and equipment are used in accordance with the manufacture's recommended installation.
- F. Lightning protection system shall employing steel structural or reinforcement as down conductor as per Drawing specified. Continuous re-bar down conductors shall be provided system to ensure continuity and run along steel reinforcement with bonding at maximum

1m interval or minimum two (2) points at each in-continuous steel structural member of reinforcement.

2.3. JOINTS AND BONDS

- A. All joints and bonds shall be soundly secured and shall be of low resistance. The cross-sectional area of the material used e.g. GI/ Copper shall not be less than the main conductor (i.e. 25mm x 3mm) unless otherwise specified.
- B. Where possible, joints shall be kept as few as possible. All joints shall be carried out with manufacturer's recommended compress type clamp. Two (2) screw minimum shall be provided for each joint.
- C. Bonding Points shall be carried out with manufacturer's recommended sets. Customer's self-made items are not acceptable.
- D. Joining of dissimilar metals shall be protected from moisture by applying recommended compound on the material. Bi-metal joint shall be provided where dissimilar metals are used.
- E. All junction and bonding clamps shall be phosphor bronze material.

2.4. TEST LINK

- A. A test link shall be provided for testing earthing pit at ground floor. The test link shall be of phosphor bronze and shall be located at 150mm above ground level in an easily accessible position for testing.
- B. The test link shall be protected from unauthorized interference. It shall be of an approved type and shall not constitute an electrical resistance within the system.
- C. Test clamps shall be provided at air termination network and Earth Termination for each down conductor and so arranged that all parts of the network can be tested independently.
- D. After installation and completion of testing, all test clamps shall be painted with bituminous paint to prevent corrosion.

2.5. EARTH TERMINATION

- A. Down Conductor re-bar will be bonded to foundation steel network. GI/ Copper tape 25mm x 3mm shall be interconnect all re-bar down conductor at the lowest ground level along the perimeter of the building.
- B. The maximum permissible earth resistance of the Lightning Protection System shall be 10 ohms. Testing earth electrode shall be provided for earthing test.
- C. All earth electrode penetrations through basement waterproofing membranes shall be provided with manufacturer's recommended water seal insert sleeve approved by Engineer. The installation of the water seal insert sleeve shall be under the supervision and endorsed by the manufacturer's representative to ensure the installation comply with the manufacturer installation details
- D. The top of each electrode shall be protected from damage by placing it in a heavy duty pre-cast concrete inspection chamber with heavy duty cover. The actual connection of the conductor to the electrode shall be accessible and visible when cover is removed.

PART 3 – LIGHTNING PROTECTION EQUIPOTENTIAL BONDING

3.1. METALLIC CURTAIN WALL BONDING

- A. All elements of the façade shall be directly earthed to the structure for the purpose of lightning protection. The Contractor shall make himself aware of the requirements under

the latest revision of the standard. All necessary connections, conductors, earthing connectors etc shall be deemed to be included in this Contract.

- B. The Contractor shall co-ordinate with the Curtain Wall Supplier/Contractor for the exact interface and bonding requirements. The curtain wall is to be electrically continuous and the installation shall comply with BS6651. Tests shall be carried out by this Contractor to the satisfaction of the Engineer to ensure electrical continuity as stipulated in the code.
- C. Lightning protection bonding terminals along each re-bar down conductor shall be provided by the Contractor at the lowest levels and roof levels for bonding with curtain walls. Intermediate bonding terminals shall be provided at an interval of not exceeding 30m apart at each of the vertical intervals as required by the standard lightning protection bonding terminals shall be confirmed with the Curtain Wall Supplier/Contractor.
- D. As a general practice, bonding points shall be provided and located on the internal face of the claddings. A conductor shall be provided and installed by the Contractor for lightning protection bonding at the down conductors.
- E. The Curtain Wall Supplier/Contractor shall be required to confirm his details on the lightning protection bonding of curtain walls. It is the responsibility of this Contractor to ensure all details (both locations and quantity) agreed complied with BS6651.
- F. All metal cladding components including panels, glazing frames, mullions, transoms, fixings and support structures shall be fully bonded electrically to ensure electrical continuity of the building development.

3.2. EQUIPMENT / STRUCTURE BONDING ON ROOF & OTHER EXTERNAL AREA

- A. The Contractor shall be responsible for bonding of all metal equipment/structure on roof and other exposed external area on flat roof and ground level, complete cabling by means of 25 x 3mm GI/ Copper tape up to the termination point provided by respective Contractor. Bonding within the equipment for maintaining electrical continuity of all metal components will be provided by the respective work in the Contract.
- B. All metallic projections, chimneys, vent pipes, cooling towers, railings, antenna masts, fuel tanks, etc. on or above the main surface of the roof and other external areas shall be bonded to and form the part of the air termination network.
- C. For equipment with plan area above 100sq.m, bonding shall be provided at distance not more than 30m apart equally spaced along the perimeter of the equipment.
- D. All bonding shall be to the nearest down conductor by most direct route available.

PART 4 – TESTING & COMMISSIONING

- A. The Contractor shall arrange with the Engineer for inspection and testing of lightning conductor system. Before the joint testing, the Contractor shall have conducted his own inspection and testing to ensure that all requirements are met as specified. Test report certified by Contractor's installation Professional Engineer shall be submitted to the Engineer. All equipment, transportation, manpower and other necessary costs for the joint inspection and testing shall be borne by the Contractor.
- B. The system shall also be tested at not greater than twelve (12) months intervals for earth resistivity, resistance to earth of the electrodes and electrical continuity of the system during the course of building construction and DLP. The results of these tests shall be by the Contractor's installation Professional Engineer compiled in report prepared by the Contractor.

- C. The Contractor shall supply facilities for the recording of the test results referred to above, arranged in such a manner that comparisons can be readily made with earlier readings.
- D. The Contractor shall submit a detailed layout drawing showing the positions of testing carry out on site.
- E. The record sheet and layout drawing shall be kept on site at all times during the course of construction.
- F. The Contractor shall carry out monthly inspection on the lightning protection system including the earthing pits to ensure that the system is in good working order.

Chapter 9. LUMINAIRES (LIGHT FITTINGS) AND LAMPS

1.1. Scope:

The scope of this section comprises of Supply, erection, testing and commissioning of lighting fixtures for internal lighting, wherever required, of the specified models.

Without restricting to the generality of the foregoing, this section shall include luminaires, lamps and accessories necessary and required for the installation.

Whether specifically mentioned or not, the luminaires and lamps shall be provided with all fixing devices, terminal blocks, holders etc. as required.

1.2. General Requirements:

All the luminaires and lamps shall be of best quality and as per approved makes. Wherever alternative makes are specified the choice of selection shall remain with the Engineer-in-Charge.

The luminaires and lamps shall be fixed in a neat work man like manner, true to level and in accordance with manufacturer's instructions.

The luminaires and lamps shall be provided with such accessories as are required to complete the item in working condition whether specifically mentioned in the specifications, drawings or not.

1.3. Luminaires:

1. Luminaires shall comply with relevant IS.
2. Unless otherwise indicated, enclosure of luminaires shall provide a minimum degree of protection of IP20 when located within buildings and IP 44 when located outside buildings, but luminaires mounted externally; and less than 2 M above finished ground or paved level shall be IP 54 unless specified in BOQ.
3. Unless otherwise indicated, luminaires, both with and without built-in ballast or transformers shall be suitable for direct mounting on normally flammable surface.
4. Where specific requirements related to flame propagation and flammability of translucent covers are indicated, certificates of tests shall be submitted to the Engineer-in-Charge. The tests shall comply with relevant IS.
5. Terminal blocks for connection of the supply cables shall be of adequate size for the size of conductors forming the loop in wiring unless separate tails are required. Wherever indicated, the terminal block shall incorporate a fuse of suitable type and rating.
6. Ballasts for tubular fluorescent lamps shall have a maximum value of harmonics complying with the colour headed "without H Marking" in Table VII of BS 288. Power factor correction shall be provided and this shall not be less than 0.85 lagging unless otherwise indicated.
7. Translucent covers and reflective surfaces shall be clean at the completion of the works.

1.4. Applicable BIS standards:

The lighting and their associated accessories such as lamps, reflectors, housings, ballasts etc. shall comply with the latest applicable standards, more specifically the following:

1.5. General and safety requirements for luminaries:

Tubular fluorescent lamps	IS-1913 (Part-1)
Industrial lighting fittings with metal reflectors	IS – 1977
Decorative lighting outfits	IS – 5077
Bayonet lamp holders	IS – 1258
BI-pin lamp holders for tubular fluorescent Lamps	IS – 3323
Electronic Ballasts for fluorescent lamps –General & safety requirement	IS – 13021 (Part-1)
Electronic ballasts for fluorescent lamps – Performance requirement	IS – 13021 (part – 2)
Ballast for HP MV lamps	IS – 6616
Tubular fluorescent lamps	IS – 2418 (part-1 to 4)
Luminaries – general requirement	IS – 10322 (part – 1)
Luminaries – constructional requirement	IS – 10322 (part – 2)
Luminaries – screw and screw-less Termination	IS – 10322 (part – 3)
Luminaries – methods of tests	IS – 10322 (part – 4)
Particular requirement – general purpose Luminaries	IS – 10322 (part-5 sec-1)
Particular requirement– recessed Luminaries	IS – 10322 (part- 5/sec-2)
Particular requirement – luminaries for Road and street lighting	IS – 10322 (part-5/sec-3)
Particular requirement – portable general Purpose luminaries	IS– 10322 (part-5/sec-4)
Particular requirement – Food lighting	IS– 10322 (part-5/sec-5)
High pressure Mercury Vapour lamps	IS – 9900 (part-1)
Tungsten filament general electric Lamps	IS – 418

1.6. Lamps:

1. Lamps shall be of the type and ratings as indicated.
2. All lamps shall be supplied and installed by the contractor unless otherwise directed.
3. Lamp caps shall be suitable for the lamp holders listed socket by means of a locking ring.

1.7. Support and Fixings:

1. Where fluorescent luminaries 1200 mm or more in length are supported directly by the conduit system, they shall be fixed to two circular conduit boxes both of which shall form an integral part of the conduit system.
2. Where the weight of a luminaire is supported by a conduit box or cable Trunking, the fixing of the conduit box or Trunking shall be adequate for the purpose and approved by Engineer-in-Charge.

3. Luminaries fitted with tungsten filament lamps and having metal back plates shall not be fixed directly to conduit box in which thermoplastic material is the principal load bearing member.
4. Support of luminaries from cable Trunking shall be by means of proprietary clamps or brackets.
5. Where luminaries are supported from the structure other than by the conduit system, the supports shall be adequate for the purpose and approved by Engineer-in-Charge.
6. Luminaries mounted on or recessed into suspended ceilings shall not support luminaries unless specifically shown and approved.
7. For wall mounted luminaries, the mounting height shall be 1900 mm above finished floor level, measured to the centre of the conduit box, unless otherwise indicated.

1.8. Wiring Connections:

1. Where luminaries, are fixed at places other than circular conduit boxes or are supported by pedants or chains, the final circuit wiring shall terminate at a terminal block in the conduit box.
2. Where luminaries having fluorescent tubes are fixed direct to circular conduit boxes, the final circuit wiring may be terminated within the luminaries unless otherwise indicated. The wiring shall enter each luminaire at the conduit entry nearest to the terminal block and where a loop in wiring system is used, leave by the same entry; wiring shall not pass through a luminaries unless the approval of the Engineer-in-Charge.
3. Where luminaries are mounted on or recessed into a suspended ceiling, connection shall be by flexible cord from a plug-in ceiling rose unless otherwise indicated. The plug-in ceiling rose shall be located not more than 500 mm from the access in the ceiling and shall be firmly supported, unless otherwise approved by the Engineer-in-Charge.
4. Cables and flexible cords for final connections to luminaries shall be suitable for the operating temperature of the luminaire.
5. The size of final connection cables or flexible cords shall be as indicated.
6. Cables and cords passing close to ballast within a luminaire shall be suitable for the operating temperature of the ballast.
7. A protective conductor shall connect the earthing terminal or earthing contact of each luminaire to an earthing terminal incorporated in the adjacent conduit box. Where the final connection is by flexible cord, the protective conductor shall form part of the cord.

1.9. High Pressure Sodium Vapour and Metal Halide Luminaries

The high-pressure sodium vapour lamp fittings and components shall conform the general requirements and to the requirements of IEC 662. They shall be of the integral type complete with accessories such as chokes, capacitor, reflectors, igniters, suspension hooks or eyes, suspension arrangements, the inserts or hooks, lamp, connectors, holders etc. complete. The fittings shall be with vapour proofing arrangement.

The control gear box, and suspension brackets shall be epoxy powder coated.

The reflector shall be Electrochemically brightened, polished and Glaskote finish high purity spun aluminium. The unit shall have the facility to receive vapour proofing arrangements.

The lamp holder shall be skirted type and of integral design. The material of the lamp holder shall be glazed porcelain.

The holder shall be provided with a locking ring. The ring shall be of threaded type and made of high-grade copper alloy duly electroplated. The centre contact pillar of the holder shall be made out of stainless steel. The holder shall be provided with back up springs made of stainless steel. The holder mounting arrangement shall be provided using an adjustable bracket to achieve narrow or wide beam light distribution.

Vapour proofing arrangements shall be obtained by using gaskets and 5 mm thick heat resistant toughened glass of high transmission quality mounted on a steel ring with hinged joint to facilitate fastening to reflector. The gaskets shall be moulded from neoprene compound.

The suspension hook/ ring shall be made of cold drawn mild steel, rod forged to shape. The arrangement for assembling the unit to the canopy shall include a collar and threaded end to facilitate assembly-using nuts and check nuts. The hook /ring opening shall not be less than 30 mm clear to provide for the swing of luminary around suspension.

The lamp shall be of specified wattage at a nominal voltage of 220 V volts. The outer shell of the lamp shall be made of hard glass. The discharge tube shall be made out of translucent poly crystalline Aluminium Oxide positioned so as to have a floating construction near the lamp end to avoid stress development.

The ignition arrangement shall consist of electronic type of igniter for ensuring instant striking of discharge and shall be of external type. Bimetallic types built in igniters are not acceptable.

For HPSV lamps, the colour-rendering group of the lamp shall be 3 and the colour-rendering index shall not be less than 21.

For Metal Halide lamps, the colour-rendering group of the lamp shall be 3 and the colour-rendering index shall not be less than 65.

Chapter 10. 11 KV DISTRIBUTION TRANSFORMER

1.1. SCOPE

Design , manufacture, factory testing , supplying and commissioning of 11000 / 415 volts step down, oil filled, core type, copper wound distribution transformer as per specifications

1.2. STANDARD

The design, manufacture and performance of transformer shall confirm to the Indian Standard IS 2026 and its latest edition

1.3. RATING

Suitable for continuous rating

1.4. CONNECTIONS & VECTOR GROUP

Delta on high voltage side and star on low voltage side with neutral terminal brought out for solid earthing corresponding to the vector group dyn11.

1.5. SYSTEM OF SUPPLY

3 phase, 50 Hz., 11 KV effectively earthed system

1.6. TAPPINGS

Off circuit tap changing on HV side. The tapings to be provided for variation on HV side +/- 7½% in steps of 2.1/2% each. The tap changing switch shall be provided with locking device and an indication plate

1.7. TEMPERATURE RISE

Continuously for full load, temperature rise not exceeding 45°C by thermometer in oil / 55°C by resistance in winding over an ambient of 50°C.

1.8. TYPE: Outdoor / indoor.

1.9. TERMINALS

Single gland trifurcating cable box with brass cone wiping gland shall be suitable for 3 core XLPE insulated armoured aluminium conductor cable on HV side.

The cable box with glands on 433 side shall be suitable for single core/three core PVC insulated, armoured aluminium conductor cables.

Cable compound wherever required is included in the cost of terminations.

1.10. COOLING

Natural cooling by means of pressed/round tubes around transformer tank. The radiators shall be detachable with top and bottom shutoff valve and air release plug on each radiator top.

1.11. INSULATION – OIL

1.12. EARTHING

Two separate earthing terminals to be provided at the bottom of the tank on both sides.

1.13. FITTINGS & ACCESSORIES

The following accessories and fittings shall be provided Lifting lugs. The arrangement for lifting the active part out of the transformer tank along with the cover by means of all lifting lugs with out disturbing the connections.

A. SWIVEL TYPE ROLLERS

The transformer to be provided with the 4 nos. Bidirectional rollers fitted on cross channels to facilitate the movement of transformer in both directions.

B. OIL CONSERVATOR

The transformer to be provided with an oil conservator with welded end plates. It is to be bolted to the cover and can be dismantled for purpose of transport. It has to be provided with oil level gauge with marking for minimum 'level' and an oil filling hole with the cap which can be used for filtering oil. For draining purpose a plug is to be provided. A connection pipe between the conservator and the main tank is to provided which projects inside the conservator.

C. Thermometer pocket

D. Rating and diagram plate

E. AIR RELEASE VALVE

An air release valve is to be provided on the top of the tank cover to facilitate the release of the entrapped air and filling of oil.

F. BREATHER

The transformer to be provided with an indicating dehydrating silicagel breather of sufficient capacity.

G. DRAIN – CUM - OIL FILTER VALVES :

The transformer to be provided with a drain-cum-oil filter valve at the bottom of the tank.

H. OFF-CIRCUIT TAP CHANGER :

An externally, hand operated off-circuit tap changer with handle, having a position indicating plate and locking device etc. filter valve at top.

I. Explosion vent.

J. Double float Buchholz Relay with alarm and trip contacts

K. 6" winding temperature indicator with alarm and trip contacts

L. 6" oil temperature indicator with alarm and trip contacts

M. Marshalling box/ junction box

N. First filling of oil.

1.14. WINDING

The transformer shall be copper wound

1.15. CORE

The magnetic core shall be made up of cold rolled grain oriented low loss steel stampings.

1.16. DRAWINGS AND INSTRUCTION MANUALS

3 copies of manual of complete instruction for the installation, operation, maintenance and repairs, circuit diagram, foundation and trenching details shall be provided with the transformers

1.17. DRAWINGS AND INSTRUCTION MANUALS

3 copies of manual of complete instruction for the installation, operation, maintenance and repairs, circuit diagram, foundation and trenching details shall be provided with the transformers

1.18. TESTING

The transformer shall be subject to the following tests at the factory before despatching the same and the test certificates shall be furnished :

- A. Measurement of winding resistance
- B. Ratio polarity and phase relationships
- C. Load losses
- D. Impedance voltage
- E. No load losses and no load current
- F. Insulation resistance
- G. Induced over voltage withstand
- H. Separate source voltage withstand

The cost of performing above tests shall be included in the equipment cost

- 1.19.** Copy of heat run test and impulse test carried out on a similar transformer during the last three years shall be submitted

Chapter 11. **MAINS FAILURE STANDBY GENERATING SYSTEM (D.G. SETS)**

PART 1 – GENERAL

1.1. WORK DESCRIPTION

This specification is intended to cover supply, installation, testing and commissioning of D.G. Sets and associated equipment/ materials, panels, cables etc.

1.2. SCOPE OF WORK:

The scope of work shall include under this specification design, manufacture, supply, loading, unloading, storage, installation, testing and commissioning of D.G. Sets with alternators and associated equipment/ materials, panels, cables etc. including labor, tools, tackles and plants, hardware and consumables, steel fabrication and items as described below:

- Silent Diesel engine & alternator set complete with base frame, acoustic container and accessories.
- Engine mounted/ separately mounted engine control integrated panel duly wired up to terminal box for engine safeties, EFC Governor with solid state potentiometers, sensors and protection for inter facing with PLC.
- Fuel oil system including day service oil tank, piping, valves, filters etc. from engine to service day oil tank. Return fuel line with fuel cooler and piping with accessories up to day service tank or collecting point as called for.
- Lube oil system with piping etc. (Pre-lube oil pump with controllers as required).
- Cooling system with engine mounted radiators.
- Exhaust emission shall meet pollution norms (CPCB & SPCB) with or without catalytic converter and residential silencer, exhaust piping with mineral wool insulation and aluminium cladding as called for.
- Steel fabricated structure/support/hanger including fixing, grouting and bolting etc. Painting of steel work.
- L.T. / Control cabling.
- Auxiliary control panel.

The bidder shall also indicate in his offer the time schedule for routine maintenance/ overhauling operations necessary for continuous satisfactory operation of D.G. Set.

The item rate shall remain valid for variation to any extent of the estimated quantities given in the Schedule of Quantities.

1.3. FEE, PERMITS & TESTS:

The contractor shall obtain all sanctions and permits required for the running of DG sets from all the relevant authorities. All actual fees payable in this regard will be reimbursed against receipt/documentary proof (evidence). On completion of the work, the supplier shall obtain N.O.C from concerned authorities including SEB, Chief Electrical Inspectorate, of State. The original of the same shall be delivered to the employer through Consultants.

The Owner shall have full power regarding the equipments/ materials get tested by authorized/ recognized independent agency at the contractor's expense in order to prove their soundness and adequacy. The contractor will rectify the defects/ suggestions pointed out by independent agency through Owner at contractor's expense.

The installation shall comply in all respects with the requirements of Indian Electricity Act 1910, Indian Electricity Rules (IER) 1956 and other related Laws and Regulations (for F.F. etc.) as amended up to date, there under and special requirements, if any, of the State Electricity Boards etc. The contractor shall be liable to furnish the list of authorized licensed persons/ employed/ deputed to carry out the works/ perform the assigned duties to fulfill the requirement of Rule No.3 of IER 1956 as amended up to date.

1.4. CODES & STANDARDS:

The design, manufacture, inspection, testing and performance shall comply with all the currently applicable statutes, safety codes, relevant Bureau of Indian Standards (BIS), British Standards (BS), International Electro Technical Commission (IEC) publication, NEMA & VDE Standards amended up to date.

The design engineering, manufacturing and the installation shall be in accordance with established codes, sound engineering, practices and specifications. Further, the same shall conform to the statutory regulations applicable in the country. Contractor shall obtain all approvals from statutory authorities, e.g. Electrical inspector, pollution control boards, SEB or any other agency as applicable before commissioning of electrical system.

Some of the relevant Indian and British Standards are listed below.

Indian Electricity Act.

Indian Electricity Rules.

Factory Act.

Any other standard may be followed provided it is equivalent or more stringent than the standards specified above.

In case of any deviation/conflict of this specification with the codes & standards, the following order of precedence shall govern

1. Engineer's decision.
2. Local codes of practice
3. Drawings.
4. Specifications
5. International standards & requirements.

1.5. DESIGN:

The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The equipment offered by the contractor shall be complete in all respects. Any materials or accessories, which may not have been specifically mentioned, but which are usual and necessary for the completion of the system and satisfactory & trouble free operation and maintenance of the equipment shall be provided without any extra cost to the Owner. This shall also include spares for commissioning of the equipment.

This specification defines the basic guidelines to develop a suitable electrical system as necessary for the Complex. All data required in this regard shall be taken in to consideration to develop a detailed engineering for the system. Site conditions as applicable are mentioned elsewhere.

Compliance with these specifications and/or approval of any of the Contractor's documents shall in no case relieve the Contractor of his contractual obligations.

All work to be performed and supplies to be made be as a part of contract shall require specific approval/review of Owner or his authorized representative

The engineering activities shall comprise the submission for approval of the following from Consultants/Owner

1.6. BIDDER SHALL BE RESPONSIBLE FOR:

- Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, cabling layouts, earthing layouts, including equipment installation and cable termination details etc. prior to start of work.
- Preparation of bill of materials for cabling, earthing and miscellaneous items etc.
- Cable schedules.
- Interconnection drawing.
- Protection co-ordination drawings/ tables for complete power system.
- Shop inspection and testing procedures.
- Field-testing and commissioning procedures.
- Preparation of as built drawings.

Bidder shall also be responsible for:

Any other work/activity which is not listed above, however is necessary for completeness of electrical system

Bidder shall clearly understand and quote accordingly:

To ensure that all clauses given in this part of the specifications shall also apply to all other electrical works of other segments. The bidder shall bring to the notice of the Owner the differences, if any, and get the same clarified failing which the Owner may impose the more stringent of the specification/ clauses at the sole risk and costs of the contractor.

1.7. DATE OF COMMENCEMENT AND COMPLETION PERIOD:

- A. The contractor shall be allowed admittance to the site on the date of commencement as described in the General Conditions and he shall thereupon and forthwith begin the works and shall regularly proceed with and complete the same on or before the date of completion subject, nevertheless to the provisions for the extension of time. The time being the essence of the contract, the Contractor will adhere to the time, progress chart and project schedule and will give proportional output/progress in proportional time

1.8. SCHEDULE AND MANNER OF OPERATIONS:

- A. Time being the essence of this Contract, the Contractor will be expected to furnish all labour and materials in sufficient quantities and at appropriate times, expedite and schedule the work as required and so manage the operation that the work will be completed within the time stated in the Contract.

1.9. PROJECT SCHEDULE:

- A. The contractor will have to submit a detailed project schedule.
 - 1. For various items of works to be carried out by him.
 - 2. For various associated works to be carried out by other agencies. so that the work gets completed within the contractual completion time. This schedule shall be submitted by the contractor in Microsoft project software format. The contractor shall follow this schedule meticulously and shall also coordinate/ follow up with other agencies to expedite the works associated with his own work. Liquidity damages clause will become applicable for any delay in completion of the work.
- B. The contractor will submit within 7 days of the award of work, a detailed schedule of program of work.
- C. No additional payment will be made to the contractor for any multiple shift work or other incentive methods contemplated by him in his work schedules even though the time schedule is approved by the Consultant/Engineer-in-Charge.

1.10. DESIGN CONDITIONS:

Design ambient: 45 Deg. C maximum dry bulb temperature & 2 Deg. C minimum dry bulb temperature
Altitude: 300 m above sea level
Relative Humidity: 98% maximum
Site Environment: Normal.

1.11. COORDINATION OF WORK

- A. Contract documents establish scope, materials and quality but are not detailed installation instruction.
- B. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
- C. The drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other divisions will permit. Provide off-sets, fittings, and accessories which may be required but not shown on the drawings. Investigate the site, and review drawings of other divisions to determine conditions affecting the work, and provide such work and accessories as may be required to accommodate such conditions.
- D. The locations of thermostats, switches, panels and other equipment indicated on the drawings are approximately correct. Exercise particular caution with reference to the location of panels, thermostats, switches, etc., and have the precise and definite locations accepted by the Engineer before proceeding with the installation.
- E. The drawings show only the general run of services and approximate location of equipment, outlets, panels, etc. Any significant changes in location of equipment, outlets, panels, etc., necessary in order to meet field conditions shall be brought to the determine attention of the Engineer for review before such alterations are made. Modifications shall be made at no additional cost to the Contract.
- F. Carefully check space requirements with other division works to ensure that equipment can be installed in the space allotted.
- G. Wherever work interconnects with work amongst different installation, coordinate with other trades to insure that they have the information necessary so that the Contractor may properly install the necessary connections and equipment. Identify items requiring access in order that the Ceiling Trade will know where to install access doors and panels.

- H. Consult amongst installation so that, wherever possible, motor controls and distribution equipment are of the same manufacturer.
- I. Furnish and set sleeves for passage of risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each riser passing through building surfaces.
- J. Provide fire stopping around all pipes, conduits, ducts, sleeves, etc, which pass through fire compartments.
- K. Provide required supports and hangers for equipment suitably so as not to exceed allowable loading of structures.
- L. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Engineer for review. At completion include a set of these drawings with each set of record drawings.
- M. Coordinate with the local utility companies/authorities for their requirements for service connections and provide all necessary provisions, grounding, materials, equipment, labour, testing, and appurtenances.
- N. Before commencing works, examine adjoining works on which this work is in any way affected and report conditions which prevent performance of the works. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered. W. The Contractor is responsible to any modifications required due to service not properly coordinated.

1.12. EXAMINATION OF SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- B. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work, based on examination of the site or other information. Failure to examine the drawings or other information does not relieve the Contractor of responsibility for satisfactorily completion of the work.

1.13. EXCAVATION AND BACKFILL

- A. Where ever required provide trenches details, duly approved by the consultant with all relevant section etc. as per IS codes to the Civil contractor, minimum before 1 month of laying the pipes, etc. Co ordinate with the civil contractor during the excavation, and ensure that the excavation and backfilling is being properly done as per requirement.
- B. Where ever it is asked by the Owner/ consultant for providing trenches in contractor's scope. It is deemed that the cost of the pipe is inclusive of trench digging and backfilling. The following points needs to be taken care of while making the trenches.
- C. The trench shall be of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum over depth of four inches below the trench depths indicated on the drawings or required. Backfill over depths in the rock excavation and unauthorized over depths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95% to standard proctor density or 75% relative density or as specified by the Engineer. Wherever unstable soil that is incapable of properly supporting the work is encountered in

the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

- D. Excavate trenches for utilities that will provide the following minimum depths of cover from existing grade or from indicated finished grade as required by local authorities.
- E. Trenches should not be placed within 3 meters of foundation or soil surfaces which must be resist horizontal forces.
- F. Do not backfill until all required tests have been performed and installation observed by the Engineer. Comply with the requirements of other sections of the specifications. Backfill shall consist of non-expansive soil with limited porosity. Deposit in 15 cm layers and thoroughly and carefully tamp until the work has a cover of not less than 30 cm. Backfill and tamp remainder of trench at 30 cm intervals until complete. Uniformly grade the finished surface.

1.14. CUTTING AND PATCHING

- A. All kinds of cutting and repairing of brick Walls or Partitions, etc. for the proper routing of pipe, shall be in the scope of the contractor. However, cutting and repairing of RCC wall, or ceiling shall be in the scope of civil contractor.
- B. Where cutting, channelling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc., using skilled trade people of the trades required at no additional cost to the Contract.
- C. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Contract.

1.15. SEALING OF PENETRATIONS

A. Air Tight Seals

- 1. All penetrations through the building fabric subject to suction or pressurization shall be sealed airtight.

B. Holes in Roof

- 1. Roof penetrations for passage of conduits or circular PVC and PVC Cables shall be sealed watertight using a flexible polypropylene conical sleeve manufacturer to seal the cable to the roof structure, regardless of the roof profile.
- 2. All sharp metal edges, which may come in contact with the cable, shall be suitably bushed.
- C. Fire Rated Penetrations Where services penetrate any fire rated barrier, the Contractor shall seal the penetration with the use of an appropriate material to ensure the integrity of the fire barrier. The Contractor shall seal the cable enclosures through fire rated barriers to ensure the integrity and rating of the fire barrier.
- D. Acoustic Penetrations Where services penetrate acoustic barriers, sealant shall be supplied and installed to maintain the acoustic separation at least equal to the barrier penetration.

1.16. MOUNTING HEIGHTS

- A. Verify exact locations and mounting heights with the Engineer before installation.

1.17. SUPPORTS

- A. Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.
- B. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and equipment room.
- C. Provide supporting frames or racks for equipment which is installed in a free standing position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on ducts, pipe, electric conduits, raceways, or cables for support.
- F. Equipment shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splinters, runners, bars and the like in the plane of the ceiling). Provide independent support of equipment. Do not attach to supports provided for ductwork, piping or work of other trades.
- G. Provide required supports and hangers for equipment so that loading will not exceed allowable loading of structure. Equipment and supports shall not come in contact with work of other trades.

1.18. FASTENINGS

- A. Fasten equipment to building in accordance with the best industry practice.
- B. Where weight applied to the attachment points is 45 kg or less, conform to the following as a minimum:
 - 1. Wood : Wood screws
 - 2. Concrete and solid masonry : Dash Fastener of appropriate ratings -HILTI/FISHER
 - 3. Solid metal : Machine screws in tapped holes or with welded studs
- C. Where weight applied to the building attachment points exceeds 45 kg, but is 135 kg or less, conform to the following as a minimum:
 - 1. At concrete slabs provide 60 cm x 60 cm x 13 cm steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top slabs screed line, where no fill is to be applied.
 - 2. At steel decking or sub-floor for all fastenings, provide through bolts and threaded rods. The tops of bolts and rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with his decking or sub-floor such hangers shall be provided.
- D. Where weight applied to building attachment points exceeds 135 kg, coordinate with and obtain the approval of Engineer and conform to the following as a minimum:
 - 1. Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall suitably weld or

clamped to building steel. Provide threaded rods or bolts to attach to bridging members.

- E. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- F. Wall mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars.

1.19. IDENTIFICATION

- A. Identify equipment with permanently attached black phenolic nameplates with 13 mm high white engraved lettering. Identification shall include equipment name or load served as appropriate. Nameplates shall be attached with cadmium plated screws; peel and stick tape or glue on type nameplates is unacceptable.
- B. Services runs shall be properly identified as per the requirements in the Contract.
- C. See individual section for additional identification requirements.

1.20. PROHIBITED LABELS AND IDENTIFICATIONS

- A. In all public areas, tenant areas, and similar locations within the project, the inclusion or installation of any equipment or assembly which bears on any surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.
- B. Required test lab certification labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

1.21. EQUIPMENT PADS AND ANCHOR BOLTS

- A. Provide all details with proper sections for the equipment pads and anchor. The equipment pads casting and making provision for anchor fastening shall be as per the final UNALTERED drawing duly approved by the consultant, shall be in the scope of Civil contractor. However, the Contractor shall ensure the proper coordination with the civil contractor.
- B. All equipment pads for all vibrating equipments shall have cork vibration pads sandwiched between the finish surface and the bottom surface of required thickness suggested by the civil consultant, to ensure that the minimum vibration can travel below.
- C. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.
- D. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an attached to 15 cm square, galvanized metal back plates which are attached to the gypsum board with an

approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

1.22. MISCELLANEOUS:

- A. A site order book will be maintained at site, which will be in the custody of the Owner, or his representative and all instructions given to the contractor will be recorded in the site order book and the same has to be signed by the contractor to comply with the instructions given therein.
- B. After completion of the work the whole installation shall be tested by the contractor in the presence of the Consultant/Engineer-in-Charge. The tests shall comply the following I.E.E. Regulations and shall be submitted along with the final bill:
 - 1. The result of the insulation test shall comply with the I.E.E. Regulations 1101 to 1108A and 1008B as may be applicable.
 - 2. Test shall be carried out to ascertain that all the non-linked SP switches have been connected to the phase conductor.
 - 3. The continuity test of the earthing system shall comply with I.E.E. Regulations 1108 to 1109 to the latest addition.
- C. If the result of the above tests does not comply with the I.E.E. Regulations, the contractor shall be bound to rectify the faults so that the required results are obtained.
- D. The contractor shall be responsible to provide all the necessary testing instruments, such as megger insulation tester, earth tester multi-meter, AVO meter etc for carrying out the above tests.
- E. The work will not be considered as complete and taken over by the employer till all the components of the work after being completed at site in all respects have been inspected/ tested by the Consultant/Owner to his entire satisfaction and a completion certificate issued by the Owner/Consultant to this effect.
- F. Shop drawing for electrical work e.g. equipment, cable earthing and conduit layout for all systems shall be prepared by the contractor and got approved before starting of the work.
- G. At the completion of the work and before issuance of certificate of virtual completion, the contractor shall submit 6 sets of drawing and two tracing of each drawing to Owner of each layout drawings drawn at approved.
- H. Contractor's Superintendence:
 - 1. The contractor shall provide all necessary superintendence during the execution of the works and as long thereafter as the engineer may consider necessary. The contractor or his competent and authorized agent or representative approved of in writing by the owner/ Engineer (which approval may at any time be withdrawn) is to be constantly on the works and shall give his whole time to the superintendence of the same. Such authorized agent or representative shall receive on behalf of the contractor, directions and instructions from the Engineer-in-charge or his representative.
 - 2. The contractor shall provide detailed organization of the execution team deployed for the works with names and CV's, of all key staff before the commencement of work and get it approved of in writing by the Owner/ Consultant. Contact telephone or pager numbers for emergency and/or twenty-four (24) hour call shall also be included.

3. If in any case of withdrawal of any worker/ technician/Engineer from the execution team, the replacement of the same shall be done with equivalent qualification, and shall be approved in writing by the Owner/ Consultant.

PART 2 – PRODUCT, TESTING & COMMISSIONING

2.1. DESIGN CRITERIA

Electrical Details for Incoming Supply:

- Supply Voltage: as approved by SEB
- Fault Level (Sym.) at supply point (Designated): MVA (to be confirmed from State Electricity Board by Bidder).
- Neutral: Grounded
- Voltage Regulations: + 10%
- Frequency Regulations: + 3%
- Combined Regulations: + 10%
- LT Power Distribution System:
- Voltage: 415 V
- Frequency: 50 Hz
- Neutral: Grounded
- Short Circuit Fault withstand capacity: 35 to 50 KA for 1 sec., as per BOQ and specifications

Control supply for Electrical System:

- The various supply voltage to be used in the control panels for the main equipment shall be as under:
- Spring charge motor: 230 V AC or 240 V DC (Universal Motor)
- Closing/ Trip Coil: 24 V DC
- Alarm/ Indication/ Relays: 24 V DC
- Heaters: 230 V AC

Painting of Panels:

- Powder coating of approved shade as per Specification. (Refer clause of painting)
- Painting of Cable Trays and Structural steel:
- Powder coating of approved shade as per Specification. (Refer clause of painting)

Cable Details:

- LT Control Cables: Copper conductor armoured PVC insulated 1.1 KV grade.
- LT Power Cables: Aluminium conductor armoured XLPE insulated.
- Grounding Conductors: Copper/ G.I. as specifications and BOQ

Accuracy Class of Meters:

- Revenue Meters: Class-I or as approved by SEB
- Ammeters, Voltmeters & Other Instruments: Digital Type

2.2. DRAWINGS:

The list of drawings is enclosed along with this specification. These drawings are meant to give general idea to bidder regarding the nature of work covered by these specifications.

Any information/data shown/not shown in these drawings shall not relieve the contractor of his responsibility to carry out the work as per the specifications. Additional information required by the bidder for successfully completing the work shall be obtained by him.

2.3. SHOP DRAWINGS:

The contractor shall prepare detailed coordinated electrical shop drawing indicating D.G. set layout, D.G. Control Panel and Cable Schedule with other relevant services and submit to the Consultant for approval or the Engineer-in-Charge before commencing the work. The shop drawings shall indicate all setting out details and physical dimensions of all components with wiring and cable details including system operating write up in the system i.e. Control and Relay Panel D.G.'s, cable schedule and routes, manhole trap and fixing details for the above mentioned work. All work shall be carried out on the approval of these drawings. However, approval of these drawings do not relieve the contractor of his responsibility for providing maintenance free and full proof system including any missing component/accessories to meet with the intent of the specifications. Contractor will submit 2 (two) prints for preliminary approval and finally 6 (six) prints for distribution.

2.4. MANUFACTURER'S INSTRUCTIONS:

Where manufacturers have furnished specific instructions, relating to the material/equipments to be used on this job, covering points not specifically mentioned in this document, manufacturer's instructions should be followed.

2.5. COMPLETION DOCUMENTS AND DRAWINGS:

1. Three copies of operation manuals/catalogues of all standard equipment are to be furnished by the contractor immediately after commissioning of plant.
2. Three copies of write up on preventive maintenance, trouble shooting and operating instructions of the system along with as-built drawings are to be supplied by the Contractor at the time of commissioning.
3. On completion of the work in all respects, the Contractor shall supply five portfolios (300x450 mm), each containing complete set of drawings on approved scale, clearly indicating complete layouts, location; wiring and sequencing of automatic controls, location of all concealed wiring and other services. Each portfolio shall also contain consolidated control diagrams and technical literature on all controls. The Contractor shall frame under glass, in the Panel rooms, one set of these consolidated control diagrams.

2.6. MATERIALS AND EQUIPMENT:

All the materials and equipments shall be of the approved make and design. Unless otherwise called for any approval by Owner's Engineer-in-Charge, only the best quality materials and equipment shall be used.

Space Heaters:

Suitable number of adequately rated heaters thermostatically controlled with On-Off switch and fuse shall be provided to prevent condensation in any panel compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

Fungi static Varnish:

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the

equipment. Such surfaces or parts shall be protected against the application of the varnish.

Ventilation Opening:

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

Degree of Protection:

The enclosures of the control cabinet, junction boxes and marshalling boxes, panels. etc to be installed shall provide degree of protection as detailed her under.

Installed indoor :	IP-55
Installed indoor in air-conditioned area :	IP-31
Installed in covered area : I	P-42
Installed indoor in non air-conditioned area where possibility of entry of water is limited :	IP-41
For LT Switchgear (AC and DC distribution boards) :	IP-42

The degree of protection shall be in accordance with IS: 13947 (Part –I) IEC-947 (Part –I). Type test report for degree of protection test, on each type of the box shall be submitted for approval.

Rating plates, Name plates and Labels:

D.G. Sets, D.G. Control panel and auxiliary items installed in the building is to permanently attached to it in a conspicuous position. A rating plate of non-corrosive material with engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of loading conditions of equipment in question has been designed to operate and such diagram plates as may require by the owner. The rating plate of each equipment shall be in accordance to IEC requirement.

All such nameplates, instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates on with Hindi and another with English inscriptions may be provided.

First fill of consumables, Oil & Lubricants:

All the first fill of consumables such as oils, lubricants, filing compounds, touch up paints, welding/ soldering/ brazing material for all Copper/ G.I earthing and essential chemicals etc. which will be required to put the equipment/ scheme covered under scope of the specifications, into successful operation, shall be furnished by the contractor unless specifically excluded under the exclusions in these specifications/ documents.

Design Improvements:

The bidder shall note that the equipment offered to him in the bid only shall be accepted for supply. If for any reason, contractor wished to deviate from specification, prior permission from owner/ consultant shall be sought.

If any change is agreed upon and that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/ or schedule of completion before the contractor proceeds with the change. Following such arrangements,

the provision thereof, shall be deemed to have been amended accordingly in the specification.

Quality Assurance Programme:

To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Owner's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance program to control such activities at all points necessary. Such programme shall be outlined by the Contractor and shall be finally accepted by the Owner after discussions before the award of Contract. A quality assurance programme of the contractor shall generally cover the following:

1. His organization structure for the management and implementation of the proposed quality assurance programme.
2. Documentation control system.
3. Qualification data for bidder's key personnel.
4. The procedure for purchases of materials, parts components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
5. System for shop manufacturing and site erection controls including process controls and fabrication and assembly control.
6. Control of non-conforming items and system for corrective actions.
7. Inspection and test procedure both for manufacture and field activities.
8. Control of calibration and testing of measuring instruments and field activities.
9. System for indication and appraisal of inspection status.
10. System for authorizing release of manufactured product to the Owner.
11. System for maintenance of records.
12. System for handling storage and delivery and.
13. The Owner or his duly authorized representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor / his Vendor's quality management and control activities.

Quality Assurance Documents

The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after dispatch of the equipment.

All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and reports including radiography interpretation reports.

Welder and welding operator qualification certificates.

Welder's identification list, listing welder's and welding operator's qualification procedure and welding identification symbols.

Raw material test reports on components as specified by the specification and / or agreed to in the quality plan.

Stress relief time temperature charts/oil impregnation time temperature charts.

Factory test results for testing required as per applicable codes/mutually agreed quality plan/standards referred in the technical specification.

The quality plan with verification of various customer inspection points (CIP) as mutually and methods used to verify the inspection and testing points in the quality plan were performed satisfactory.

2.7. INSPECTION, TESTING AND INSPECTION CERTIFICATES:

The Owner and the Consultant or duly authorized representative shall have at all reasonable times free access to the Contractor's premises or works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection, if part of the works is being manufactured or assembled at other premises or works, the Contractor shall obtain permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Owner and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Bidder shall submit the type tests reports for approval. The Contractor shall intimate the Owner/Consultant the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies. If for any item type test were pending payment would be made on successful completion of type/routine test(s) actually carried out as per Consultant/Owner instructions.

The Contractor shall give the Consultant/Owner thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account. The Consultant/Owner unless witnessing of the tests is virtually waived will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed with the test which shall be deemed to have been made in the presence of Owner/Consultant and he shall forthwith forward to the Consultant duly certified copies of tests in triplicate.

The Consultant/Owner shall within fifteen (15) days from the date of inspection as defined shall inform in writing to the Contractor of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and make the necessary modifications accordingly.

When the factory tests have been completed at the Contractor's or Sub-contractor's works, the Consultant/Owner shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Consultant/Owner, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Consultant/Owner. Failure of the issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificate shall not bind the Owner to accept the equipment should, it, on further tests after erection, is found not to comply with the Specification. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Owner.

For tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments

as may be required by Owner/Consultant or this authorized representative to carry out effectively such tests of the equipment in accordance with the Specification.

The inspection by Owner/Consultant and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.

The Consultant/Owner will have the right of having at his own expenses any other tests(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests to satisfy that the material comply with the specifications.

The Owner/Consultant reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipments for these tests shall be provided by the Contractor.

2.8. TESTS:

Charging (Pre-commissioning tests):

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Owner/Consultant and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial precommissioning tests at Site. The pre-commissioning tests to be performed as per relevant I.S. / vendor/ bidder submittal and as included in the Contractor's quality assurance programme.

Commissioning Tests:

The available instrumentation and control equipment will be used during such tests and the Contractor will calibrate all such measuring equipment and devices as far as practicable. However, unmeasurable parameters shall be taken into account in a reasonable manner by the Contractor for the requirement of these tests. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The Contractor will apply proper corrections in calculation, to take into account conditions which do not correspond to the specified conditions.

All instruments, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.

Pre-commissioning test shall be carried out as per relevant IS and/or as specified in the relevant clause.

The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning of the equipment. However necessary fee shall be reimburse by Owner on production of requisite documents.

2.9. PACKAGING:

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon/truck/trailer sizes in India should be taken account of the Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by

the transporters, railways etc. shall be to the account of the Contractor. Owner takes no responsibility of the availability of any special packaging/transporting arrangement.

2.10. PROTECTION:

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

2.11. FINISHING OF METAL SURFACES:

General:

All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts and bolts and spring washers shall be electro galvanize. All steel conductors used for earthing/grounding (above ground level) shall be galvanized according to IS: 2629.

Painting:

All sheet steel work shall be degreased, pickled, and phosphated in accordance with the IS-6005 "Code of practice for Phosphating iron and sheet". All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swab shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

After Phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved.

Powder coating/electrostatic painting of approved shade shall be applied. The exterior color of the paint shall be as per IS-5 or as approved by Consultant. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments, if required.

In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures like electrostatic painting etc. the procedure shall be submitted along with the Bids for Owner's review and approval.

2.12. HANDLING, STORAGE AND INSTALLATION:

In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Owner or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented.

Contractor shall follow the unloading and transporting procedure at site, as well as storing, testing and commissioning of the various equipment being procured by him separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's Engineer(s) and shall extend full co-operation to them.

In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the Owner/Consultant. Contractor shall be held responsible for any damage to the equipment consequent for not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than the one section, Contractor shall make all necessary connections between sections. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.

The Contractor shall submit to the Owner every week, a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.

The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Owner in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Owner, as well as protection of the same against theft, element of nature, corrosion, damages etc.

The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment, which require indoor storage.

The words 'erection' and 'installation' used in the specification are synonymous.

Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

The minimum phase to earth, phase to phase and section clearance along with other technical parameters for the various voltage levels shall be maintained as per relevant IS.

2.13. PROTECTIVE GUARDS

- A. Suitable guards shall be provided for protection of personnel on all exposed rotating and / or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.
- B. The Contractor shall also conform to the general regulations governing personnel on the site and must keep to the working space allocated for their use.
- C. The contractor shall be responsible for any kind of mishap, etc. happened with personnel. The Owner shall not take the responsibility for any of such kind.

2.14. TOOLS AND TACKLES:

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dismantling and maintenance of the equipments.

2.15. PERFORMANCE REQUIREMENTS:

The equipment shall be capable of delivering power continuously at the generator terminals, a net output not less than the specified value at 0.8-p.f. excluding auxiliary power (shall be included over and above), when operating under the site ambient

conditions described in this specification. Gen. Set should have minimum 50% single step loading capacity and it should be able to take full load in less than 25 sec. from start. (The set shall be suitable for prime duty). The bidder shall furnish the detailed derating calculation due to temperature and other parameters with supporting document.

The design parameters of the generator and excitation system shall be so chosen that the set is stable while running at any load between no-load and full load and also during starting of motors as specified in Annexure-I. It should also have iso-synchronous speed control with load sensing governing system suitable for parallel running of D.G. sets.

Engine should be heavy-duty four strokes, turbo charged after cooler 'V' construction, electric start. Engine should have minimum lube oil change period 300 hrs.

The set shall have vibration limit less than 250 microns (as per BS: 4999 Part-142) and noise level shall be (105-110 db (A)) at 1 Mtr) under all conditions of load. The set shall be dynamically balanced. The set shall be mounted directly on the inertia foundation or with foundation bolts etc. The efficient residential silencer shall be provided.

The total harmonics contents should be less than 3% as per IS 4722/1969. The graph & calculation for harmonic distortion shall be submitted.

Contractor to specify and guarantee maintenance contract cost and to give an Undertaking to take a comprehensive maintenance contract after expiry of warranty period for which price may be quoted.

The successful bidder will submit shop drawing of the equipments/accessories selected for this work for the approval of Consultant/ Employer.

2.16. DIESEL ENGINE – CONSTRUCTION

Material of construction of major parts shall be as under or as per manufacturer design.

M.S. base frame with anti-vibration mountings.

Crankcase – Aluminium alloys.

Crank shaft, connecting rods – Forged Alloy Steel.

Piston – Al. alloy casting

Piston rings – Alloy steel

Engine block – Cast iron.

Cylinder liner – Cast

All other materials of construction shall be as per relevant standard/code and the copies of same shall be supplied free of cost to Consultant/Owner.

The Diesel Engine shall be multi-cylinder, 4-stroke, water cooled with engine mounted radiator with shaft driven fan (not motor driven), totally enclosed, continuous duty, direct fuel injection, turbo charged, compression ignition, inter cooled oil engine or with individual cylinder head with provision to measure exhaust temperature.

One common base frame shall be provided for mounting the engine and alternator complete with electric suspension between DG set and foundation bolts, leveling lines etc. as required.

All externally mounted hardware shall be high tensile steel only.

The engine shall be fitted with an exhaust gas driven turbo charger of air/water cooled type complete with its own self contained lubricating system. The turbocharger shall be

positioned at the free end of the engine preferably. The turbocharger will be provided with a provision to check its lube oil level.

The engine shall be fitted with a charge air inter cooled of the air/water type. Air from the turbo-charger compressor passes through the inter cooler and then to the engine manifold. The inter cooler shall be of tubular construction or as per manufacturer design with aluminium bronze tubes, mild sheet steel and cast iron water headers.

Diesel engine shall be capable of starting and operating for a few minutes without supply of raw water for cooling. Contractor shall indicate the maximum time for which the Diesel Engine can be operate.

2.17. GOVERNING SYSTEM

The Governor shall be electronic fuel control type for coupled Genset along with speed control switch (solid state potentiometer) at the end of start on over speed.

2.18. ENGINE STARTING SYSTEM

Starting of the Diesel Engine shall be done by electric starting system.

The electric starting system shall comprise starter motor, starter batteries and battery charger including with all required instruments and accessories. The engine mounted alternator shall charge the batteries while engine is running and floor panel mounted solid state battery charger while engine is at stationery. The battery charger shall be of 2 rate (boost/trickle) with all metering and control instruments and protections for A/C and D/C circuit. The total system shall be suitable for auto and manual operation including their wiring etc. Calculation for the battery and battery charger capacity as well as complete descriptive circuit diagram shall be submitted for review of Consultant based on 6 consecutive start commands.

2.19. CATALYTIC CONVERTER

- A. Catalytic Converter should be suitable for high speed diesel oil available in the country with sulphur contents to control Hydrocarbon (HC), Carbon Monoxides (CO), Total Particulate Matter (TPM) and NOX.
- B. The catalytic converter should be suitably designed to avoid sulphation of catalyst up to 550 Deg.
- C. The converter should be air washable type or can be washed with DG set exhaust gasses in case compressed air is not available. The casing of the catalytic converter should be in stainless steel construction and should have a metal catalyst applied to a wash coat ceramic substrate which will durable at 500 Deg. C temperature. The life of the catalytic converter should be more than 10,000 hrs. C. The conversion efficiency of the catalytic converter to control exhaust gas pollutants should be as following at the outlet of converter.

CO (Carbon Monoxides) : 80 – 90%

THO (Total Hydrocarbon) : 80 – 90%

TPM (Total Particulate Matter) : 40 – 50%

NOX : 15 – 20%

Catalytic converter shall be able to reduce the noise level by 10db (A)

2.20. FUEL OIL SYSTEM:

The manufacturer shall furnish a mild steel day tank of required capacity for individual engine. The day tank shall be suitably located to avoid gravity feed to the engine, shaft driven fuel oil pumps and shall be complete with gauges, glasses, filling, draining and vent connection with valves and level switch for auto filling of tank and for alarm in case oil level goes beyond limit.

The fuel system shall be provided with full flow duplex oil cartridge filter preferably changeable during running of the set.

The fuel oil system shall be equipped with a crankshaft driven fuel oil transfer pump which will draw the fuel oil from the day tank via filters and shall be as per the engine manufacturer design.

Multi point (electronically controlled) fuel injection system or direct injection/through ISO synchronous fuel Governing system shall be designed taking into account the type of fuel used, engine speed etc. so as to achieve safe knock free performance with low emission smoke.

2.21. LUBRICATING OIL SYSTEM:

All lubricating parts of the engine shall be connected to a pressurized lubricating oil distribution piping system being continuously charged by gear type lube oil pump mounted at the free end of the engine and driven from the engine crank shaft. The pumps shall take suction from a sump tank integral with the engine through a foot valve, suction filter through oil cooler and deliver oil to a main supply header. High-pressure oil shall be supplied to the main and big end bearings, crankshaft bearings, governor, auxiliary drive gear etc. Suitable lubricating arrangement for engine cylinder valve gear, cams and pistons at the required level shall be arranged. A pressure relief valve shall be mounted on the main supply header for safety against too high-pressure while starting with cold oil. A timer based, auto running (auto priming pump) shall be provided to keep engine primed all the time complete with control system (if required).

The lube oil system shall be provided with full flow duplex lube oil cartridge filters. The minimum lube oil change shall be 300 hrs.

Arrangement shall be provided to bypass the lube oil pressure switches and safety at the starting till the pressure is built up.

The lube oil sump shall have provision to sense the low level of lube oil in the sump and fill it up manually or automatically from the main lube oil tank/sump and stop the transfer pump, once the lube oil is filled in the sump without stopping the engine. Pressure switches to give alarm under extreme low pressure of lube oil and subsequently to trip the unit when the minimum safe pressure has been reached, shall be provided.

All necessary accessories such as pressure gauges, temperature indicators, pressure relief valves, bypass valves, pressure switches shall be provided and the safeties shall be wired up to junction box

2.22. EXHAUST SYSTEM:

Engine emission exhaust system shall be residential type silencer ducting, bends, hood/canopy, thermally insulated aluminium clad exhaust piping etc. shall be provided along with structural support with stays for each engine. Heat resistant paint shall be provided on exhaust pipe for the portion, which is of outside the building including canopy. Exhaust system pollution level shall be indicated and shall be got approved by authorities.

(Exhaust smoke quality & quantity should be within the norms of central & state pollution control board).

2.23. ENGINE ALTERNATOR CONTROL PANEL:

- A. Engine alternator (D.G.) control panel shall be provided with speedometer, lubricating oil pressure gauge, lube oil temp, jacket water temp, battery charging, water pressure, fuel pressure for local indication panel mounted on the engine itself.
- B. Engine shall be supplied with engine control module (ECM) for diesel generating set monitoring control system, which should be equipped with (digital) electronic Governor along with solid-state AVR to facilitate discreet control of speed and voltage or as per manufacture design. The system shall be equipped with starting control including integrated fuel ramping to limit the black smoke frequency overshoot with optimized cold weather starting. The engine instrument panel shall be equipped with digital alarm and status to monitor and display the following parameters. The scanner, inter face modules, converter, probe and their wiring up to terminal block in panel with 485 ports etc. making compatibility with PLC. The necessary CT/PT shall be included and wired accordingly to meet the requirements.
- C. Engine Indicators:
 - Digital tachometer with running hour meter
 - Lubricating oil pressure low
 - Lube oil temp. high
 - Coolant water temp. high.
 - Over speed
 - Bearing temperature.
 - Engine fail to start
 - Lack of fuel due to low level.
 - Volts RY-YB-BR.
 - Amps R-Y-B.

2.24. AMF CONTROL PANELS:

Control Philosophy:

Automatic Starting and Stopping of Engines:

The system should come in operation after sensing of GRID FAILURE and / or the voltage drops below preset value. For this purpose the NB-2 or equivalent "ENGINE CONTROL & AUTOMATIC MAINS FAILURE STAND BY SYSTEM" shall be provided to perform the following functions.

- Sensing the healthiness of supply from Supply Company, the engine shall be at rest.
- On sensing the supply healthiness (the supply fails or drop below the preset value) the command shall be issued to start the D.G. Set.

- In case the D.G. Set does not start in the 1st command, the two more commands shall be given to start the D.G. Set at an equal interval of time (5 Sec). Even then if the engine does not start, the indication shall appear on window / screen "Set fail to start" and alarm shall be generated.
- On starting of D.G. Set & monitoring the healthiness of supply, the load shall automatically be transferred on D.G.
- On restoration of the supply & monitoring the healthiness of the system, the load shall be transferred to Mains automatically & vice versa.

Manual Mode:

Select manual mode on the relay unit.

The Set shall only be started by pushing the "start button" on the relay.

On attaining the requisite voltage & frequency, the D.G. breaker / Contactor will be closed or tripped manually without shutting down the engine.

The Engine shall be shut down manually by pressing the push button.

Test Mode:

The test mode operation is independent of the conditions of the mains supply & thereby enables routine testing or exercising of the D.G. Set without closing the D.G. breaker / contactor. (Select the switch on selector mode & is similar to the auto mode except closing of the breaker).

The relay shall have following features such as:

- Mode selector switch (Auto/Manual/Test/Off)
- Engine Control switch (On/Off push button)
- Reset/Acknowledge push button.
- Breaker close/open push button.
- Test push button.
- Set of visual indication shall be
- Load on Mains.
- Load on D.G. Set.
- Set fails to start.
- Low-pressure alarm & Trip.
- High temperature alarm & Trip.
- Engine over speed.
- Alternator overload & short circuit.
- Voltages, phase to phase & phase to neutral.
- Ammeter Line / Phase current.
- Power factor meter.
- Kilowatt-hour meter.
- Frequency meter.
- Tachometer.

2.25. ALTERNATOR (415V – 3 PHASE, 4 WIRE SYSTEM):

- The Alternator shall be industrial type screen protected drip proof. IP-23. Class – H insulation with temperature rise limited to Class-'H', self ventilated, air cooled, rotating field, salient pole, brush less, machine with self excited, self regulated exciter and shall be rated for continuous duty.

- The Alternator shall have a continuous rating of not less than the value specified under specific requirement shall be at 0.8. The alternator shall be suitable to run for P.F.0.99 (lag) with capacitor controlled by APFC relay.
- The short circuit ratio (SCR) of the generator at rated KVA and rated voltage shall not be less than 0.48.
- The Alternator shall withstand without mechanical damage, an over speed of 20% for a period of 3 minutes.
- The generator/alternator shall with stand over load of 10% for 1 hour every 12 hourly. The terminal voltage shall be adjustable and the range of adjustment shall be + 5% of nominal voltage.
- The Alternator shall be capable of withstanding without damage/injury for 3 secs., 3-phase short circuit at its terminals, when operated at rated KVA and power factor at 5% over voltage with fixed excitation (3 times the line current for 10 Sec.).
- The Alternator shall be capable of withstanding for thirty (10) secs. a current of fifty (50) percent in excess of its rated current, the voltage being maintained, as near the rated value as possible, consistent with max. capacity of the prime mover.
- Six Nos. embedded Resistant temperature detector (RTDs) of platinum. 100-ohm resistance at 0 Degree to measure the winding temperature and 2 Nos., BTDS bearing temperature shall be provided.
- The leads of embedded RTDs shall be wired up to the terminal block in a separate auxiliary terminal box. Manufacturer shall indicate the setting values for each RTD/BTD for alarm and trip.
- All external nuts and bolts shall be of high tensile steel only.
- Alternator shall be provided with anti-condensation space heater of adequate rating suitable for 240V, 50 Hz., 1ph A.C. supply and shall be wired up to a separate terminal box. Thermostatically controlled shall work when the machine is in idle condition only (wiring and equipment shall be provided by D.G. supplier).
- Two independent earth terminals on the frame, complete with nuts, spring washer and plain washer shall be provided.
- Alternator shall be provided with suitable terminal box for terminating TP&N bus-duct/cables droop and protection. CTS within the terminal box duly wired up to the panel should be provided.
- The alternator shall be capable to sustain the unbalanced current between the phases minimum 40% of rated current provide that the KVA rating and maximum current does not exceed 11% of rated current in any phase as per BS-4999 Part-101.
- The alternator shall be fitted with radio interference suppressors in accordance with BS-613-1977 and shall be within the limit of CISPR standard also.
- The alternator shall be dynamically balanced complete with rotor and shaft.
- Alternator should have bearings at both shaft ends.
- Damper winding shall be provided in the pole to damp the oscillations and ensure satisfactory performance during parallel operation.

- Winding of 3 phase alternator shall be of star connected and neutral point shall be brought out to the terminal box through protection and earthed with independent earth or through contactor as per scheme.
- Protection CT's/PT's shall be mounted above the terminal box with enclosure. Bus duct/cable shall be terminated on terminals through this.
- Diesel generating set shall be able to start motor of 30% capacity of D.G. set with a 20% base load.

2.26. AUTOMATIC VOLTAGE REGULATOR:

An automatic high speed, dead band channel voltage regulator shall be provided with all accessories. The regulation system shall be with equipment accessories for automatic as well as for manual switchover control.

The voltage regulator shall be dual be dual control type i.e. the voltage regulation shall be through compound transformer or magnetic amplifier and the electronic regulation through solid state devices automatically both shall be secured from all three phases. The combined voltage regulation shall be $\pm 1\%$ from full load to no-load from hot to cold at unity power factor and 0.8 to 0.99 power factor with 4% speed regulation of the engine.

Voltage regulation and steady state modulation shall be within $\pm 1\%$ of the line voltage and with manual voltage adjustment capability within $\pm 5\%$. The maximum permissible wave from distortion should not exceed 5% at any load.

Necessary equipment for field suppression and surge protection shall be provided.

The response time of the exciter and the generator shall be matched to avoid hunting.

AVR system shall be provided with equipment for auto-manual operation from remote (PLC – joystick or push buttons)

In the event of AVR failure, the generator excitation control is transferred automatically without any change in the excitation current.

Necessary equipment shall be furnished for the following:

To prevent rise of field voltage in case of failure of potential supply.

To initiate from automatic to manual control of excitation on fuse failure in the generator potential signal.

To facilitate reactive load sharing of parallel operating generator shall be in proportion to their ratings. The quartrative droop current transfer compensation feature should be provided on exciter regulation and droop voltage shall be within 1% variation.

D.G. Set Vendor shall inspect the existing system and include all necessary hardware, input/ output modules and junction box with terminal block and its wiring complete as required to make the system operational in PLC/ Manual mode and to be included in price bid.

2.27. COMMISSIONING CHECKS:

In addition to the checks and test recommended by the manufacturer, the Contractor shall supervise the following commissioning checks to be carried out at site.

A. Load Test (site and factory):

The engine shall be given test run for a period of at least 6 hours. The set shall be subjected to the maximum achievable load as directed by Owner without exceeding the specified D.G. Set rating: During the load test, half hourly records of the following shall be taken:

- Ambient temperature
- Cooling water temperature at a convenient point adjacent to the water output from the engine jacket.
- Lubricating oil temperature where oil cooler fitted.
- Lubricating oil pressure.
- Color of exhaust gas.
- Speed.
- Voltage, wattage and current output.
- Oil tank level.

The necessary load to carry out the test shall be provided by the Owner.

B. Insulation Resistance Test for Alternator:

Insulation resistance in mega-ohms between the coils and the frame of the alternator when tested with a 1000V megger shall not be less than

$$IR = 2 \times (\text{rated voltage in KV}) + 1$$

C. Fuel consumption Check:

A check of the fuel consumption shall be made during the load run test. This test shall be conducted for the purpose of proper tuning of the engine.

D. Insulation Resistance of Wiring:

Insulation resistance of control panel wiring shall be checked by 500V megger. The IR shall not be less than one mega ohm.

E. Functional Tests:

Functional tests on control panel. Functional test on starting provision on the engine. Functional tests on all Field devices. Functional tests on AVR and speed governor.

F. Vibration Measurement:

The vibration shall be measured at Load as close to maximum achievable load and shall not exceed 130 microns.

2.28. TEST CERTIFICATES AND REPORTS:

Test Certificate shall be submitted in eight (8) copies.

The test certificates shall be furnished to the owner for prior approval before dispatch of any equipment from works and the approval in writing from owner shall be essential to effect dispatch of the equipment.

The test reports shall furnish complete identification of the data including serial number of each equipment.

2.29. NOISE CONTROL IN DIESEL GENERATOR ROOMS:

A. Construction Features/ Requirements:

1. The container shall be designed for easy access to serviceable parts of the D.G Set.
2. The acoustic container shall be made of Modular construction for easy assembling and dismantling.
3. The container shall be fabricated out of CRCA sheet of 14 Gauge. Base frame should be made out of ISMC of suitable sections or made out of sheet steel minimum of thickness 5 mm.
4. All the hard ware used shall be of high tensile grade.
5. Fuel tank shall be kept outside of enclosure and shall have 990-liter capacities. The fuel piping shall be carried out to connect the D.G set kept inside.
6. Battery shall be accommodated in the container itself.
7. The container doors should be gasketed to avoid leakage of sound.
8. All the door handles shall be lockable type.
9. The D.G set shall be integrated part of the container .The complete assembly shall be one unit

B. Painting:

The sheet metal components should be hot dip and seven tanks pretreated.

To have long life of container it shall be painted with P.P. based powder coated (inside as well outside)

C. Acoustic Insulation:

Sound proofing of enclosure should be done with quality rock wool/mineral wool

The Residential silencer should be provided within the DG to control exhaust noise as per noise emission laws

Interconnection between silencer and engine should be through stainless steel flexible hose/ pipe.

The insulation should be designed to have 75 dB (A) at a distance of one meter to meet the noise limitations of pollution department

- D. D. Ventilation and Air Circulation:
1. The system should be designed to provide air inlet/exhaust acoustic louvers for efficient air circulation
 2. The ventilation should be designed to restrict the temperature rise above ambient as five to seven degree centigrade.
 3. The manufacturer of acoustic container shall have approval from engine manufacturer for the design parameter as specified above and laid down by them from time to time for engine performance and warrantee.

E. Electrical:

1. Provision for Neutral/Body Earthing: Points shall be available at side of the enclosure with the help of flexible copper wires from alternator neutral, and electrical panel body respectively. The earthing point shall be isolated through DMC insulator mounted on enclosure.
2. Control Panel shall be mounted outside the container.
3. Safeties:
 - Low lube oil pressure
 - High water temperature

- High enclosure temp.

There should be provision for emergency shut down from outside the container.

F. Exhaust Pipe Insulation:

Exhaust pipe insulation shall be carried out with mineral wool (rigid pipe sections) of 150 kgs/m³ for temp above 250 °C. The material for pipe insulation shall be factory faced with aluminium foil reinforced with Kraft paper. The aluminium foil shall extend by min. 50 mm on one side of pipe side along the length to seal all longitudinal joints etc.

TESTING AND COMMISSIONING:

- A. Testing and commissioning shall be done as per the programme/instructions to be given by Owner/Consultant's authorized representative. All testing equipments necessary to carry out the tests shall be arranged by the electrical Contractor.
- B. Before the electrical system is made live, the electrical Contractor shall carry out suitable tests to the satisfaction of Owner/Consultant that all equipment wiring and connections have been correctly done and are in good working condition and will operate as intended.

Chapter 12. **POWER FACTOR CORRECTION EQUIPMENT**

PART 1 – GENERAL

1.1. DESCRIPTION

Provide power factor correction equipment in accordance with the Contract Documents.

1.2. STANDARDS

The installation shall comply with IS-2834 – Capacitors, BS 1650 and IEC 70 and SEB regulation.

1.3. SUBMITTALS

- A. Manufacturer's product data sheets for Capacitor Banks, over current protection devices, automatic power factor regulators, harmonic filters, etc.
- B. Dimensioned layout and elevation drawings showing the capacitor banks, housekeeping pads, and support locations and types.
- C. One line diagram showing capacitor ratings, over current protection device ratings, cable lugs, metering displays, identification nameplate, and fuse clip sizes.
- D. Wiring diagrams.
- E. Installation instructions.
- F. Certified test reports.

1.4. FIELD TESTING

- A. Field inspection and testing shall occur after installation is complete, feeders are terminated, and the room is secure. Testing shall be conducted not more than 4 weeks before equipment is energized.
- B. Testing Scope:
 - 1. Visual and physical inspection of equipment.
 - 2. Check control wiring and metering.
 - 3. Meter calibration.
 - 4. System Grounding
- C. Certified Test Reports:
 - 1. Field testing shall be performed by an independent third party testing agency.
 - 2. Verify that the installation is in accordance with the manufacturer's instructions.
 - 3. Verify that the equipment has been fully type tested and is operational.
 - 4. Perform testing and compile detailed test reports for each capacitor banks and over current protection device.

PART 2 – PRODUCTS

2.1. POWER FACTOR CORRECTION / HARMONIC FILTERING EQUIPMENT

- A. Voltage: 400volts $\pm$ 10% three phase, 50HZ
- B. Operating Temperature Limits: manufacture detail to operate at 100 percent rated voltage in ambient air temperature up to 50°C.
- C. Indicators: Include LED indicating light for each step of capacity.
- D. Basic Impulse Level: 30kV
- E. Integrated Equipment Short-Circuit Rating: 65,000 rms amperes symmetrical.
- F. Power Factor Sensing and Control: Utilize reactive current sensing and solid state electronic controller to automatically connect appropriate correction capacitors and detuned reactors to line through contactors. Include time delay to accommodate capacitor resistor discharge and prevent hunting.
- G. Contactors: electrically held, three-pole, 600-volt, general-purpose magnetic contactors sized in accordance with IEC Standard. Contacts shall be silver plated. Allow 50 kVAR steps.
- H. Power Bus: tin-plated copper sized to handle rated current without abnormal temperature rise.
 - I. Under voltage Relay: Controller shall incorporate an under voltage relay to interrupt control relays for power failures longer than 15 milliseconds.
- J. Fuses each individual capacitor branch circuit on the line side of the contactor. Fuses shall be current limiting type with 100,000-ampere symmetrical interrupting capacity.
- K. Blown Fuse Indicator: Each capacitor and harmonic filter fuse circuit shall be provided with a blown fuse indicator consisting of a fused neon lamp which illuminates without requiring removal of covers.
- L. Transient Suppressors: Each capacitor and harmonic filter branch circuit shall include a current-limiting air core inductor. The inductor shall be sized to limit the capacitor in-rush current to a value equal to or less than the capacitor switching rating of the contactor.
- M. Blocking Reactor; a harmonic current suppression (Blocking Reactor – 7%) shall be provided for each step.
- N. Power Factor Meter: switchboard-type power factor meter with display range of 0.5 lagging accuracy, plus or minus 1 percent to 0.5 leading. Meter shall be located in the door of the controller enclosure.
- O. Current Transformer: Provide a current transformer with turns ratio as required. Extend control conductors to controller.
- P. Dielectric Impregnate: non-PCB, non combustible liquid.
- Q. Enclosure: Complete with enclosure and located in switch room outside switchboard
- R. Construction: internally fused, replaceable capacitor cells factory assembled and bussed and together in protective enclosure; include internal discharge resistor.
- S. Cooling: naturally ventilated.
- T. Access: enclosure access through a removable capacitor door located on top of enclosure; access door shall be interlocked to de-energised contactor(s) when the door is opened.
- U. Finish: manufacturer's standard grey enamel

PART 3 – EXECUTION

3.1. EXAMINATION

- A. Install in accordance with manufacturer's instructions.
- B. Locate capacitors and harmonic filters to allow adequate ventilation around enclosure.
- C. Provide disconnecting switch to remove capacitors and detuned reactors.

3.2. DEMONSTRATION

- A. Provide a factory trained field representative to instruct the Employer's personnel for a period of no less than 2 days in maintenance and operation of the equipment.

3.3. FIELD QUALITY CONTROL

- A. Test the Capacitor Banks in accordance with the requirements of Start-up Testing and Commissions of Electrical Equipment.

Chapter 13. ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1. WORK DESCRIPTION

- A. The scope of works for all electrical works and systems comprises engineering, supply, delivery, installation, testing and commissioning, handover, training, maintenance and warranty all as described or reasonably implied in the Contract. The Contractor is obliged to provide fully functioning works and systems in conformance with the requirements of the Contract. In the event certain items are not fully described or indicated in the Contract, but deemed essential by the Engineer for the performance of the works and systems then the provision of such items shall form part of the Contractors scope of works at no additional cost to the Owner.
- B. The Contractor shall be responsible to co-ordinate the equipment and services and shall produce properly co-ordinated shop drawings to demonstrate the installation comply with the performance requirement with shop drawing, calculations and details. A. Shop drawings shall take into account actual measurement and setting out dimensions/levels obtained and determined by the Contractor on site, actual equipment/material used, actual routing of services, co-ordination with all installation, and site conditions/constraints. This specification is intended to cover installation, testing and commissioning of LV Panels and associated equipment/ materials, panels, etc.

1.2. SCOPE OF WORK:

- A. The Electrical and ELV installation shall generally include the following:
 - 1. Common Services:
 - a. Liaison with the local supply Authority to obtain and coordinate provision of incoming electricity supply.
 - b. Installation, testing & commissioning of MV system including incoming electricity supply, consumer main MV switchboard, cabling to component MV switchboards, cabling to power transformer, power transformers and associated accessories to SEB requirement and arrange SEB acceptance upon completed.
 - c. Supply, installation, testing & commissioning of telephone system including incoming telephone lines, component telephone distribution panel at each level, interconnecting cablings and associated accessories.
 - d. To provide telephone cabling as specified on the drawings.
 - e. Complete central earthing systems for connection with component electrical systems.
 - 2. Internal Services
 - a. Complete LV distribution system including main LV switchboard, automatic power factor correction devices, sub-boards and distribution boards, UPS and associated distribution main and sub-main cabling and associated accessories.
 - b. Complete lighting and power installation including all final circuiting work and associated accessories.
 - c. Normal and emergency lighting supply and installation and associated accessories.
 - d. Complete earthing system.

- e. Complete lightning protection system and associated accessories.
 - f. Complete telephone cabling system and associated accessories.
 - g. Complete wiring work to external/landscape and public area architectural/special lighting and dimming systems and associated accessories.
 - h. Complete cable support system for future structure cabling system and associate works.
 - i. Miscellaneous works like providing and fixing of rubber mats, fire buckets, first aid box, fire extinguishers, etc.
 - j. All associated interfacing power supply work to other mechanical installations.
 - k. All interfacing works with the Building Management System for remote control and monitoring.
 - l. All associated interfacing works with other M&E installations.
 - m. Other works as shown on the Drawings and described elsewhere in the Contract documents.
- B. The item rate shall remain valid for variation to any extent of the estimated quantities given in the Schedule of Quantities.
- C. All equipment shall be of the class most suitable for working under the conditions specified and shall withstand the atmospheric conditions without deterioration.
- D. Minor civil work is included in the contractor's scope of work. Further, the responsibility of coordination with the civil and other contracting agencies ensuring completion of turnkey contract rests with the contractor.
- E. Contractor shall co-ordinate with all other agencies working at site for interconnection and safety aspects.
- F. Also the Contractor shall furnish back up combined guarantee minimum for 1 year from the date of successful commissioning from the manufacturer. In case there is any defect, the free replacement of any part or in whole will be made immediately at no extra cost to Owner.

1.3. FEE, PERMITS & TESTS:

- A. The contractor shall obtain all sanctions and permits required for the above said works from all the relevant authorities. All actual fees payable in this regard will be reimbursed against receipt/documentary proof (evidence). On completion of the work, the Contractor shall obtain N.O.C from concerned authorities including SEB, Chief Electrical Inspectorate, of State. The original of the same shall be delivered to the Owner through Consultants.
- B. The Owner shall have full power regarding the equipments/ materials get tested by authorized/ recognized independent agency at the contractor's expense in order to prove their soundness and adequacy. The contractor will rectify the defects/ suggestions pointed out by independent agency through Owner at contractor's expense.
- C. The installation shall comply in all respects with the requirements of Indian Electricity Act 1910, Indian Electricity Rules (IER) 1956 and other related Laws and Regulations (for F.F. etc.) as amended up to date, there under and special requirements, if any, of the State Electricity Boards etc. The contractor shall be liable to furnish the list of authorized

licensed persons/ employed/ deputed to carry out the works/ perform the assigned duties to fulfill the requirement of Rule No.3 of IER 1956 as amended up to date.

1.4. CODES & STANDARDS:

- A. The design, manufacture, inspection, testing and performance shall comply with all the currently applicable statutes, safety codes, relevant Bureau of Indian Standards (BIS), British Standards (BS), International Electro Technical Commission (IEC) publication, NEMA & VDE Standards amended up to date.
- B. The design engineering, manufacturing and the installation shall be in accordance with established codes, sound engineering, practices and specifications. Further, the same shall conform to the statutory regulations applicable in the country. Contractor shall obtain all approvals from statutory authorities, e.g. Electrical inspector, SEB or any other agency as applicable before commissioning of electrical system if required.
- C. Some of the relevant Indian and British Standards are listed below.
 - 1. Indian Electricity Act.
 - 2. Indian Electricity Rules.
 - 3. Factory Act.

Any other standard may be followed provided it is equivalent or more stringent than the standards specified above.

In case of any deviation/conflict of this specification with the codes & standards, the following order of precedence shall govern

- 1. Engineer's decision.
- 2. Local codes of practice
- 3. Drawings.
- 4. Specifications
- 5. International standards & requirements.

1.5. DESIGN:

- A. The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The equipment offered by the contractor shall be complete in all respects. Any materials or accessories, which may not have been specifically mentioned, but which are usual and necessary for the completion of the system and satisfactory & trouble free operation and maintenance of the equipment shall be provided without any extra cost to the Owner. This shall also include spares for commissioning of the equipment.
- B. This specification defines the basic guidelines to develop a suitable electrical system as necessary for the Complex. All data required in this regard shall be taken in to consideration to develop a detailed engineering for the system. Site conditions as applicable are mentioned elsewhere.
- C. Compliance with these specifications and/or approval of any of the Contractor's documents shall in no case relieve the Contractor of his contractual obligations.

- D. All work to be performed and supplies to be made as a part of contract shall require specific approval/review of Owner or his authorized representative
- E. The engineering activities shall comprise the submission for approval of the following from Consultants/Owner

1.6. BIDDER SHALL BE RESPONSIBLE FOR:

- 1. Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, cabling layouts, earthing layouts, including equipment installation and cable termination details etc. prior to start of work.
- 2. Preparation of bill of materials for electrical works.
- 3. Protection co-ordination drawings/ tables for complete power system.
- 4. Shop inspection and testing procedures.
- 5. Field-testing and commissioning procedures.
- 6. Preparation of as built drawings.

Bidder shall also be responsible for:

Any other work/activity which is not listed above, however is necessary for completeness of electrical system

Bidder shall clearly understand and quote accordingly:

To ensure that all clauses given in this part of the specifications shall also apply to all other electrical works of other segments. The bidder shall bring to the notice of the Owner the differences, if any, and get the same clarified failing which the Owner may impose the more stringent of the specification/ clauses at the sole risk and costs of the contractor.

1.7. DATE OF COMMENCEMENT AND COMPLETION PERIOD:

- A. The contractor shall be allowed admittance to the site on the date of commencement as described in the General Conditions and he shall thereupon and forthwith begin the works and shall regularly proceed with and complete the same on or before the date of completion subject, nevertheless to the provisions for the extension of time. The time being the essence of the contract, the Contractor will adhere to the time, progress chart and project schedule and will give proportional output/progress in proportional time

1.8. SCHEDULE AND MANNER OF OPERATIONS:

- A. Time being the essence of this Contract, the Contractor will be expected to furnish all labour and materials in sufficient quantities and at appropriate times, expedite and schedule the work as required and so manage the operation that the work will be completed within the time stated in the Contract.

1.9. PROJECT SCHEDULE:

- A. The contractor will have to submit a detailed project schedule.

1. For various items of works to be carried out by him.
 2. For various associated works to be carried out by other agencies. so that the work gets completed with in the contractual completion time. This schedule shall be submitted by the contractor in Microsoft project software format. The contractor shall follow this schedule meticulously and shall also coordinate/ follow up with other agencies to expedite the works associated with his own work. Liquidity damages clause will become applicable for any delay in completion of the work.
- B. The contractor will submit within 7 days of the award of work, a detailed schedule of program of work.
- C. No additional payment will be made to the contractor for any multiple shift work or other incentive methods contemplated by him in his work schedules even though the time schedule is approved by the Consultant/Engineer-in-Charge.

1.10. DESIGN CONDITIONS:

- A. Design ambient: 45 Deg. C maximum dry bulb temperature & 2 Deg. C minimum dry bulb temperature
- B. Altitude: 300 m above sea level
- C. Relative Humidity: 98% maximum D. Site Environment: Normal.

1.11. COORDINATION OF WORK

- A. Contract documents establish scope, materials and quality but are not detailed installation instruction.
- B. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
- C. The drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other divisions will permit. Provide offsets, fittings, and accessories which may be required but not shown on the drawings. Investigate the site, and review drawings of other divisions to determine conditions affecting the work, and provide such work and accessories as may be required to accommodate such conditions.
- D. The locations of thermostats, switches, panels and other equipment indicated on the drawings are approximately correct. Exercise particular caution with reference to the location of panels, thermostats, switches, etc., and have the precise and definite locations accepted by the Engineer before proceeding with the installation.
- E. The drawings show only the general run of services and approximate location of equipment, outlets, panels, etc. Any significant changes in location of equipment, outlets, panels, etc., necessary in order to meet field conditions shall be brought to the determine attention of the Engineer for review before such alterations are made. Modifications shall be made at no additional cost to the Contract.
- F. Carefully check space requirements with other division works to ensure that equipment can be installed in the space allotted.
- G. Wherever work interconnects with work amongst different installation, coordinate with other trades to insure that they have the information necessary so that the Contractor may properly install the necessary connections and equipment. Identify items requiring access in order that the Ceiling Trade will know where to install access doors and panels.

- H. Consult amongst installation so that, wherever possible, motor controls and distribution equipment are of the same manufacturer.
- I. Furnish and set sleeves for passage of risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each riser passing through building surfaces.
- J. Provide fire stopping around all pipes, conduits, ducts, sleeves, etc, which pass through fire compartments.
- K. Provide required supports and hangers for equipment suitably so as not to exceed allowable loading of structures.
- L. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Engineer for review. At completion include a set of these drawings with each set of record drawings.
- M. Coordinate with the local utility companies/authorities for their requirements for service connections and provide all necessary provisions, grounding, materials, equipment, labor, testing, and appurtenances.
- N. Before commencing works, examine adjoining works on which this work is in any way affected and report conditions which prevent performance of the works. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- O. The Contractor is responsible to any modifications required due to service not properly coordinated.

1.12. ELECTRICAL POWER SUPPLY INTERFACES

- A. The Contractor shall provide power supply points/isolators at certain designated locations within the development for all mechanical and electrical installations as indicated on the drawings. It is the responsibility of the Contractor to coordinate and make connections to these power supply points/isolators and to provide all the necessary 'down-stream' power supply distribution board/network to the mechanical system's control panels, equipment, sensors, field devices, etc.

1.13. BUILDING MANAGEMENT SYSTEM AND INTERFACES

- A. The Contractor shall co-ordinate the mechanical system and equipment to interface with the Building Management System in accordance with the point schedules specified on the Drawings. All necessary interfacing works shall be included in the Contract.

1.14. CENTRAL CONTROL ROOM INTERFACES

- A. The Contractor shall include the supply and installation of a custom-built control console of proprietary make in the Fire Command Centre and each building component's Security Room to integrate all control panels, mimic panels, and central equipment of the following systems:
 - 1. Building Management system

2. Security systems, including CCTV, access control, door monitoring, watchman tour, panic alarm system, etc.
3. Fire Alarm and Detection system
4. Ventilation Control Panel for all emergency operation fans/systems
5. Lift system
6. Escalator system
7. Fireman Intercom system
8. Fire Protection Pumps Control Panel
9. Fireman's Override Control Panel
10. Public Address and Emergency Evacuation Announcement systems
11. MATV System
12. all other systems to be housed inside the Fire Command Centre/Security Room

1.15. INTERFACING WITH ALL SERVICES AND SYSTEMS

A. General

1. The Contractor shall provide all necessary provisions for interfacing amongst installation, services, and equipment. All necessary sensors, current/voltage transformers, voltage-free contacts, relays, auxiliary contacts, terminals, transducers, etc. for interfacing works shall be provided by the Contractor.
2. All control/monitoring wiring from sensors, equipment, and components for the interfacing shall be terminated at a separate interfacing compartment located at the respective equipment/system's switchboard or control panel. The interfacing compartment shall be completed with all necessary connectors, terminals, and with proper identifications to allow interfacing works to be easily carried out. The compartment shall clearly indicate "Extra Low Voltage Cable Only. No Power Cable Connection". Where there is no equipment/system switchboard or control panel involved, the Contractor shall provide separate interfacing panels with provisions same as the interfacing compartment as described above. The locations of the switchboard/control panels and the interfacing panels shall be properly coordinated.
3. For every control panel and each module of the switchboard, at least five (5) spare terminals shall be provided for future interfacing works.
4. Wiring and cables for interfacing with the fire alarm system and other fire protection and life safety systems shall be fire rated to comply with Civil Defense's requirements.
5. Unless otherwise specified or shown on the Drawings, interfacing wiring from Fire Alarm and Building Management systems shall be provided and terminated at the terminals of the interfacing compartments or panels by the Fire Alarm System and Building Management System installation respectively. The Contractor shall co-ordinate the current and voltage requirements for the interfacing works/provisions. The type of provisions for interfacing signals shall be as follows, unless otherwise specified:
6. Digital inputs and outputs : voltage-free dry contact
7. Analog inputs and outputs : 4 – 20 mA or 0 – 10 mV
8. All the interface provisions shall be DC operated and rated not more than 50 mA.

9. For interfacing works between Fire Alarm System and Building Management System, the Contractor shall provide the Fire alarm installation with interface wiring and terminate them at the Building Management System's interfacing compartments or panels.
10. The Contractor shall provide and make all power cable connections from mechanical equipment, local control panels, and distribution boards to the electrical isolators or power points (including cable termination) provided under Division 16 works. Location of power supply isolators and power points shall be properly coordinated.
11. In addition to the interfacing requirements shown on the Drawings, interfacing provisions as described below shall also be provided and included in the Contract.

B. Electrical Installation

1. The Electrical Installation shall provide the following:
 - a. Isolators and power points (fused spur units) for all mechanical equipment and systems. Where shown on the Drawings, the Electrical installation shall include direct power cable connections to the mechanical system's main motor control centres.
 - b. Earthing terminal in the Fire Command Centre and all other plant rooms for supplementary equipotential bonding of mechanical equipment and systems.
 - c. Power failure signal to the Lift System (including wiring terminations into the Lift interfacing panel in the Lift Motor Room), Fire Alarm System and the Building Management System.
 - d. Electrical bonding of all roof equipment and external metal cladding including provisions and connection of bonding cables.
 - e. Fuel main storage tank and day tank High/Low level alarm signals to the Building Management System.
 - f. Emergency power supplies to Building Management System (including all field panels), Fire Alarm System, car parking system, and all security systems.
 - g. Emergency power supplies to all fire shutters, smoke shutters/curtains, and automatic doors.
 - h. Power point in each toilet for the plumbing installation (for connection to automatic sanitary sensors and flush valve under the Plumbing and Sanitary installation).
2. Power supply to variable air volume (VAV) boxes and the ACMV system's control components/sensors shall however be provided under the ACMV installation from the corresponding equipment motor control panel.

1.16. EXAMINATION OF SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- B. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work, based on examination of the site or other information. Failure to examine the drawings or other information does not relieve the Contractor of responsibility for satisfactorily completion of the work.

1.17. EXCAVATION AND BACKFILL

- A. Where ever required provide trenches details, duly approved by the consultant with all relevant section etc. as per IS codes to the Civil contractor, minimum before 1 month of laying the pipes, etc. Co ordinate with the civil contractor during the excavation, and ensure that the excavation and backfilling is being properly done as per requirement.
- B. Where ever it is asked by the Owner/ consultant for providing trenches in contractor's scope. It is deemed that the cost of the pipe is inclusive of trench digging and backfilling. The following points needs to be taken care of while making the trenches.
- C. The trench shall be of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum over depth of four inches below the trench depths indicated on the drawings or required. Backfill over depths in the rock excavation and unauthorized over depths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95% to standard proctor density or 75% relative density or as specified by the Engineer. Wherever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.
- D. Excavate trenches for utilities that will provide the following minimum depths of cover from existing grade or from indicated finished grade as required by local authorities.
- E. Trenches should not be placed within 3 meters of foundation or soil surfaces which must be resist horizontal forces.
- F. Do not backfill until all required tests have been performed and installation observed by the Engineer. Comply with the requirements of other sections of the specifications. Backfill shall consist of non-expansive soil with limited porosity. Deposit in 15 cm layers and thoroughly and carefully tamp until the work has a cover of not less than 30 cm. Backfill and tamp remainder of trench at 30 cm intervals until complete. Uniformly grade the finished surface.

1.18. CUTTING AND PATCHING

- A. A. All kinds of cutting and repairing of brick Walls or Partitions, etc. for the proper routing of pipe, shall be in the scope of the contractor. However, cutting and repairing of RCC wall, or ceiling shall be in the scope of civil contractor.
- B. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc., using skilled trade people of the trades required at no additional cost to the Contract.
- C. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Contract.

1.19. SEALING OF PENETRATIONS

- A. Air Tight Seals 1. All penetrations through the building fabric subject to suction or pressurization shall be sealed airtight.
- B. Holes in Roof

1. Roof penetrations for passage of conduits or circular PVC and PVC Cables shall be sealed watertight using a flexible polypropylene conical sleeve manufacturer to seal the cable to the roof structure, regardless of the roof profile.
2. All sharp metal edges, which may come in contact with the cable, shall be suitably bushed.

C. Fire Rated Penetrations

1. Where services penetrate any fire rated barrier, the Contractor shall seal the penetration with the use of an appropriate material to ensure the integrity of the fire barrier.
2. The Contractor shall seal the cable enclosures through fire rated barriers to ensure the integrity and rating of the fire barrier.

D. Acoustic Penetrations

1. Where services penetrate acoustic barriers, sealant shall be supplied and installed to maintain the acoustic separation at least equal to the barrier penetration.

1.20. MOUNTING HEIGHTS

- A. Verify exact locations and mounting heights with the Engineer before installation.

1.21. SUPPORTS

- A. Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.
- B. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and equipment room.
- C. Provide supporting frames or racks for equipment which is installed in a free standing position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on ducts, pipe, electric conduits, raceways, or cables for support.
- F. Equipment shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splinters, runners, bars and the like in the plane of the ceiling). Provide independent support of equipment. Do not attach to supports provided for ductwork, piping or work of other trades.
- G. Provide required supports and hangers for equipment so that loading will not exceed allowable loading of structure. Equipment and supports shall not come in contact with work of other trades.

1.22. FASTENINGS

- A. Fasten equipment to building in accordance with the best industry practice.

- B. Where weight applied to the attachment points is 45 kg or less, conform to the following as a minimum:
 - 1. Wood : Wood screws
 - 2. Concrete and solid masonry : Dash Fastener of appropriate ratings -HILTI/FISHER
 - 3. Solid metal : Machine screws in tapped holes or with welded studs
- C. Where weight applied to the building attachment points exceeds 45 kg, but is 135 kg or less, conform to the following as a minimum:
 - 1. At concrete slabs provide 60 cm x 60 cm x 13 cm steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top slabs screed line, where no fill is to be applied.
 - 2. At steel decking or sub-floor for all fastenings, provide through bolts and threaded rods. The tops of bolts and rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or subfloor manufacturer produces specialty hangers to work with his decking or sub-floor such hangers shall be provided.
- D. Where weight applied to building attachment points exceeds 135 kg, coordinate with and obtain the approval of Engineer and conform to the following as a minimum:
 - 1. Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall suitably weld or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
- E. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- F. Wall mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars.

1.23. DENTIFICATION

- A. Identify equipment with permanently attached black phenolic nameplates with 13 mm high white engraved lettering. Identification shall include equipment name or load served as appropriate. Nameplates shall be attached with cadmium plated screws; peel and stick tape or glue on type nameplates is unacceptable.
- B. Services runs shall be properly identified as per the requirements in the Contract.
- C. See individual section for additional identification requirements.

1.24. PROHIBITED LABELS AND IDENTIFICATIONS

- A. In all public areas, tenant areas, and similar locations within the project, the inclusion or installation of any equipment or assembly which bears on any surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.
- B. Required test lab certification labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

1.25. EQUIPMENT PADS AND ANCHOR BOLTS

- A. Provide all details with proper sections for the equipment pads and anchor. The equipment pads casting and making provision for anchor fastening shall be as per the final UNALTERED drawing duly approved by the consultant, shall be in the scope of Civil

contractor. However, the Contractor shall ensure the proper coordination with the civil contractor.

- B. All equipment pads for all vibrating equipments shall have cork vibration pads sandwiched between the finish surface and the bottom surface of required thickness suggested by the civil consultant, to ensure that the minimum vibration can travel below.
- C. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.
- D. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an attached to 15 cm square, galvanized metal back plates which are attached to the gypsum board with an approved nonflammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

1.26. MISCELLANEOUS:

- A. A site order book will be maintained at site, which will be in the custody of the Owner, or his representative and all instructions given to the contractor will be recorded in the site order book and the same has to be signed by the contractor to comply with the instructions given therein.
- B. After completion of the work the whole installation shall be tested by the contractor in the presence of the Consultant/Engineer-in-Charge. The tests shall comply the following I.E.E. Regulations and shall be submitted along with the final bill:
 - 1. The result of the insulation test shall comply with the I.E.E. Regulations 1101 to 1108A and 1008B as may be applicable.
 - 2. Test shall be carried out to ascertain that all the non-linked SP switches have been connected to the phase conductor.
 - 3. The continuity test of the earthing system shall comply with I.E.E. Regulations 1108 to 1109 to the latest addition.
- C. If the result of the above tests does not comply with the I.E.E. Regulations, the contractor shall be bound to rectify the faults so that the required results are obtained.
- D. The contractor shall be responsible to provide all the necessary testing instruments, such as megger insulation tester, earth tester multi-meter, AVO meter etc for carrying out the above tests.
- E. The work will not be considered as complete and taken over by the Owner till all the components of the work after being completed at site in all respects have been inspected/ tested by the Consultant/Owner to his entire satisfaction and a completion certificate issued by the Owner/Consultant to this effect.
- F. Shop drawing for electrical work e.g. equipment, cable earthing and conduit layout for all systems shall be prepared by the contractor and got approved before starting of the work.

- G. At the completion of the work and before issuance of certificate of virtual completion, the contractor shall submit 6 sets of drawing and two tracing of each drawing to Owner of each layout drawings drawn at approved.
- H. Contractor's Superintendence:
1. The contractor shall provide all necessary superintendence during the execution of the works and as long thereafter as the engineer may consider necessary. The contractor or his competent and authorized agent or representative approved of in writing by the owner/ Engineer (which approval may at any time be withdrawn) is to be constantly on the works and shall give his whole time to the superintendence of the same. Such authorized agent or representative shall receive on behalf of the contractor, directions and instructions from the Engineer-in-charge or his representative.
 2. The contractor shall provide detailed organization of the execution team deployed for the works with names and CV's, of all key staff before the commencement of work and get it approved of in writing by the Owner/ Consultant. Contact telephone or pager numbers for emergency and/or twenty-four (24) hour call shall also be included.
 3. If in any case of withdrawal of any worker/ technician/Engineer from the execution team, the replacement of the same shall be done with equivalent qualification, and shall be approved in writing by the Owner/ Consultant.

PART 2 – PROUCT, TESTING & COMMISIONING

1.1. DESIGN CRITERIA

- A. Electrical Details for Incoming Supply:
1. Supply Voltage: as approved by SEB
 2. Fault Level (Sym.) at supply point (Designated): MVA (to be confirmed from State Electricity Board by Bidder).
 3. Neutral: Grounded
 4. Voltage Regulations: + 10%
 5. Frequency Regulations: + 3%
 6. Combined Regulations: + 10%
- B. LT Power Distribution System:
1. Voltage: 415 V
 2. Frequency: 50 Hz
 3. Neutral: Grounded
 4. Short Circuit Fault withstand capacity: 20 to 50 KA for 1 sec., as per BOQ and specifications
- C. Control supply for Electrical System: The various supply voltage to be used in the control panels for the main equipment shall be as under: 1. Spring charge motor: 230 V AC or 24 V DC (Universal Motor) 2. Closing/ Trip Coil: 24 V DC 3. Alarm/ Indication/ Relays: 24 V DC 4. Heaters: 230 V AC
- D. Painting of Panels: Powder coating of approved shade as per Specification. (Refer clause of painting)
- E. Painting of Cable Trays and Structural steel: Powder coating of approved shade as per Specification. (Refer clause of painting)

F. Cable Details:

1. LT Control Cables: Copper conductor armoured PVC insulated 1.1 KV grade.
2. LT Power Cables: Aluminium conductor armoured XLPE insulated.
3. Grounding Conductors: Copper/ G.I. as specifications and BOQ

G. Accuracy Class of Meters:

1. Revenue Meters: Class-I or as approved by SEB
2. Ammeters, Voltmeters & Other Instruments: Digital Type

1.2. DRAWINGS:

- A. The list of drawings is enclosed along with this specification. These drawings are meant to give general idea to bidder regarding the nature of work covered by these specifications.
- B. Any information/data shown/not shown in these drawings shall not relieve the contractor of his responsibility to carry out the work as per the specifications. Additional information required by the bidder for successfully completing the work shall be obtained by him.

1.3. SHOP DRAWINGS:

- A. The contractor shall prepare detailed coordinated electrical shop drawing indicating Panel layout, with other relevant services and submit to the Consultant for approval or the Engineer-in- Charge before commencing the work. The shop drawings shall indicate all setting out details and physical dimensions of all components with wiring and cable details including system operating write up in the system i.e. Control and Relay Panel and fixing details for the above mentioned work. All work shall be carried out on the approval of these drawings. However, approval of these drawings do not relieve the contractor of his responsibility for providing maintenance free and full proof system including any missing component/accessories to meet with the intent of the specifications. Contractor will submit 2 (two) prints for preliminary approval and finally 6 (six) prints for distribution.

1.4. MANUFACTURER'S INSTRUCTIONS:

- A. Where manufacturers have furnished specific instructions, relating to the material/equipments to be used on this job, covering points not specifically mentioned in this document, manufacturer's instructions should be followed.

1.5. COMPLETION DOCUMENTS AND DRAWINGS:

- A. Three copies of operation manuals/catalogues of all standard equipment are to be furnished by the contractor immediately after commissioning of plant.
- B. Three copies of write up on preventive maintenance, trouble shooting and operating instructions of the system along with as-built drawings are to be supplied by the Contractor at the time of commissioning.
- C. On completion of the work in all respects, the Contractor shall supply five portfolios (300x450 mm), each containing complete set of drawings on approved scale, clearly indicating complete layouts, location; wiring and sequencing of automatic controls, location of all concealed wiring and other services. Each portfolio shall also contain consolidated control diagrams and technical literature on all controls. The Contractor shall frame under glass, in the Panel rooms, one set of these consolidated control diagrams.

1.6. MATERIALS AND EQUIPMENT:

All the materials and equipments shall be of the approved make and design. Unless otherwise called for any approval by Owner's Engineer-in-Charge, only the best quality materials and equipment shall be used.

- A. Space Heaters: Suitable number of adequately rated heaters thermostatically controlled with On-Off switch and fuse shall be provided to prevent condensation in any panel compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.
- B. Fungi static Varnish: Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.
- C. Ventilation Opening: In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.
- D. Degree of Protection: The enclosures of the control cabinet, junction boxes and marshalling boxes, panels. etc to be installed shall provide degree of protection as detailed her under.
 - 1. Installed indoor : IP-55
 - 2. Installed indoor in air-conditioned area : IP-31
 - 3. Installed in covered area : IP-42
 - 4. Installed indoor in non air-conditioned area where possibility of entry of water is limited :IP-41
 - 5. For LT Switchgear (AC and DC distribution boards) :IP-42 The degree of protection shall be in accordance with IS: 13947 (Part –I) IEC-947 (Part –I). Type test report for degree of protection test, on each type of the box shall be submitted for approval.
- E. Rating plates, Name plates and Labels: LV panel and auxiliary items installed in the building is to permanently attach to it in a conspicuous position. A rating plate of non-corrosive material with engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of loading conditions of equipment in question has been designed to operate and such diagram plates as may require by the owner. The rating plate of each equipment shall be in accordance to IEC requirement. All such nameplates, instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates on with Hindi and another with English inscriptions may be provided.
- F. Design Improvements: The bidder shall note that the equipment offered to him in the bid only shall be accepted for supply. If for any reason, contractor wished to deviate from specification, prior permission from owner/ consultant shall be sought. If any change is agreed upon and that if affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/ or schedule of completion

before the contractor proceeds with the change. Following such arrangements, the provision thereof, shall be deemed to have been amended accordingly in the specification.

G. Quality Assurance Programme: To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Owner's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance program to control such activities at all points necessary. Such programme shall be outlined by the Contractor and shall be finally accepted by the Owner after discussions before the award of Contract. A quality assurance programme of the contractor shall generally cover the following:

1. His organization structure for the management and implementation of the proposed quality assurance programme.
2. Documentation control system.
3. Qualification data for bidder's key personnel.
4. The procedure for purchases of materials, parts components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
5. System for shop manufacturing and site erection controls including process controls and fabrication and assembly control.
6. Control of non-conforming items and system for corrective actions.
7. Inspection and test procedure both for manufacture and field activities.
8. Control of calibration and testing of measuring instruments and field activities.
9. System for indication and appraisal of inspection status.
10. System for authorizing release of manufactured product to the Owner.
11. System for maintenance of records.
12. System for handling storage and delivery and. The Owner or his duly authorized representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor / his Vendor's quality management and control activities.

H. Quality Assurance Documents The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after dispatch of the equipment.

1. All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and reports including radiography interpretation reports.
2. Welder and welding operator qualification certificates.
3. Welder's identification list, listing welder's and welding operator's qualification procedure and welding identification symbols.
4. Raw material test reports on components as specified by the specification and / or agreed to in the quality plan.
5. Stress relief time temperature charts/oil impregnation time temperature charts.
6. Factory test results for testing required as per applicable codes/mutually agreed quality plan/standards referred in the technical specification.

7. The quality plan with verification of various customer inspection points (CIP) as mutually and methods used to verify the inspection and testing points in the quality plan were performed satisfactory.

1.7. INSPECTION, TESTING AND INSPECTION CERTIFICATES:

- A. The Owner and the Consultant or duly authorized representative shall have at all reasonable times free access to the Contractor's premises or works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection, if part of the works is being manufactured or assembled at other premises or works, the Contractor shall obtain permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Owner and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
- B. All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Bidder shall submit the type tests reports for approval. The Contractor shall intimate the Owner/Consultant the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies. If for any item type test were pending payment would be made on successful completion of type/routine test(s) actually carried out as per Consultant/Owner instructions.
- C. The Contractor shall give the Consultant/Owner thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account. The Consultant/Owner unless witnessing of the tests is virtually waived will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed with the test which shall be deemed to have been made in the presence of Owner/Consultant and he shall forthwith forward to the Consultant duly certified copies of tests in triplicate.
- D. The Consultant/Owner shall within fifteen (15) days from the date of inspection as defined shall inform in writing to the Contractor of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and make the necessary modifications accordingly.
- E. When the factory tests have been completed at the Contractor's or Sub-contractor's works, the Consultant/Owner shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Consultant/Owner, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Consultant/Owner. Failure of the issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificate shall not bind the Owner to accept the equipment should, it, on further tests after erection, is found not to comply with the Specification. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Owner.
- F. For tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labor, materials, electricity, fuel, water, stores, apparatus and instruments as may be required by Owner/Consultant or this authorized representative to carry out effectively such tests of the equipment in accordance with the Specification.

- G. The inspection by Owner/Consultant and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.
- H. The Consultant/Owner will have the right of having at his own expenses any other tests(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests to satisfy that the material comply with the specifications.
- I. The Owner/Consultant reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipments for these tests shall be provided by the Contractor.

1.8. TESTS:

- A. Charging (Pre-commissioning tests): On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Owner/Consultant and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial precommissioning tests at Site. The pre-commissioning tests to be performed as per relevant I.S. / vendor/ bidder submittal and as included in the Contractor's quality assurance programme.
- B. Commissioning Tests:
 - 1. The available instrumentation and control equipment will be used during such tests and the Contractor will calibrate all such measuring equipment and devices as far as practicable. However, unmeasurable parameters shall be taken into account in a reasonable manner by the Contractor for the requirement of these tests. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The Contractor will apply proper corrections in calculation, to take into account conditions which do not correspond to the specified conditions.
 - 2. All instruments, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
 - 3. Pre-commissioning test shall be carried out as per relevant IS and/or as specified in the relevant clause.
 - 4. The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning of the equipment. However necessary fee shall be reimburse by Owner on production of requisite documents.

1.9. PACKAGING:

- A. All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon/truck/trailer sizes in India should be taken account of the Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Owner takes no responsibility of the availability of any special packaging/transporting arrangement.

1.10. PROTECTION:

- A. All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a nonmetallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

1.11. FINISHING OF METAL SURFACES:

- A. General: All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hotdip galvanized after fabrication. High tensile steel nuts and bolts and spring washers shall be electro galvanize. All steel conductors used for earthing/grounding (above ground level) shall be galvanized according to IS: 2629.
- B. Painting:
 - 1. All sheet steel work shall be degreased, pickled, and phosphated in accordance with the IS- 6005 "Code of practice for Phosphating iron and sheet". All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swab shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
 - 2. After Phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved.
 - 3. Powder coating/electrostatic painting of approved shade shall be applied.
 - 4. The exterior color of the paint shall be as per IS-5 or as approved by Consultant. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments, if required.
 - 5. In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures like electrostatic painting etc. the procedure shall be submitted along with the Bids for Owner's review and approval.

1.12. HANDLING, STORAGE AND INSTALLATION:

- A. In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Owner or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented.
- B. Contractor shall follow the unloading and transporting procedure at site, as well as storing, testing and commissioning of the various equipment being procured by him separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's Engineer(s) and shall extend full co-operation to them.
- C. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the

Owner/Consultant. Contractor shall be held responsible for any damage to the equipment consequent for not following manufacturer's drawings/instructions correctly.

- D. Where assemblies are supplied in more than the one section, Contractor shall make all necessary connections between sections. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.
- E. The Contractor shall submit to the Owner every week, a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.
- F. The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Owner in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Owner, as well as protection of the same against theft, element of nature, corrosion, damages etc.
- G. The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment, which require indoor storage.
- H. The words 'erection' and 'installation' used in the specification are synonymous.
- I. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.
- J. The minimum phase to earth, phase to phase and section clearance along with other technical parameters for the various voltage levels shall be maintained as per relevant IS.

1.13. PROTECTIVE GUARDS

- A. Suitable guards shall be provided for protection of personnel on all exposed rotating and / or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.
- B. The Contractor shall also conform to the general regulations governing personnel on the site and must keep to the working space allocated for their use.
- C. The contractor shall be responsible for any kind of mishap, etc. happened with personnel. The Owner shall not take the responsibility for any of such kind.

1.14. TOOLS AND TACKLES:

- A. The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dismantling and maintenance of the equipments.

Chapter 14. **PREAMBLE TO BILL/ SCHEDULE OF QUANTITIES**

- 1.1. Tender shall be on the basis of item rates which shall include the cost of materials, labour, all taxes, duties and all other services required for the complete installation, testing and commissioning in accordance with the relevant NEC/IER and code in practice including the fees for inspection together with the liabilities and obligations as detailed in the general conditions of contract. It will also be the responsibility of the bidder to obtain all types of sanctions etc like power/light connections and the drawings etc if any, required by the concerned local authorities.
- 1.2. Prices shall remain firm and free from variation due to rise and fall in the cost of materials and labour or any other price variation whatsoever whether during extended period of completion, if any.
- 1.3. Item rates shall remain valid for any variation in the estimated quantities given in schedule of quantities.
- 1.4. In order to facilitate the technical scrutiny of the various quotations, the bidder must supply with their quotations detailed technical particulars make catalogues and erection drawings for various items under different parts specified in the schedule of quantities.
- 1.5. The drawing and specifications lay down minimum standard of equipment and workmanship and the deviations. In the absence of any deviations, it will be deemed that the bidder is fully satisfied with the intents of the specifications and drawings and their compliance with the statutory and fire insurance provisions including local codes, where the drawings and specifications conflict, the stringiest shall apply.
- 1.6. All equipments and the installations shall be tested as specified and a test certificate in the prescribed form as required by the local supply authorities shall be furnished.
- 1.7. The entire installation shall be guaranteed against defective materials or workmanship for a period of 12 months from the date of the installation certified by the Consultant and taken over by the Client. During the guarantee period all the defects shall be rectified by the contract free of cost.
- 1.8. The successful bidder shall submit the shop drawings to the Consultant for approval prior to start the work. The approval of these drawings will be general and will not absolve the contractor of the responsibility of the correctness of these drawings. At least 6 copies of the approved drawings shall be supplied to the Consultant for their distribution to the various agencies at site at no cost to the Client.
- 1.9. The position of distribution boards and switchboards may require some minor adjustments due to either site requirements or change in structural layout. All such changes from the position, shown in the drawings, shall be required to be incorporated without any extra payment or deduction for change in length of wiring etc.
- 1.10. The bidders must see the site conditions and take all the aforesaid and foregoing factors while quoting the rates, as no extra payment will be allowed on any ground arising out of or relating to the aforesaid and foregoing.
- 1.11. In single phase (230 V) A.C. supply system circuit wires of same phase shall be drawn in same conduit. For 3 phase, 4 wire wiring system wires of different colour shall be used and for insulated neutral only black colour wire shall be used.
- 1.12. The bidder shall include in his rates for painting with three coats of synthetic enamel paint to match the surroundings or as directed by the Consultant for all steel structure used for works at no extra cost.

- 1.13. The successful bidder shall supply completion drawings of the entire installation on tracing cloth as well as three prints of each drawing showing the complete wiring diagram as executed at site drawn to scale approved by the Consultant after the completion of work but before completion certificate is given by the Consultant.
- 1.14. After laying and jointing the cables shall be subject to necessary tests as stipulated in IS: 5959 (Part-I): 1970.
- 1.15. As more than one make is mentioned, prior approval of particular make for use shall be obtained from the Consultant. All samples of all electric fittings and other accessories shall be approved by the Consultant prior to their installation.
- 1.16. No alteration whatsoever is to be made to the text of quantities of this schedule of quantities, unless such alteration is authorized in writing by the Consultant. Any such alteration or addition shall, unless authorized in writing, be disregarded when tender documents are considered.
- 1.17. Any error in description or in quantity or omission of items from the contract shall not vitiate this contract but shall be corrected and demand to be a variation required by the Consultants.
- 1.18. All measurements shall be taken in accordance with the Indian Standard Electrical Installation in buildings method of measurements of IS: 5908:1970, unless otherwise specified.
- 1.19. The contractor shall provide, within one month after completion of the work or along with the final bill, three sets of manuals properly bound which shall contain the following information:
 - A. Description of installation items using main items of equipments.
 - B. Description of all equipments and system operation with trouble shooting manuals.
 - C. Line diagram of each system including main feature of equipments and showing method of setting controls.
 - D. Method of fault finding, routine, adjustment and wiring diagram.
 - E. Description of routine maintenance, oil and greasing points and recommended lubricants.
 - F. Manufacturer service manuals for all equipments.
 - G. Spares reference manuals.
- 1.20. The contractor shall provide the following at no extra cost to the Client.
 - A. Danger Notice Boards
 - B. Treatment for electric shock giving details of FIRST AID TREATMENT with chart diagrams (mounted in suitable frame).
 - C. Line wiring diagrams of the electrical system mounted in suitable frame.
- 1.21. The contractor will remove all the debris and surplus earth from work site (belonging to his work) free of cost.

Chapter 15. **ACCEPTABLE MAKES OF MATERIALS – ELECTRICAL**

S.NO	Details of Materials / Equipment	Manufacturer
1.	Main Lt Panel And Motor Control Centre	L&T, Siemens, C&S, Schneider (Or Firms With Valid Cpri Test Certificates)

S.NO	Details of Materials / Equipment	Manufacturer
2.	MCCB, MCB, RCCB, ELCB	Schneider Electric (Merlin Gerin), Larsen & Toubro, Legrand, Hager
3.	Distribution Board	Schneider Electric (Merlin Gerin), Larsen & Toubro, Legrand, Hager
4.	Poly Carbonate MCB DB	Hensel, Legrand, Hager Or Equivalent
5.	Change Over Switch	Larsen & Toubro, HPL-Socomec, GE, Siemens
6.	Metal Clad Sheet Steel Enclosure Socket/Plug Box	L&T, Legrand, Hager, Siemens, Schneider, Hensel
7.	Switch Fuse Unit, HRC Fuse	L&T, ABB,GE, SIEMENS
8.	HRC HBC Fuses & Bases	L&T, Siemens, Legrand, Schneider
9.	Automatic Transfer Switches	L&T, Siemens, Legrand, Schneider
10.	Load Break Switches	L&T, Siemens, GE, Schneider
11.	Protection Relay (Numeric Type)	Alstom, ABB, Siemens, L&T, Schneider
12.	Modular Plate Switches And Sockets	Legrand, Clipsal, Crabtree, MK
13.	Overload Relays With Built In Single Phase Preventer	Larsen & Toubro (ESBEE), Siemens, Schneider Electric (Telemecanique-Ldr Series)
14.	Electronic Digital Meters (A/V/PF/HZ/KW/KWH) With Led Display	CG Schlumberger, Secure, L&T- CONZERV
15.	Bustrunking Rising Mains	Legrand, C&S, OBO
16.	Automatic Power Factor Correction Relay(Numeric Type)	Bleuk (Germany), Larsen & Toubro, Abb, Epcos, Alstom
17.	XLPE Aluminium/Copper Conductor Armoured MV Cables Upto 1100 V Grade	Finolex, Rr Kabel, Polycab, Havells, CCI
18.	1100 Volts Grade Frls Pvc Control Cables	Finolex, Rr Kabel, Polycab, Havells, L&T
19.	11/33 KV HT Cable	Finolex, Havells, L&T, RR Kabel, Polycab
20.	LT Jointing Kit / Termination	Raychem, Safe Kit, M-Seal
21.	Cable Glands Double Compression With Earthing Links	Comet, Peeco, Gripwell, Dowells
22.	Bimettalic Cable Lug	Dowell's , Lapp Kabel, Comet
23.	PVC Insulated Copper Conductor Stranded Flexible Wires (FRLS)	Finolex, Rr Kabel, Havells, Polycab, Nicco,
24.	MS Conduit (ISI Approved)	BEC, AKG, Precision
25.	Accessories For Ms Conduit (ISI Approved)	Sharma Sales Corporation, Prakash Engineering Works, Super Sales Corporation

S.NO	Details of Materials / Equipment	Manufacturer
26.	PVC Conduit & Accessories (ISI Approved)	Polycab, Harsh, Berlia, AKG
27.	Ceiling Fan	Crompton Greaves, Polar, Bajaj, Havells,
28.	VCB/HT Switchgear (11/33KV)	Siemens, Crompton, Schneider, ABB, L&T
29.	Light Fixtures	Philips/ Wipro/ Havells-Sylvania/ As Per BOQ
30.	External Lighting Fixture, Poles	Philips/ Wipro/ Crompton/ Bajaj/ As Per BOQ
31.	Lamps	Philips, Osram, Havells
32	Selector Switch, Toggle Switch	Salzer (Larsen & Toubro), Kaycee, Siemens
33	Timer In Distribution Boards	Schneider Electric (Telemecanique), Mdslexic, Larsen & Toubro (Hager), Abb, Siemens, GE(C&I)
34	Batteries Lead Acid	Exide, Standard Furkawa, Amron, Amco
35	Sealed Maintenance Free Batteries	Exide, Amron, Standard Furukawa, Hbl
36	Battery Charger	Volstat, Crompton Greaves, Caldine, Chhabi Electricals
37	LT Servo Automatic Voltage Stabilizer	Icon, Recon, Selvon, Automatic Electric
38	Cable Trays (Factory Fabricated) /Raceways	Venus/Pilco/Slotco/Indiana/Steelways/Prof Ab/Skaber/ Dynamic
39	Fire Sealant	Birla 3M, HILTI, Promat
40	220/24V Transformers	Volstat Electronics, Automatic Electric
41	Lighting High Mast System	Philips, Bajaj, Keselec, Crompton
42	Soft Starter	Allen Bradley, Siemens, ABB, L&T, Schneider.
43	Variable Speed Drives	Allen Bradley, Siemens, ABB, L&T, Schneider, Danfoss.
44	Telephone Outlets	Legrand, MK, Clipsal
45	Multi-Meters & Meggers	Escrop/Motwani Or Equivalent
46	Lighting Protection	Indelec, Piorteh, Pouyet
47	Pumps	Kirloskar, Crompton, Grundfoss, KSB, Mather & Platt
48	Flexible Conduit	LAPP, Hensel, Jainsons
49	Bakelite Sheet	HYLAM/FORMICA/GREENLAM
50	Telecommunication Cable	Batra Henlay, Finolex, Delton, Havells
51	TV Coaxial Cable	Batra Henlay, Finolex, Delton, Havells
52	Computer/Data Cable	Legrand, Digilink, D-Link, AVAYA, AMP, CLIPSAL
53	TAG Block	Krone, Ericsson

S.NO	Details of Materials / Equipment	Manufacturer
54	Motors	Siemens, Kirloskar, Crompton, ABB
55	Transformers (OIL Immersed & Dry Type)	ABB, Kirloskar, Crompton, Schneider, Seimens
56	Ring Main Unit	Schneider, Siemens, ABB, L&T
57	AIR-Break Switch	ABB, Crompton, Schneider, Legrand
58	Current Transformers/ Potential Transformers	MDC, AE, Kappa, Poweronics, Resise, C&S, Indotec, Forme Marshall, Gilbert& Maxwell
59	DG Set	Caterpillar, Lerroysomer, Cummins, Stamford, Volvo-Penta, Kirloskar
60	Dg Amf Panel, DG Auxiliary Panel And Motor Control Centre	Same as LT Panel/ DG packager.
61	Vibration Isolators	Resistoflex, Flenonics (USA), GERB
62	Noise Control Silencer / Muffler	Intertec, Sound Control India
63	D.G. Packager	Sudhir Gensets, TIL, Sterling Wilson, Jakson, Gmmco, Raipower.
64	Hsd Fuel Transfer Pumps	ROTODEL
65	Fuel Tank	Avenue Engineers, Indo Asiatic Engineers Pvt Ltd
66	CCTV	Sony, Honeywell, Sanyo
67	UPS	Emerson, Socomec, Aros, PCI, Mitsubishi
68	Smoke Detectors	Morley-IAS, Edwards, Notifier, Cooper, Schrack
69	Heat Detectors	Morley-IAS, Edwards, Notifier, Cooper, Schrack
70	Control Modules / Monitor Modules / Fault Isolators	Morley-IAS, Edwards, Notifier, Cooper, Schrack
71	Main Control Panel	Morley-IAS, Edwards, Notifier, Cooper, Schrack
72	Manual Call Stations / Hooters	Morley-IAS, Edwards, Notifier, Cooper, Schrack
73	Strobe Lights	Morley-IAS, Edwards, Notifier, Cooper, Schrack
74	Speakers/ Amplifiers	Bose, Bosch, Edwards, Notifier, Cooper,
75	Response Indicator	Morley-IAS, Edwards, Notifier, Cooper, Schrack
76	MIMIC Panel	Morley-IAS, Edwards, Notifier, Cooper, Schrack
77	MICC Cables	Tyco (UK), Wrexham (UK), MICC(UK), KME (Italy)
78	Voice Evacuation System	Edwards, Notifier, Honeywell
79	Fire Fighting Telephone	Edwards, Notifier, Honeywell

ANNEXURE -- I

**PARTICULARS TO BE FURNISHED FOR CONSTRUCTION OF
bank building at -----**

1. Name of Company / Firm:
2. Registered Address of the Company with Telephone No., FAX & E-mail ID:
3. Address of the company with Telephone No., FAX & E-mail ID:
4. Year of Establishment:
5. Status of the Company (whether Proprietary / private Ltd. / Public Limited/ Co-operative Society / Public Sector / Autonomous body / Govt. Department):
6. Name of the Proprietor / Directors / Partners / Controlling body:
 - i)
 - ii)
 - iii)
7. Whether registered with the Registrar of Companies / Registrar of Firms / Registrar of Co-operative societies. If so, please mention the number of such registration and date:
8. a) Name and Address of Bankers:
 - i)
 - ii)
 - iii)

a) Enclose Solvency certificate from at least one Banker in a sealed envelope marked confidential.
9. Whether registered for VAT. If so, please mention the VAT registration number and furnish a copy of such registration certificate:
10. Whether registered for Service Tax. If so, please mention the Service Tax registration number and furnish a copy of such registration certificate:
11. Whether an assessee of Income Tax. If so, please mention the Permanent Account Number:

12. Furnish copies of audited Balance Sheet
2012-13 2013 -14 2014-15with
Profit & Loss account for last three
Years :

- 13 Whether empanelled with other PSU Banks /
Govt. Deptts. / PSUs / Autonomous bodies. If so,
please furnish the following particulars:

Name of the Organisation /	Trade/Services	Date of Empanelment
Institution	Validity	Financial

14. Furnish the names of three responsible persons who will be in a position to certify about
the quality as well as past performance of your organization

i)

ii)

iii)

The particulars furnished in the application are true to the best of my/our knowledge
& belief. I/we understand that if any of the particulars is found incorrect, even at a later
stage, my/our empanelment will be cancelled.

Date:

(Seal)

Signature of Applicant

ANNEXURE - II

Detailed Particulars for the works done in past seven years:

work completed	Name of organization	Name of work	Value	Compliance of stipulated completion time

(Furnish photocopies of credentials)

ANNEXURE - III

Particulars in respect of work executed

[illegible]

ANNEXURE – IV

Key personnel permanently employed

Sr. No.	Name	Designation	Qualification	Experience	Years with the firm	Any other

ANNEXURE - V**Other relevant information****Work Force:**

Sr. No.	Permanently employed	No.	Any other	Years with the Firm
1	Masons			
2	Carpenters			
3	Mechanics			
4	Electricians			
5	Mate/helpers			
6	Others			

ANNEXURE - VI

WORKSHOP FACILITIES.

[illegible]

ANNEXURE – VII

ARTICLES OF AGREEMENT

ARTICLES OF AGREEMENT made this ----- day of two thousand --
----- between “UCO Bank, a body corporate, constituted under the Banking Companies (Acquisition & Transfer of Undertakings) Act, 1970 as amended from time to time having its Head Office at No.10, BTM Sarani, Kolkata-700001 and a Circle Office amongst other places at hereinafter referred to as “the Employer” (which expression shall unless excluded by or repugnant to the subject or context be deemed to mean and include its assigns, administrators and successors) of the “ONE PART”.

and

M/s.....having its office
at.....represented by its
....., son of..... (hereinafter
called the “CONTRACTOR (which expression should include its successors and assignee/s.) of
the OTHER PART,

WHEREAS the Employer is desirous of executing the General Building, Sanitary & Plumbing and Area development work in connection with construction of Bank Building at -----
----- of UCO Bank and has caused drawings and specifications describing the work to be prepared by M/s -----(Name & Address)----- (hereinafter called the “CONSULTANT”).

AND WHEREAS the said DRAWINGS numbered as mentioned in the tender document and to be issued from time to time, the Specifications and the Schedule of Items and quantities have been signed by and on behalf of the parties hereto.

AND WHEREAS the Contractor has agreed to execute upon and subject to the conditions set forth herein and Schedule of Items and quantities, General Conditions of Contract, Special Conditions of Contract including all other conditions as mentioned in the tender document, specifications and all correspondence exchanged by or between the parties from the submission of tender till the award of work, both letters inclusive, (all of which are collectively hereinafter referred to as “the said conditions”) the work shown upon the said drawings described in the said specification and included in the schedule of items and quantities at the respective rates therein set forth amounting to sum of Rs. (Rupee.....only) as therein arrived at or such other sum as shall become payable thereunder (Hereinafter referred to as “the said Contract amount”).

NOW IT IS HEREBY AGREED AS FOLLOWS:

1. In consideration of the said contract amount to be paid at the times and in the manner set forth in the said conditions, the Contractor shall upon and subject to the said conditions execute and complete the work shown upon the said drawings and described in the said specifications and the schedule of items and quantities.

2. The Employer shall pay the Contractor the said contract amount or such other sum as shall become payable, at the times and in the manner specified in the said conditions
8. The Consultant in the said conditions shall mean the M/s ----- (Name & Address) ----- or, in the event of their ceasing to be the Consultant for the purpose of this Contract for whatever reason, such other person or persons as shall be nominated for that purpose by the Employer, provided always that no person subsequently appointed to be Consultant under this contract shall be entitled to disregard or overrule any previous decision or approval or direction given or expressed in writing by the Consultant for the time being.
9. The said conditions and Appendices thereto shall be read and considered as forming part of this Agreement, and the parties hereto shall respectively abide by, submit themselves to the said conditions and perform the agreement on their part respectively in the said conditions contained.
10. The plans, agreements and documents mentioned herein shall form the basis of this contract.
11. This contract is neither a fixed lump sum contract nor a piece work contract but is a contract to carry out the work in respect of General building, Sanitary, Plumbing and Area development work relating to construction of Bank Building at ----- as per the scope described and to be paid for according to actual measured quantities at the rates contained in the Schedule of rates and probable quantities or as provided in the said conditions.
12. The Employer reserves to itself the right of altering the drawings and nature of the work by adding to or omitting any items of work or having portions of the same carried out without prejudice to this contract.
13. Time shall be considered as the essence of this contract. and the contractor hereby agrees to commence the work on the day of handing over of the site or within fourteenth days from the date of issue of formal work order whichever is later as provided for in the said conditions and to complete the entire work within --- (-----) calendar months subject nevertheless to the provisions for extension of time **AS WOULD BE GRANTED BY THE EMPLOYER IN WRITING.**
14. All payments by the Employer under this contract will be made at New Delhi.
15. THE TERMINATION OF CONTRACT AND ITS EFFECT WOULD BE IN ACCORDANCE WITH THE STIPULATIONS LAID DOWN IN GENERAL CONDITIONS OF CONTRACT.
16. Any dispute arising under this Agreement shall be referred to arbitration in accordance with the stipulations laid down in the general conditions of contract.
17. That the several parts of this contract have been read by the contractor and fully understood by the contractor.
In witness whereof the Employer and the Contractor have set their respective hands to these presents through their authorized official and the said two duplicates hereof to be executed on its behalf of the day and year first therein above written.

Signed on behalf of the UCO Bank by its
Duly authorized official

Signed on behalf of the Contractor

In the presence of :

In the presence of :

(1) Signature: -----

(1) Signature : -----

Name with address: -----

Name with address: -----

(2) Signature: -----

(2) Signature : -----

Name with address: -----

Name with address: -----

ANNEXURE – VIII**RUNNING ACCOUNT BILL / FINAL BILL**

- I) : Name of Contractor / Agency :
 ii) : Name of work
 iii) : SL No. of this bill
 iv) : No. and date of previous bill
 v) : Reference to Agreement No
 vi) : Date of commencement
 vii) : Date of completion as per Agreement
 viii) : Contract amount
 vix) : Validity of Insurance
 a) : Workmen Compensation:
 b) : Contractor's All Risk Insurance
 x) : Validity of Labour License:
 xi) : Total retention money including Earnest Money to be deducted as per contract.
 xii) : Earnest Money deposited :
 xiii) : Total retention money including Earnest Money and ISD deducted up to this bill
 xiv) : Period of execution of work for which this bill has been submitted.

Sl no	Item description	unit	Rate (R.S) Quantity	As per tender Amount(R.S)
1	2	3	4	5

Up to previous R A. bill	Upto date (Gross)	Present Bill
Quantity Amount	Quantity Amount	Quantity Amount

Net value since previous Bill (9)

Remarks (10)

NOTE : i) If part is allowed for any item, it should be indicated with reason for allowing such rate.
 ii) If ad hoc payment is made, it should be mentioned specifically.

MEASUREMENT CERTIFICATE

The measurements on the basis of which the above entries for the running bill No. were made have been taken jointly on ----- and are recorded at pages..... To..... of Measurement Book

Signature and
Date of Contractor

Signature and date of
Consultant's representative

Signature and
date of site
Site Engineer/PMC

The work recorded In the above mentioned measurements have been done at the site satisfactorily as per tender drawings, conditions and specifications

Consultant

Site Engineer I PMC /

Bank's Engineer

**ACCOUNT OF SECURED ADVANCE, IF ADMISSIBLE
ON MATERIALS HELD AT SITE BY THE CONTRACTOR**

No.	Item	quantity	Unit	Amount	Remark
Total value of materials at site					
Secured Advance @ ----- %of above value (B)					

Certified (i) that the materials mentioned above have actually been brought by the Contractor to the site of the work and no advance on any quantity of any of this item is outstanding on their security, (ii) that the secured advance against all the materials are payable as per contract and all are required by the Contractor for use in the work in connection with the items for which rates of finished work have been agreed upon.

Date

Signature of Site Engineer
/PMC preparing bill

Date:

Signature of Contractor

Date:

Signature of Consultant's Site Engineer

Date:

.....
Signature of Consultant at

MEMORANDUM OF PAYMENT

Date.

1. Name of work:
2. Name of owner:
3. Name of Contractor
4. Contact Amount
5. Date of Commencement
6. Stipulated date of Completion
- 7: Actual date of completion
- 8: Insurance Valid up to
 - a. Workmen Compensation Act
 - b. All Risk Insurance Policies
9. Gross value of work done Up tobill
Less : Rebate @ as Per tender
- 10, Retention money
11. Add: Secured Advance against materials:
12. Less: Payment made up to Bill: (-) Rs.
13. Less: Adhoc payment certified.....

Rs
(-)
Rs
.....
Say: Rs

The bill amounting to Rs. ----- (Rupees -----) has been scrutinized by me after due test checking of the measurements of work as required and is recommended for payment.....

Signature of Employer's Engineer with date.

Statutory Deductions :

(1) Total amount due : Rs.....

(2) Less: I.T. Payable

(-) : Rs..... , .

3) Less: Sales Tax on Works Contr . (-): Rs.....

Net payable : Rs.....

The figures given in the Memorandum of Payment has been verified and the bill passed for payment of Rs. ----- (Rupees-----)

.....
Signature of Authorized Official of UCO Bank
Date:

CERTIFICATE OF PAYMENT
(TO BE GIVEN ON BILLS AS WELL AS ON MEASUREMENT BOOKS)

Certified that the various items of work claimed in this -----bill by the Contractor -----
----- have been completed to the extent claimed and at
appropriate rates and that the items are In accordance with and fully conforming to the
standard/prescribed specifications and drawings. We further certify that we have checked
the measurements to the extent of 100%. Hence the bill is recommended for payment of Rs:
.....

Signature of Consultant

ANNEXURE – IX

PROFORMA OF GUARANTEE BOND FOR ANTI-TERMITE TREATMENT
The Bond is to be Submitted in a Non-Judicial stamp paper of appropriate value

The General Manager
UCO Bank
Circle Office,

Pre-construction anti-termite treatment for
construction of RSETI Building at -----

The above work has been executed by us on behalf of M/s as per the relevant I.S. Code.

We hereby certify that the foundation and the structure of the above premises of UCO Bank has been pre-treated against subterranean termites infestation in accordance with the specifications, stipulated in relevant I.S. Code and terms and conditions under which the said work has been awarded to us.

We hereby guarantee that the foundation and structure with its fittings and fixtures of the said premises of the UCO Bank shall be absolutely safe against subterranean termite attack or infestation for a minimum period of 5 (Five) years from the date of handing over of the work to the UCO Bank. The date of handing over of the work is DD/MM/YYYY.

In the event of said structures with its fittings and fixtures and foundation being or becoming subject to subterranean termite attack(s) or infestation(s) at any time during the guarantee period of SEVEN YEARS, we agree to carry out as often as it becomes necessary, entirely at our cost and expenses, all and every treatment that may be necessary to render the said foundation and structure free from such subterranean termite attack(s) or infestation(s) Failing which we shall be liable to pay RS..... AS DAMAGES AND COMPENSATION WITHIN A MONTH FROM THE DATE OF DEMAND MADE ON US BY YOU/EMPLOYER IN WRITING.

The question whether the foundation and structure of the said premises are or become subject to subterranean termite attack(s) or infestation(s) and whether any anti-termite treatment is or has become necessary shall be decided by the UCO Bank and we agree that their decision in this regard shall be final and binding on us.

.....
Signature of the specialized
Contractor With Official Seal

Witness and address :

- 1.
- 2.

.....
Signature of the Main Contractor with official seal.

ANNEXURE-X

PROFORMA OF GUARANTEE BOND FOR WATERPROOFING TREATMENT WORK
[This bond is to be submitted on non-judicial stamp papers of appropriate value by the Main Contractor and the specialized agency separately]

General Manager
Circle Office,

Water proofing treatment to the roof and sunken floor of toilets
etc. - Construction of RSETI Building at -----

We hereby guarantee that beforeday of the month ofof year..... If at any time or times the roofs, moris, sunken floor of toilets, water tanks and any other portion thus treated by us,M/s..... (Name of specialised contractor) on behalf of MIs (Name of Main Contractor), start leaking or in any way give way to the influence of water including forming wet patches, dampness etc. due to the inadequacy of the work carried out or due to any other reason whatsoever relating to the specification, workmanship etc. including the responsibility for any surface treatment and plumbing etc. works carried out by other agencies, we shall without any extra cost to the Employer or to the occupants carry out necessary remedial measures to such extent and so often as may be necessary to free the AFORESAID premises from leakage etc. The question of whether there is any leakage or the treatment has given way to water or moisture after completion of the treatment aforesaid and before,....., shall be decided by the Employer and the decision of the Employer in this regard shall be final and binding on us. We shall reinstate the surface to its original condition after carrying out the rectification work, if necessary by bringing new materials at no extra cost to the employer.

Notwithstanding anything contained hereinbefore, we shall not be held responsible for any leakage caused by earthquake or other NATURAL CALAMITIES OR RIOTS ETC causing damage to the roofs, underground reservoir, overhead reservoir and sunken floors of the said Residential Flats for UCO Bank at Faridabad (Haryana). IN CASE OF DEFAULT OR REFUSAL BY YOU/EMPLOYER WILL BE AT LIBERTY TO CAUSE THE SAID REPAIRING WORKS DONE BY ANY OUTSIDE AGENCIES AND IN THAT EVENT WE SHALL BE LIABLE TO PAY THE SAID COST ON DEMAND MADE ON US BY YOU/EMPLOYER.

Witness with address:

1

Signature of the specialized
Contractor with official seal
Place

2

Date

Signature of the Main Contractor with official seal .

ANNEXURE - XI
BOND FOR SECURED ADVANCE

KNOW ALL MEN by these presents that we,engaged as Contractor by the UCO BANK (Hereinafter known as the Employer for the work of CONSTRUCTION OF BANK BUILDING AT ----- and upon the terms and conditions as mentioned in the work Order..... from the Employer and assignsfirmly by these presents duly signed by us dated -----.

WHEREAS the Employer allowed us Secured Advance for various constructional material lying at Site for an amount of Rs. -----Lakhs (Rupees -----Lakh) in our Bill for the above work. Whereas these are lying AT THE SITE AT -----CUSTODY AT OUR OWN RISKS AND RESPONSIBILITIES. The Employer has full and complete lien over these materials AND SO we hereby undertake to provide full security arrangements of the materials at our own risk and cost. The material will be utilized by us from time to time for the bonafide purpose of the work after giving prior intimation to the Employer.

We further indemnify the Employer on the materials from all risks and responsibilities. In the event of any unforeseen eventuality, we take full responsibility to replace the damaged/missing materials entirely at our cost, we agree not to shift these materials from the present site Store without the Employer's prior permission or concurrence.

WE HEREBY AUTHORISE YOU that the said secured advance may either be adjusted from our running bills or the materials can be lifted from our site at any time AS ON WHEN YOU desire.

THIS MAY BE STATED THAT after all the secured advances MADE TO US BY YOU/EMPLOYER are adjusted FROM THE BILLS DRAWN ON YOU BY US/CONTRACTOR.

In the presence of :-

Signed for and on behalf
of the Contractor

ANNEXURE – XII

FORM OF BANK GUARANTEE FOR INITIAL SECURITY DEPOSIT

Form No.

Dated :

M/s UCO Bank,
Circle Office,

Dear Sirs,

GUARANTEE NO. :
AMOUNT OF GUARANTEE:
GUARANTEE COVER FORM:
LAST DATE OF LODGEMENT OF CLAIM:

This Deed of guarantee executed ON THIS DAY OF BETWEEN UCO BANK, A BANK CONSTITUTED UNDER THE BANKING COMPANIES (ACQUISITION & TRANSFER OF UNDERTAKINGS) ACT, 1970 AS AMENDED FROM TIME TO TIME HAVING ITS HEAD OFFICE AT 10, B.T. MSARANI, KOLKATA - 700001 AND HAVING INTER ALIA A CIRCLE OFFICE AT (HEREINAFTER REFERRED TO AS THE "EMPLOYER/UCOBANK") WHICH EXPRESSION SHALL INCLUDE ITS SUCCESSOR/ASSIGNEES.

AND

....., A COMPANY REGISTERED UNDER THE COMPANIES ACT, 1956, HAVING ITS HEAD OFFICE AT (HEREINAFTER REFERRED TO AS "THE CONTRACTOR") WHICH EXPRESSION SHALL INCLUDE ITS SUCCESSOR/ASSIGNEE

WHEREAS THE CONTRACTOR M/S HAS BEEN AWARDED A CONTRACT FOR CONSTRUCTION OF BANK BUILDING AT FOR RS (Hereinafter referred to as the 'said contract') AND ACCORDING TO THE SAID CONTRACT, THE SAID CONTRACTOR IS REQUIRED TO DEPOSIT INITIAL SECURITY DEPOSIT OF RS

AND WHEREAS IN CONSIDERATION OF THE EMPLOYER/UCO BANK HAVING AGREED TO EXEMPT THE CONTRACTOR FROM DEPOSITING THE SECURITY DEPOSIT OF RS UNDER THE TERMS AND CONDITIONS OF THE SAID CONTRACT ENTERED INTO BY AND BETWEEN THE EMPLOYER/UCO BANK AND THE CONTRACTOR ON THE CONTRACTOR FURNISHING A BANK GUARANTEE FOR SECURITY DEPOSIT AMOUNT IN FAVOUR OF THE EMPLOYER/UCO BANK FOR THE DUE FULFILLMENT OF THE CONTRACT BY THE CONTRACTOR.

AND WHEREAS THE CONTRACTOR HAS APPROACHED THE GUARANTOR BANK FOR ISSUE OF SUCH A GUARANTEE IN FAVOUR OF THE EMPLOYER/UCO BANK ON BEHALF OF THE CONTRACTOR FOR THE PERFORMANCE AND DISCHARGE OF THE

OBLIGATIONS OF THE CONTRACTOR UNDER THE SAID CONTRACT ENTERED INTO BY AND BETWEEN THE EMPLOYER/UCO BANK AND THE CONTRACTOR.

AND WHEREAS THE EMPLOYER/UCO BANK HAS FORWARDED A DRAFT BANK GUARANTEE WHICH THE CONTRACTOR HAS SCRUTINISED AND APPROVED AND THEREAFTER REQUESTED THE GUARANTOR BANK TO ISSUE A BANK GUARANTEE IN FAVOUR OF THE EMPLOYER/UCO BANK IN ACCORDANCE WITH THE TERMS CONTAINED IN THE DRAFT BANK GUARANTEE PROVIDED BY THE EMPLOYER UCO BANK.

NOW, THEREFORE, THESE PRESENTS WITNESSETH AND THE PARTIES HEREBY AGREE AS FOLLOWS:

1. THE GUARANTOR BANK HEREBY UNDERTAKES TO PAY TO THE EMPLOYER/UCO BANK UPTO RS AS MAY BE DUE AND PAYABLE UNDER THIS GUARANTEE ON THE FIRST DEMAND BEING MADE WITHOUT ANY DEMUR IRRESPECTIVE OF ANY DISPUTE BETWEEN THE CONTRACTOR AND THE EMPLOYER/UCO BANK IN RESPECT OF ANY AMOUNT OF CLAIM AGAINST THE CONTRACTOR AS BEING DUE BY WAY OF LOSS OR DAMAGE CAUSED TO AND SUFFERED BY THE EMPLOYER/UCO BANK WITHOUT ANY QUESTION AS TO THE FACTUM OR QUANTUM THEREOF PROVIDED THAT THE LIABILITY OF THE GUARANTOR BANK UNDER THIS GUARANTEE SHALL BE RESTRICTED TO AN AMOUNT NOT EXCEEDING RS.....
2. THE BANK GUARANTEE CONTAINED HEREIN SHALL REMAIN IN FULL FORCE AND EFFECT FOR A PERIOD OF YEARS FROM THE EXECUTION HEREOF AND THAT IT SHALL CONTINUE TO BE ENFORCEABLE BY THE EMPLOYER BANK TILL ALL THE DUES THEREUNDER OR BY VIRTUE OF ANY AGREEMENT HAVE BEEN DULY PAID AND THE CLAIM WILL BE SATISFIED OR DISCHARGE OR THAT THE SAID AGREEMENT/CONTRACT IS FULLY CARRIED OUT BY THE SAID CONTRACTOR .
3. THE GUARANTOR BANK AGREES AND DECLARES THAT THE EMPLOYER/UCO BANK HAVE FULLEST LIBERTY WITHOUT THE WRITTEN CONSENT OR PRIOR APPROVAL AND WITHOUT AFFECTING ANYTHING IN ANY MANNER ANY OBLIGATION HEREUNDER TO VARY ANY OF THE TERMS AND CONDITIONS OF THE SAID AGREEMENT/CONTRACT OR TO EXTEND THE TIME OF PERFORMANCE BY THE CONTRACTOR FROM TIME TO TIME OR TO POSTPONE AT ANY TIME OR FROM TIME TO TIME ANY OF THE POWER EXERCISABLE BY THE EMPLOYER UCO BANK AGAINST THE CONTRACTOR AND TO FORBEAR TO ENFORCE ANY OF THE TERMS AND CONDITIONS RELATING TO THE SAID AGREEMENT/CONTRACT AND IT IS DECLARED THAT NOT WITHSTANDING ANY SUCH VARIATION OR EXTENSION OR FORBEARANCE, ACT, OMISSION OR INDULGENCE ON THE PART OF THE EMPLOYER/UCO BANK IN FAVOUR OF THE CONTRACTOR, THE GUARANTOR BANK SHALL NOT BE RELEASED OF ITS LIABILITY BY REASON OF ANY SUCH VARIATION, EXTENSION, ACTS OR FORBEARANCE.
4. THE GUARANTOR BANK HEREBY UNDERTAKES NOT TO REVOKE THE GUARANTEE DURING ITS CURRENCY EXCEPT WITH THE PREVIOUS CONSENT OF THE EMPLOYER/UCO BANK AND THIS GUARANTEE WILL NOT BE DISCHARGED DUE TO THE CHANGE IN THE CONSTITUTION OF THE EMPLOYER BANK OR THE GUARANTOR BANK OR THE CONTRACTOR.

5. ANY CLAIM FOR THE BREACH OF CONTRACT BY THE CONTRACTOR OR FOR ANY LOSS OR DAMAGES SUFFERED BY THE EMPLOYER/UCO BANK SHOULD BE MADE BY INVOCATION OF THESE BANK GUARANTEE WITHIN ITS VALIDITY PERIOD. NO CLAIM UNDER THIS GUARANTEE SHALL BE ENTERTAINED BY THE GUARANTOR BANK AFTER 3 MONTHS FROM THE DATE OF EXPIRY OF THE BANK GUARANTEE PERIOD.
6. THAT ON INVOCATION OF THE BANK GUARANTEE THE BANK WOULD PAY TO THE EMPLOYER UCO BANK WITHOUT ANY QUESTION AS TO ANY BREACH OF THE AGREEMENT OR LOSS SUSTAINED OR OTHERWISE AND THE INVOCATION IN TERMS OF THE GUARANTEE WILL BE TAKEN AS FINAL AND CONCLUSIVE.

NOTWITHSTANDING ANYTHING CONTAINED HEREIN :

- (1) OUR LIABILITY UNDER THIS BANK GUARANTEE SHALL NOT EXCEED RS.....(RUPEES.....) ONLY.
- (2) THIS BANK GUARANTEE SHALL BE VALID UPTO.....AND
- (3) WE ARE LIABLE TO PAY THE GUARANTEED AMOUNT OF ANY PART THEREOF UNDER THIS BANK GUARANTEE ONLY AND ONLY IF YOU SERVE UPON A WRITTEN CLAIM OR DEMAND ON OR BEFORE.....(DATE OF EXPIRY OF GUARANTEE).

IN WITNESS WHEREOF THE PARTIES HEREIN EXECUTED THESE PRESENTS ON THE.....DAY OF OF AT.....

Signed, sealed and delivered by
..... Bank by its
Authorized agent Mr
Being the Manager of Bank
Of Branch.

In the presence of:

- 1.
- 2.

Signature

ANNEXURE – XIII

FORM OF PERFORMANCE SECURITY (BANK GUARANTEE)

IN CONSIDERATION OF THE UCO Bank (hereinafter called the Employer) having agreed to place order on M/S ----- (hereinafter called the Contractor) for execution of contract against the tender being tender no. Dated for construction of Residential Buildings, Sanitary & Plumbing and Area Development work for Construction of Bank Building at ---- ----- as per agreement dated and the Contractor having agreed to execute the contract against the said tender and the contractor having agreed to furnish a Bank Guarantee of Rs. ----- (Rupees ----- Only) litigations for fulfillment of said contract in terms and conditions of the said tender we (Name of the Bank) do hereby undertake to pay to the Employer an amount not exceeding Rs: against any loss or damage caused to or suffered by the Employer by reasons of any breach of the said contract of any of the terms and conditions contained in to said tender.

We (Name of Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demur merely on demand from the Employer stating that the amount claimed is due by way of the contractor's failure to perform the Agreement to be executed between Employer and contractor. Any such demand made on the Bank shall be conclusive as regards the amount due payable by Bank under this guarantee. However, our liability under this guarantee, shall be restricted to an amount not exceeding Rs. ----- (Rupees ----- Only) AND FOR THE PERIOD OF YEARS/MONTHS FROM THE DATE HEREOF.

We undertake to pay the Employer any money so demanded notwithstanding any dispute or disputes by the Contractor in any suit or proceeding pending before any court of Tribunal relating there to, or liability under this present being absolute and unequivocal.

The payment so made by us under this GUARANTEE shall be a valid discharge of our liability or payment there under and the contractor shall have no claim against us for making much payment.

We (Name of Bank) further agrees that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance or the Agreement to be executed between Employer and contractor and that, it shall continue to be enforceable till all dues of the Employer under or by virtue the said Agreement have been full paid and its claims satisfied or discharged or till appropriate Authority certifies that terms and conditions of the said Agreement have been fully and properly carried out by the said contractor and accordingly discharge this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the (Date) ----- we shall be discharged from all liability under this guarantee.

We (Name of Bank) further agree/s with the Employer that the Employer shall have the fullest liberty, without our consent and without affecting in any manner our obligations of the said Agreement to extend time of performance by the said contractor from time to time or to postpone for any time or from time to any of the powers exercisable by the Employer against the said Contractor, and to forbear or enforce any if the terms and conditions relating to the said Agreement, and we shall not be relieved to the said Agreement and we shall not be relieved from our liability by reasons of any such variation or for any such variation or for any forbearance or omission on the part of the Employer any indulgence by the Employer to the said contractor .

By any such matter or thing whatsoever, which under the law relating to sureties would but for this provision have effect of so relieving us.

This guarantee will not be discharged due to the change in the constitution of the bank or of the Contractor.

We (Name of Bank) FURTHER AGREE THAT WE SHALL NOT REVOKE this guarantee during the currency OF THIS GUARANTEE EXCEPT with the previous consent of the employer/UCO BANK in writing.

Notwithstanding anything contained herein :

- (1) Our liability under this Bank guarantee shall not exceed Rs.....(Rupees.....) only
- (2) This Bank Guarantee shall be valid uptoand
- (3) We are liable to pay the guaranteed amount of any part thereof under this Bank Guarantee only and only if you serve upon a written claim or demand on or before(date of expiry of Guarantee)

Signature and seal of the guarantor.

Name of Bank -----

Address -----

Date -----

ANNEXURE - XIV

On Rs.----/-- Stamp Paper

KNOW all men by these presents that I/We -----(name of the contractor) having its registered office at-----, being the indemnifier do hereby execute indemnity bond in favour of UCO Bank having their Head Office at 10, B.T.M Sarani, Kolkata-700 001 and a Zonal Office amongst other places at ----- Pin-----, on this--- day of-----, 2015.

WHEREAS the UCO Bank has appointed us as civil contractor for their proposed building at ----- and M/s ----- as their Architects/Engineers. In consideration of the Bank having agreed to award the aforesaid contract to us more particularly described and stated in the aforesaid Articles of Agreement dated ----- and the related tender documents, we do hereby agree and undertake that we, being the indemnifier shall, at the time hereinafter save and keep the bank harmless and indemnified including its respective Directors, officers and employees and keep them indemnified from and against

1. Any third party claims, civil or criminal complaints/ liabilities, site mishaps and other accidents or disputes and/or damages occurring or arising out of any mishaps at the site due to faulty work, negligence, faulty construction and/or for violating any law, rules and regulations in force, for the time being while executing civil work by me/us.
2. Any damages, loss or expenses due to/ resulting from any negligence or breach of duty on the part of me/us or any sub-contractor/s if any, servants or agents.
3. Any claim by an employee of mine/ours or of sub-contractors if any, under the Workmen Compensation Act and Employer Liability Act or any other law, rules and regulations in force for the time being and any acts replacing and/or amendments thereof as may be in force at the time and under any law in respect of injuries to persons or property arising out of and in the course of execution of the contract work and/or arising out of and in course of employment of any workmen/employee.
4. Any act or omission of mine/ours or sub-contractors if any, ours/theirs servants or agents which may involve any loss, damage, liability, civil or criminal action.
5. We further agree and undertake that we shall during the contract period, ensure that all permissions, authorizations, consents are obtained from the local and or municipal and/or governmental authorities, as may be required under the applicable laws, regulations, guidelines, notifications, orders framed or issued by any appropriate authorities.
6. If any, additional approval, consent or permission is required by us to execute and perform the contract during the currency of the contract, we shall procure the same and/or comply with the conditions stipulated by the concerned authorities without any delay.
7. Our obligations herein are irrevocable, absolute and unconditional in each case irrespective of the value, genuineness, validity, regularity or enforceability of the aforesaid agreement or the insolvency, bankruptcy, reorganization, dissolution, liquidation or change in ownership of the bank or indemnifier.
8. Our obligation under this bond shall not be affected by any act, omission, matter or thing which would reduce, release us from any of the indemnified obligation under this indemnity or diminish the indemnified obligations in whole or in part, including in law, equity or contract (whether or not known to it, or to the bank).

9. This indemnity shall be governed by and construed in accordance with the laws of India. We irrevocably agree that any legal action or proceedings arising out of or relating to this indemnity may be brought in the Courts, Tribunals at ----- . Final judgment against us in any such action, suit or proceedings shall be conclusive and may be enforced in any other jurisdiction by way of suit on the judgment/decree, a certified copy of which shall be conclusive evidence of the judgment/decree, or in any other manner provided by law. By the execution of this indemnity, we irrevocably submit to the exclusive jurisdiction of such Court/Tribunal in any such action or proceeding.

IN WITNESS WHEREOF ----- has set his/their hands on this ----- day of -----
-----, 2017.

SIGNED AND DELIVERED BY THE
AFORESAID-----

IN THE PRESENCE OF WITNESS

1)

2)

ANNEXURE – XVI

PROFORMA OF REGISTERS TO BE MAINTAINED

TABLE -I
CEMENT REGISTER

Name of work :

Name of Contractor:

Agreement No :

[illegible][illegible]

TABLE –II

STEEL REGISTER

Name of work.....

Name of Contractor.....

Sl no	Source of receipt with reference S.O./indent to	Consumption per measurement vide M.B. No. & page No. Or issues to other works and their T.E Nos.	Mild steel 6mm 8mm 10mm 12mm 15mm	total
1	2	3	4	5

Tor Steel 6mm 8mm 10mm 12 15m	TOTAL	Initial of Site Engineer	Initial of Contractor	Initial of Bank's Engineer/Consul tant
6	7	8	9	10

N. B.: Number of diameters given is only illustrative. Open more columns for other diameters wherever needed.

TABLE – III
PESTICIDE/WATER PROOFING /PAINT/LEAD MATERIALS / BITUMEN REGISTER

Name of work:

Name of contractor:

Dt. Of receipt	Source of with reference S.O./Indent	Quantity Received	Progressi total	Date of issue	Quantity assured	Qty .returned the end of
1	2	3	4	5	6	7

Total issued	Daily Balance in hand.	Where used	Contractor's Initials	Site initials	initial of Bank Engineers/ Consultant	Remarks

TABLE-IV
C. I. RAIN WATER PIPE 100/150 MM DIA. REGISTER

Sl no	As per standard	As per site	Initial of Site Engineer	Initial of contractor	Initial of Banks Engineer/con sultant
	Description of water pipe	Description wt. of pipes Averages			

TABLE – V

H C I PIPE REGISTAR

Sl no	As per standard	As per site	Initial of Site Engineer	Initial of contractor	Initial of Banks Engineer/con sultant
	Description of water pipe	Description wt. of pipes Averages			

TABLE - V**H C I PIPE REGISTAR**

	As per standard actual					
	Nomi nal Bore mm	Thick -ness mm	Over all weight of pipe	Nominal Bore mm	Thick ness mm	Overall wt. of pipe 1.50 av. 1.80 av 2.00 av M wt. m wt. m wt. Long long long
1	2	3	4 5 6	7	8	9 10 11 12 13 14

Initial of Site	Initial of Contractor	Initial of Bank's / Consultant's Representative	Remarks
15	16	17	18

TABIE- VI
BULKAGE TEST OF SAND REGISTER

SI	Date of test	Values of dust sand in Cylinder	Values of Inundated Sand in Cylinder	Percentage of Bulkage	Signature of Site Engineer	Signature of Contractor	Signature of Bank's / Consultant's representative

TABLE – VII

SILT TEST REGISTER

[illegible]

UCO BANK
PROPOSED CONSTRUCTION
OF
RSETI BUILDING
AT
SARAITALI VILLAGE NALBARI ,ASSAM

BILL OF QUANTITIES
FOR
BOUNDARY WALL , GATE & BARBED WIRE FENCING

Sl. No.	Specification of item of works	Unit	Quantities	Rate (in figure)	Rate (in words)	Amount
1	EARTHWORK IN EXCAVATION Earthwork in excavation for foundation trenches of walls, retaining walls, footings of column, steps, septic tank etc. including refilling (return filling) the quantity as necessary after completion of work, breaking clods in return filling, dressing, watering and ramming etc. and removal of surplus earth with all lead and lifts as directed and specified in the following classification of soils including bailing out water where necessary as directed and specified. Up to a depth of 2.00m below the existing ground level. In ordinary soil	Cu.M.	43.00			

Sl. No.	Specification of item of works	Unit	Quantities	Rate (in figure)	Rate (in words)	Amount
2	PLAIN CEMENT CONCRETE WORKS Plain cement concrete works with coarse aggregate of sizes 13mm to 32mm in foundation bed for footing steps, walls, brick works etc. as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). In prop. 1 cement:3 sand : 6 coarse aggregate by volume	Cu.M.	16.00			
3	REINFORCED CEMENT CONCRETE WORKS Providing and laying plain/reinforced cement concrete works cement , coarse sand & 20mm down graded stone aggregate including dewatering if necessary, and curing complete but excluding cost of form work and reinforcement for reinforced cement concrete work (form work and reinforcement will be measured and paid separately) Using mixture machine (a) In sub - structure up to plinth level Foundation, footing, columns with base tie and plinth beam, pile cap, base slab, retaining walls, walls of septic tank, inspection pit and the like and other works not less than 100mm thick up to plinth level. Without using admixture, plasticiser M20 grade concrete or Prop. 1:1.5:3	Cu.M.	6.00			

Sl. No.	Specification of item of works	Unit	Quantities	Rate (in figure)	Rate (in words)	Amount
(b)	In super-structure from plinth level upto 1st floor level. Columns, pillars, posts, struts, suspended floor, roof, landing, shelf and support, balcony, lintel, sill band, beam, girder, bressumer, cantilever, staircase (except spiral staircase and landing) including preparing the top surface and finishing of nosing. Without using admixture, plasticiser M20 grade concrete or Prop. 1:1.5:3	Cu.M.	5.00			
4	TIMBER SHUTTERING (FORMWORK) Providing form work of ordinary timber planking so as to give a rough finish including centering, shuttering, strutting and propping etc., height of propping and centering below supporting floor to ceiling not exceeding 4.0M and removal of the same for in-situ reinforced concrete and plain concrete work in: Sides of tie beams, grade beams etc. at or below ground level. Using 25mm thick plank	Sq.M.	28.00			
	Columns, Pillars, Posts & Strut Square, Rectangular, polygonal in plan or any shape like Tee/L etc. having plane vertical face Using 38mm thick plank	Sq.M.	118.00			
5	MASONRY WORKS Providing soling in foundation and under floor with stone/ best quality picked jhama brick, sand packed and laid to level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete. Brick on flat soling.	Sq.M.	19.00			

Sl. No.	Specification of item of works	Unit	Quantities	Rate (in figure)	Rate (in words)	Amount
6	IN SUPERSTRUCTURE. 1st class brick nogged wall in cement mortar including racking out joints and curing complete as directed in super structure above plinth up to 1st floor level (protruding M.S rod/Tor steel of column to be embedded in cement mortar and will be measured and paid separately) 112mm thick brick wall In cement mortar in proportion 1:4. (1 cement:4 sand)	Sq.M.	248.00			
7	STONE MASONRY WORK Stone masonry work in retaining wall, wing wall, abutment, foundation, steps, plinth etc. in cement mortar in prop 1:6 with levelling course of 1:6:12 with both faces hammer dressed including bonding, providing face stone, through stone and centering including racking of joints, curing and supplying and all carriage of stone as directed including payment of forest royalty and sales tax and carriage. (a) Random Rubble Masonry	Cu.M.	39.50			
8	CEMENT PLASTERING 10 mm thick Cement plaster in single coat on fair side of brick/concrete walls for interior plastering up to 1st floor level including arises or rounded angles not exceeding 80mm girth and finished even and smooth including curing complete as directed. In cement mortar 1:4	Sq.M.	264.00			

Sl. No.	Specification of item of works	Unit	Quantities	Rate (in figure)	Rate (in words)	Amount
9	15 mm thick Cement plaster in single coat on rough side of single or half brick wall for interior plastering up to 1st floor level including arises, internal rounded angles, not exceeding 80mm girth and finished even and smooth including curing complete as directed. On rough side In cement mortar 1:4	Sq.M.	0.00			
10	GRILLS Providing, fitting and fixing M.S. grill of required pattern for windows/ clerestory windows/ openingwith M.S. flats at required spacing in frame all round, square or round M.S. bars with round headed bolts and nuts or screws. Plain grill Fixed to Brickwork/P.C.C/R.C.C.	Kg.	242.00			
11	CEMENT PAINT & PRIMER a) Applying one coat of cement primer of approved brand and manufacture on new wall surface after thoroughly brooming the surfaces free from mortar droppings and other foreign matter and including preparing the surface even and sand papered smooth.	Sq.M.	512.00			

Sl. No.	Specification of item of works	Unit	Quantities	Rate (in figure)	Rate (in words)	Amount
12	PAINTING ON STEEL AND OTHER METAL SURFACE Applying primary coat over new steel and other metal surface over 100m in width or girth after preparing the surface by thoroughly cleaning oil,grease, dirt and other foreign matter and scoured with wire brushes, fine steels, wood scrapers and sand paper. With ready mixed "red-lead/ red oxide" primer.	Sq.M.	35.00			
13	Painting two coats (excluding priming coat) on new steel and other metal surface with enamel paint of approved brand and manufacture(Asian paint/ Berger paint/ ICI paint/ J & N paint/ Nerolac) to give an even shade including cleaning the surface of all dirt, dust and other foreign matter. Surfaces over 100mm in width or girth. High gloss (Asian paint/ Berger paint/ ICI paint/ J & N paint/ Nerolac)	Sq.M.	53.00			
14	Finishing old / new wall with water proofing weather coat smooth anti-fungal exterior painting of approved make of Berger paint of required shade after cleaning and clearing the surface etc. including scaffolding complete as directed at all levels (two coats)	Sq.M.	512.00			

Sl. No.	Specification of item of works	Unit	Quantities	Rate (in figure)	Rate (in words)	Amount
15	Supplying , fitting and fixing galvanised barbed wire fencing with seven strands of barbed wire 12 S. W. G .x 2plies x 4 points at 75mm apart with angle iron intermediate fencing posts not more than 1800mm apart and straining and end post etc. as necessary to be fitted with straining eye bolts and staples etc.complete as directed, specification of the angle iron post as given below. a) Intermediate post 35mm x35mm x5mm x1800mm long bottom torched and duly slotted. b) Straining post 65mm x 65mm x 6mm x 1820mm long with 2 stays of 35mmx35mmx1520mm long and 3 base plates 200mm x 200mm x 5mm, duly slotted to take eye bolts etc. c) Corner posts 65mm x 65mm x 6mm x1820mm long with 2 stays of 35mm x 35mm x 5mm x 1 670 mm and 3 base plates 200mm x 200mm x 5mm,duly slotted to take eye bolts etc. d) Straining or end posts 65mmx 65mm x 6mmx 1820mm long with 1 stays of 35mm x 35mm x 5mmx 1820 mm long with base plates 200mmx 200mm x 5mm, duly slotted to take eye bolts etc. (All the angle iron posts to be embeded 600mm in C.C.pillars of size 300mmx300mmx600mm in prop.1: 3: 6 and one coat of anticorrosive ready mixed painting to all iron works) including excavation of foundation trenches for C.C. blocks and refilling and removal of surplus soil after completion of works.	M.	212.50			

Sl. No.	Specification of item of works	Unit	Quantities	Rate (in figure)	Rate (in words)	Amount
16	Supplying, fitting and fixing double leaf heavy duty iron gate, frame made from 40mm x 40mm x 6mm M.S. angle and with M.S. flat of 40mm x 6mm size as per approved design.Necessary locking arrangement for temporary closing the gate and 2nos.(minimum) strong iron hinges of M.S bars and flat of same sizes on each leaf to be embedded in C.C brick pillars as necessary including a red oxide painting to all iron works as directed and specified.(Separate payment will be made for posts).	Sq.M.	8.25			
17	STEEL & IRON WORKS REINFORCEMENT Supplying, fitting and fixing in position reinforcement bars conforming to relevant I.S. Code for R.C.C. work/ R.B. walling including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (No extra measurement for lap, hook, chair, anchor etc. will be entertained in the measurement as they are included in the rate) (Upto 1st floor level) From Primary Producer: TATA/SAIL/Essex Steel/ Jindal steel/Shyam steel/RINL Super Ductile (SD) TMT reinforcement bars	Qtl.	16.00			

=Rs.

Date:

Signature of the Contractor:

UCO BANK
PROPOSED CONSTRUCTION
OF
RSETI BUILDING
AT
SARAITALI VILLAGE NALBARI , ASSAM

BILL OF QUANTITIES
PART - A (CIVIL WORKS)

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
1	RAISING LOW SITE Raising low site around the building with approved soil obtained from outside by truck carriage including breaking clods,dressing etc. complete including paying necessary forest royelty, sales tax, land compensation, municipal gate fees, if any monopoly duty etc.(profile measurement to be taken and 12.5% deduction for shrinkage to be made from total quantity) etc complete as directed and specified. Other than Guwahati city	Cu.M.	953.96			
2	EARTHWORK IN EXCAVATION Earthwork in excavation for foundation trenches of walls, retaining walls, footings of column, steps, septic tank etc. including refilling (return filling) the quantity as necessary after completion of work, breaking clods in return filling, dressing, watering and ramming etc. and removal of surplus earth with all lead and lifts as directed and specified in the following classification of soils including bailing out water where necessary as directed and specified. Up to a depth of 2.00m below the existing ground level. In ordinary soil	Cu.M.	594.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
	Extra over sl no 1 above for each 1m depth or part thereof beyond the initial depth of 2m	Cu.M.	43.00			
3	Earth/ sand filling in plinth in layers not more than 150mm thick including necessary carriage, watering, ramming etc. complete as directed and specified including payment of land compensation, forest royalty, sales tax and other duties and taxes as may be necessary. With river sand or silt (predominantly non plastic) by truck carriage including loading and unloading.	Cu.M.	143.50			
4	PLAIN CEMENT CONCRETE WORKS Plain cement concrete works with coarse aggregate of sizes 13mm to 32mm in foundation bed for footing steps, walls, brick works etc. as directed and specified including dewatering if necessary, and curing complete (shuttering where necessary shall be measured and paid separately). In prop. 1 cement:3 sand : 6 coarse aggregate by volume	Cu.M.	3.00			
	In prop. 1 cement:4 sand : 8 coarse aggregate by volume	Cu.M.	15.50			
5	Plain cement concrete floor base in prop1:3:6 laid in alternate bays as specified with coarse agg. of size 13mm to 32mm including dewatering if necessary, and curing etc. complete.	Sq.M.	400.00			
(i)	. 50 mm thick					

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
6	Providing and laying 25mm thick damp proof course with cement concrete in prop 1:1.5:3 with graded stone agg. of 10mm down nominal size including providing approved damp proof admixture in proportion as recommended by the manufacturer including curing etc. complete as directed.	Sq.M.	17.00			
7	REINFORCED CEMENT CONCRETE WORKS Providing and laying plain/reinforced cement concrete works cement , coarse sand & 20mm down graded stone aggregate including dewatering if necessary, and curing complete but excluding cost of form work and reinforcement for reinforced cement concrete work (form work and reinforcement will be measured and paid separately) Using mixture machine In sub - structure up to plinth level Foundation, footing, columns with base tie and plinth beam, pile cap, base slab, retaining walls, walls of septic tank, inspection pit and the like and other works not less than 100mm thick up to plinth level. Without using admixture, plasticiser M15 grade concrete or Prop. 1:2:4	Cu.M.	1.00			
	M20 grade concrete or Prop. 1:1.5:3	Cu.M.	132.00			
	In super-structure from plinth level upto 1st floor level. Walls (thickness not less than 100mm) including attached pillasters, buttresses, plinth and string course etc. Without using admixture, plasticiser M20 grade concrete or Prop. 1:1.5:3	Cu.M.	5.40			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
	Columns, pillars, posts, struts, suspended floor, roof, landing, shelf and support, balcony, lintel, sill band, beam, girder, bressumer, cantilever, staircase (except spiral staircase and landing) including preparing the top surface and finishing of nosing. Without using admixture, plasticiser M20 grade concrete or Prop. 1:1.5:3	Cu.M.	123.00			
	From 1st floor level to 2nd floor level. Walls (thickness not less than 100mm) including attached pillasters, buttresses, plinth and string course etc. Without using admixture, plasticiser M20 grade concrete or Prop. 1:1.5:3	Cu.M.	5.40			
	Columns, pillars, posts, struts, suspended floor, roof, landing, shelf and support, balcony, lintel, sill band, beam, girder, bressumer, cantilever, staircase (except spiral staircase and landing) including preparing the top surface and finishing of nosing. Without using admixture, plasticiser M20 grade concrete or Prop. 1:1.5:3	Cu.M.	106.50			
	From 2nd floor level to 3rd floor level. Columns, pillars, posts, struts, suspended floor, roof, landing, shelf and support, balcony, lintel, sill band, beam, girder, bressumer, cantilever, staircase (except spiral staircase and landing) including preparing the top surface and finishing of nosing. Without using admixture, plasticiser M20 grade concrete or Prop. 1:1.5:3	Cu.M.	7.20			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
8	TIMBER SHUTTERING (FORMWORK) Providing form work of ordinary timber planking so as to give a rough finish including centering, shuttering, strutting and propping etc., height of propping and centering below supporting floor to ceiling not exceeding 4.0M and removal of the same for in-situ reinforced concrete and plain concrete work in: Foundation, footings, bases of columns, pile cap, raft and mass concrete works etc. Using 25mm thick plank	Sq.M.	90.50			
	Sides of tie beams, grade beams etc. at or below ground level. Using 25mm thick plank	Sq.M.	448.00			
	Staircase with sloping or stepped soffits including risers and stringers but excluding Landing. (Using 38mm thick plank)	Sq.M.	30.00			
	From 1st floor level to 2nd floor level. Staircase with sloping or stepped soffits including risers and stringers but excluding Landing. (Using 38mm thick plank)	Sq.M.	30.00			
	STEEL SHUTTERING : Providing formwork using 2mm pressed bend shuttering plate of mild sheet and tubular telescopic steel props including centering, shuttering, strutting and propping etc. complete and removal of the same for in situ reinforced concrete and plain concrete work in: Columns, Pillars, Posts & Strut of square/ rectangular/ polygonal in plan or any shape like Tee/L etc. having plane vertical face	Sq.M.	300.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
	Sides and Soffits of Beams, beam haunchings, cantilever girders and bressumers.	Sq.M.	419.00			
	Flat Surfaces such as soffits of suspended floors, roofs, landings and the like.	Sq.M.	525.00			
	Vertical surface such as walls (any thickness), Lift shafts, partitions and the like including attached pilasters, buttresses, plinth and string courses and the like.	Sq.M.	124.00			
	From 1st floor level to 2nd floor level. Columns, Pillars, Posts & Strut of square/ rectangular/ polygonal in plan or any shape like Tee/L etc. having plane vertical face	Sq.M.	126.00			
	Sides and Soffits of Beams, beam haunchings, cantilever girders and bressumers.	Sq.M.	333.00			
	Flat Surfaces such as soffits of suspended floors, roofs, landings and the like.	Sq.M.	477.00			
	Vertical surface such as walls (any thickness), Lift shafts, partitions and the like including attached pilasters, buttresses, plinth and string courses and the like.	Sq.M.	117.00			
	From 2nd floor level to 3rd floor level. Columns, Pillars, Posts & Strut of square/ rectangular/ polygonal in plan or any shape like Tee/L etc. having plane vertical face	Sq.M.	30.00			
	Sides and Soffits of Beams, beam haunchings, cantilever girders and bressumers.	Sq.M.	47.60			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
9	MASONRY WORKS Providing soling in foundation and under floor with stone/ best quality picked jhama brick, sand packed and laid to level and in panel after preparing the subgrade as directed including all labour and materials and if necessary dewatering, complete. Brick on flat soling.	Sq.M.	791.50			
10	IN SUB-STRUCTURE. Brick work in cement mortar with 1st class brick including racking out joints and dewatering if necessary, and curing complete as directed In Sub-structure up to plinth level. In proportion 1:4.	Cu.M.	59.00			
11	IN SUPERSTRUCTURE. 1st class brick nogged wall in cement mortar including racking out joints and curing complete as directed in super structure above plinth up to 1st floor level (protruding M.S rod/Tor steel of column to be embeded in cement mortar and will be measured and paid separately) 112mm thick brick wall In cement mortar in proportion 1:4. (1 cement:4 sand)	Sq.M.	672.00			
	From 1st floor level to 2nd floor level. 112mm thick brick wall In cement mortar in proportion 1:4. (1 cement:4 sand)	Sq.M.	515.00			
	From 2nd floor level to 3rd floor level. 112mm thick brick wall In cement mortar in proportion 1:4. (1 cement:4 sand)	Sq.M.	107.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
12	CEMENT CONCRETE FLOORING 40 mm thick cement concrete floor consisting of 25 mm under layer of cement concrete in prop. 1:3:6 (1cement : 3 coarse sand : 6 coarse aggregate of 12.5 mm and down) and 15 mm thick wearing layer in cement concrete in prop. 1:1:2 (1cement :1 coarse sand : 2 coarse aggregate of size 10mm down) finished with a floating coat of neat cement finish using cement slurry for bond @ 2.75 kg. per square metre of floor area , wearing layer is to be laid in panels including curing etc. complete as directed.	Sq.M.	587.00			
13	Cement plaster skirting with cement mortar in prop. 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement including rounding of junctions with floor.	Sq.M.	64.10			
14	TILES WORKS CERAMIC TILES ON FLOOR Providing Ceramic Tiles of approved quality, size, shape and thickness not less than 8 mm on floors, skirtings, treads and risers of steps over cement mortar bed 15 mm thick in prop. 1:3 (1 cement : 3 coarse sand) including cutting where necessary finished with flush pointing with Fix-A-Tile Choksey /Sika/Pedelite /Rouf) /white cement slurry mixed with approved pigment to match the shade of granite slab, complete at all levels as specified and directed. (Coloured pigment should be in conformity with colour of slab and as approved and directed by the Department). Normal range (Somany/ Orient/ Nitco /Asian Make) Of size 300mmx 300mm and above	Sq.M.	110.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
15	A) ON WALLS Providing polished ceramic wall Tiles of approved quality, size, shape and thickness not less than 8mm on walls and skirtings over cement mortar bed 10 mm thick in prop. 1:3 (1 cement : 3 coarse sand) including cutting where necessary finished with flush pointing with Fix-A-Tile (Choksey / Sika / Pedelite / Rouf) /white cement slurry mixed with approved pigment to match shade of tiles complete at all levels as specified and directed. (Coloured pigment should be in conformity with colour of tiles and as approved and directed by the Department). (Walls means both interior and exterior walls). Normal range Somany/ Orient/ Nitco /Asian Make Of size 200mmx 300mm and above	Sq.M.	180.00			
16	VITRIFIED TILES ON FLOOR Providing VITRIFIED floor tiles of approved quality of specified size, shape and thickness not less than 18mm on floors, skirtings, risers and treads of steps over 15 mm thick base of cement mortar in prop. 1:3 (1 cement : 3 coarse sand) including cutting where necessary finished with flush pointing with Fix-A-Tile (Choksey/Sika/Pedelite/Rouf) / white cement slurry mixed with approved pigment to match shade of tiles, mixed with approved pigment to match the shade of the tiles, complete at all levels as specified and directed. (Coloured pigment should be in conformity with colour of tiles and as approved and directed by the Department) Normal range Somany/ Orient /Nitco /Varmora/ VITA/ Marbito/ Make Of size 600mmx 600mm and above	Sq.M.	61.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
17	KOTA STONE SLAB / SAND STONE FLOORING Kota-stone slab flooring of 18 mm thick over 20mm thick base of cement plaster 1:6 (1 cement : 6 coarse sand) laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing and polishing complete. 600mm x 900 mm and above	Sq.M.	61.00			
18	Kota stone slab of 18 mm thick in riser of steps, skirting, dado and pillars laid with 10mm thick cement plaster 1:3 (1 cement : 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs including rubbing and polishing complete. 600mm x 900 mm and above	Sq.M.	16.00			
19	CEMENT PLASTERING 10 mm thick Cement plaster in single coat on fair side of brick/concrete walls for interior plastering up to 1st floor level including arises or rounded angles not exceeding 80mm girth and finished even and smooth including curing complete as directed. In cement mortar 1:4	Sq.M.	3809.00			
20	15 mm thick Cement plaster in single coat on rough side of single or half brick wall for interior plastering up to 1st floor level including arises, internal rounded angles, not exceeding 80mm girth and finished even and smooth including curing complete as directed. On rough side In cement mortar 1:4	Sq.M.	1294.00			
21	Neat Cement Punning	Sq.M.	66.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
22	ROOFING Providing corrugated galvenised Iron sheet roofing of TATA SHAKTEE / SAIL including fitting and fixing necessary galvenised J or L hooks, bolts and nuts 8 mm dia with bitumen washer 25 mm dia x 3 mm thick and 1.6 mm thick limpet washer complete excluding cost of roof truss, purlin etc. (Roof trusses and purlin etc.to be measured and paid separately). 0.50 mm thick	Sq.M.	30.00			
23	BLOCK BOARD SHUTTERS Providing and fixing flush door shutters solid core construction with frame of 1st class hard wood with cross band and face veneered ply wood face panels conforming to relevent I.S code including oxidised iron butt hinges (100mm x 75mm x 3.5mm) 6 nos with necessary wood screws. Non decorative type and block board core. 35 mm thick .	Sq.M.	60.00			
24	GRILL Providing and fixing M.S grill of required pattern for windows/clerestory windows / opening with M.S. flats at required spacing in frame all round, squar or round M.S. bars with round headed bolts and nuts or screws. Plain grill Fixed to brickwork/P.C.C/R.C.C	kg	156.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
	ALUMINIUM DOORS, WINDOWS AND OTHER WORKS					
25	DOORS Providing, fitting and fixing anodised aluminium framed glazed doors with anodised aluminium frame made of 100mm x 45mm x 2.5mm section of approved brand with door style of size 88mm x 45mm x 2.5mm, top rails 50mm x 45mm x 2mm lock rails 100mm x 45mm x 2mm and bottom rails 100mm x 45mm x 2.5mm fitted with glazing clip, special type rubber gasket complete including hydraulic floor spring, pivot, tower bolt in each leaf, aluminium door handle, lock, angles, cleat etc complete as specified and directed by the department at all levels. 5 mm clear glass	Sq.M.	6.25			
26	P.V.C. DOORS & DOOR FRAMES Providing, fitting and fixing 40mm x 48mm wood reinforced PVC chowkhats fixed to the columns/stiffeners /walls with necessary holdfast/sleeves etc. as specified and directed at all levels.	RM	120.00			
27	Providing, fitting and fixing 24mm/ 29mm thick polymer reinforced moulded PVC door shutters fixed to the chowkath with necessary hinges, screws, bolts etc. as specified and directed at all levels (Door fixtures and fittings to be measured and paid seperately) 29mm thick	Sq.M.	41.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
28	DISTEMPERING c) Applying one coat of distemper primer of approved brand and manufacture on wall surface after thoroughly brushing the surfaces free from mortar droppings and other foreign matter and including preparing the surface even and sand papered smooth..	Sq.M.	2441.50			
29	Distemping with dry distemper of approved brand and manufacture (twocoats) and of required shade on new wall surface to give an even shade,after thoroughly brushing the surface free from mortar dropings and other foreign matter and including preparing surface even and sand papered smooth.	Sq.M.	2441.50			
30	CEMENT PAINT & PRIMER Applying one coat of cement primer of approved brand and manufacture on new wall surface after thoroughly brooming the surfaces free from mortar droppings and other foreign matter and including preparing the surface even and sand papered smooth.	Sq.M.	1367.50			
31	PAINTING ON WOOD AND WOOD WOOD BASED SURFACES Applying priming coat over new wood and wood based surfaces over 100mm in girth/width after and including preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter , sand papering and knotting. With ready mixed paint , wood primer (white).	Sq.M.	120.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
32	Painting two coats (excluding priming coat) on new wood and wood based surface with enamel paint of approved brand and manufacture (Asian paint/ Berger paint/ ICI paint/ J & N paint/ Nerolac) to give an even shade including cleaning the surfaces of all dirt, dust and other foreign matter sand papering and stopping. Surfaces over 100mm in width or girth. High gloss (Asian paint/ Berger paint/ ICI paint/ J & N paint/ Nerolac).	Sq.M.	120.00			
33	PAINTING ON STEEL AND OTHER METAL SURFACE Applying primary coat over new steel and other metal surface over 100m in width or girth after preparing the surface by thoroughly cleaning oil,grease, dirt and other foreign matter and scoured with wire brushes, fine steels, wood scrapers and sand paper. With ready mixed "red-lead/ red oxide" primer.	Sq.M.	26.00			
34	Painting two coats (excluding priming coat) on new steel and other metal surface with enamel paint of approved brand and manufacture(Asian paint/ Berger paint/ ICI paint/ J & N paint/ Nerolac) to give an even shade including cleaning the surface of all dirt, dust and other foreign matter. Surfaces over 100mm in width or girth. High gloss (Asian paint/ Berger paint/ ICI paint/ J & N paint/ Nerolac)	Sq.M.	342.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
35	EXTERIOR PAINTS / COATINGS Finishing wall with two coats of waterproofing cement coatings of Unicem "Shakti" brand of required shade by thinning 1 part of paint with 1 part of water to give an even shade after thoroughly brooming the surfaces to remove all dirt and remains of loose powdered materials as specified and directed by the department.	Sq.M.	1367.50			
36	ALUMINIUM FITTINGS Supplying, fitting, fixing anodised aluminium fittings of approved make, resonably smooth, free from sharp edges and corners, flaws and other defects and with counter sunk holes for screws including necessary aluminium screws etc. complete.(anodised to bright natural matt & satin finished)					
(a)	Sliding door bolts 300mm x 16mm	Each	23			
(b)	Tower bolts 250mm x 12mm	Each	66			
(c)	Door handles 150mm	Each	74			
(d)	Hydraulic door closure	Each	14			
(e)	Door stopper with rubber stopper	Each	36			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
37	STEEL & IRON WORKS REINFORCEMENT Supplying, fitting and fixing in position reinforcement bars conforming to relevant I.S. Code for R.C.C. work/ R.B. walling including straightening, cleaning, cutting and bending to proper shapes and length as per details, supplying and binding with 20G annealed black wire and placing in position with proper blocks, supports, chairs, spacers etc. complete. (No extra measurement for lap, hook, chair, anchor etc. will be entertained in the measurement as they are included in the rate) (Upto 1st floor level) From Primary Producer: TATA/ SAIL/ Esser Steel/ Jindal steel / Shyam steel/RINL (a) Super Ductile (SD) TMT reinforcement bars	Qtl.	384.00			
(b)	From 1st floor level to 2nd floor level.	Qtl.	157.00			
(c)	From 2nd floor level to 3rd floor level.	Qtl.	10.60			
38	ROOF TRUSS Providing fitting, hoisting and fixing of roof trusses including purlins fabricated using MS circular hollow section conforming to relevant I.S. code, as per approved design and drawings including providing M.S. cleats, base plates, bolts and nuts and one coat of red oxide Zinc Chromate primer and two coats of approved enamel paints complete including fitting necessary cleats etc. for fixing ceiling joists as per design and drawing as directed. Using other ISI marked approved circular hollow section	Qtl	4.00			

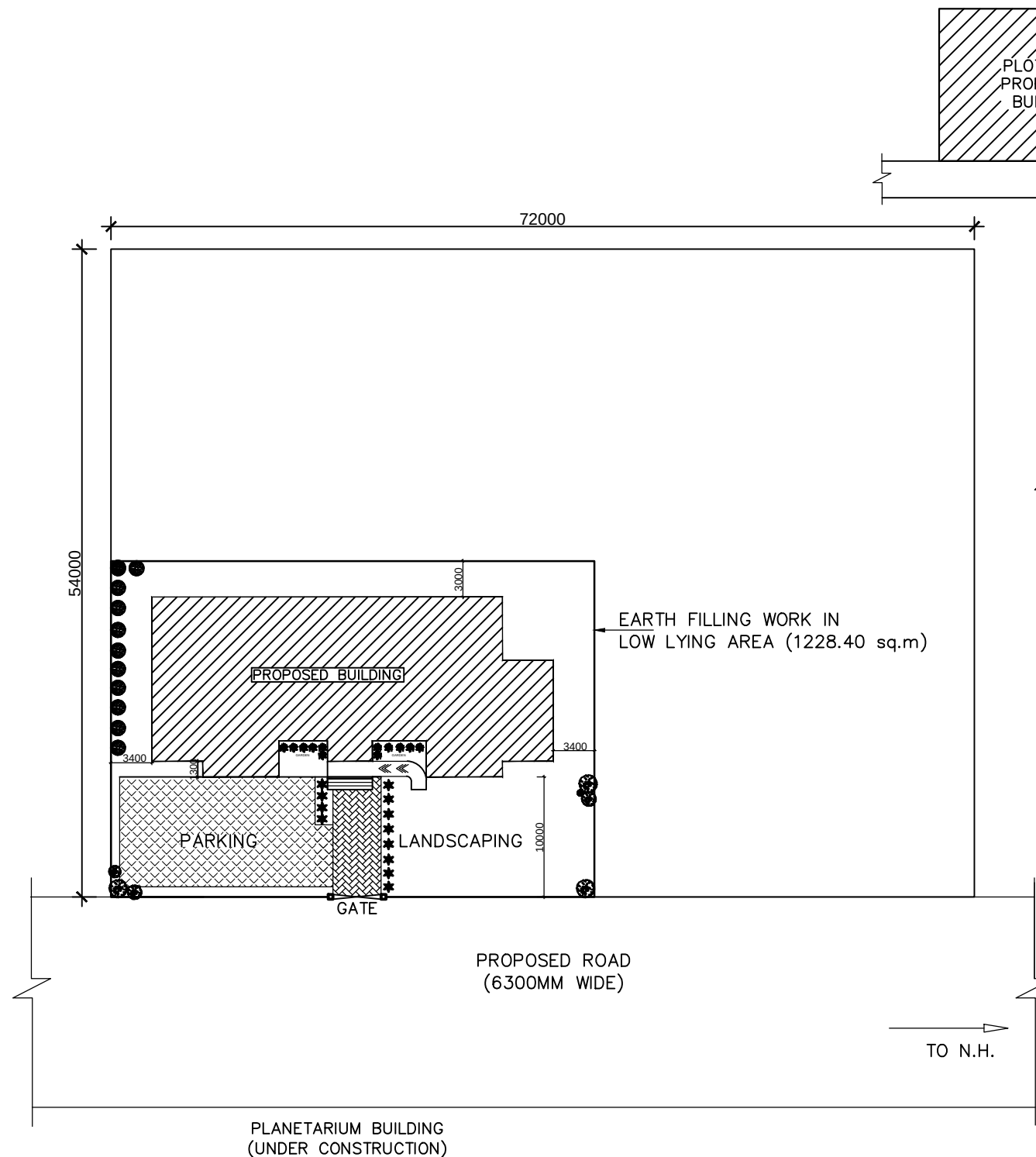
Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
39	COLLAPSIBLE / ROLLING SHUTTERS Providing and fixing in position collapsible M.S. shutters with vertical channels 20mmx10mmx2mm braced with flat iron diagonals 20mmx5mm size with top and bottom rails of T-iron 40mmx40mmx6mm with 38mm dia steel pulleys complete with bolts and nuts, locking arrangements, stoppers, handles including applying a priming coat of red lead paint.	Sq.m.	3.50			
40	WINDOWS / VENTILATORS Providing , fitting and fixing steel windows of standard rolled steel sections as per relevant I.S. Code, joints mitred and welded with 15mmx13mmx100mm lugs embedded in cement concrete block of M-10 grade including providing and fixing of projecting hinges (not more than 65mm and not less than 15mm wide) bolting device , steel handles , pegs, stays of 300mm long etc. complete including providing 12mmx12mm sq. bars duly welded to steel frame at not more than 12cm c/c applying a priming coat of red-lead paint etc. complete as per drawing. a) Openable	Sq.m	160.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
41	DOOR FRAMES Supplying, fitting and fixing door frame made of M.S equal angle of size 40mmx40mmx5mm fabricated,welded, mitred and joined as per relevant I.S Codes including fitting 8nos. Of M.S. hold fast, providing closing/ holding device for 2 nos. tower bolts of door for each side and 1 no. for fitting and fixing Aldrop (for single leaf) to the frame for fixing the door to the frame, applying primer to all steel surface fixing the frame to the wall/ R.C.C members by embedding the hold fast securely in C.C. block of M-15 grade complete at all levels as specified and directed.(Door hinges to be paid as per relevant item of the schedule of rates)	RM	125.50			
42	Providing and fixing M.S. Tube hand rail of approved size by welding etc. to steel ladder railing, balcony railing, staircase railing and similar works , including applying priming coat of approved steel primer complete as specified and directed by department	Kg.	144.00			
43	PLINTH PROTECTION WORKS AND DRAINS Providing plinth protection 50mm thick to cement concrete 1 : 3 : 6 with coarse agg.of 20mm nominal size including finishing the surface with 10mm thick cement plaster in proportion 1:3 with a floting coat of neat cement finished.	Sq.M.	90.00			

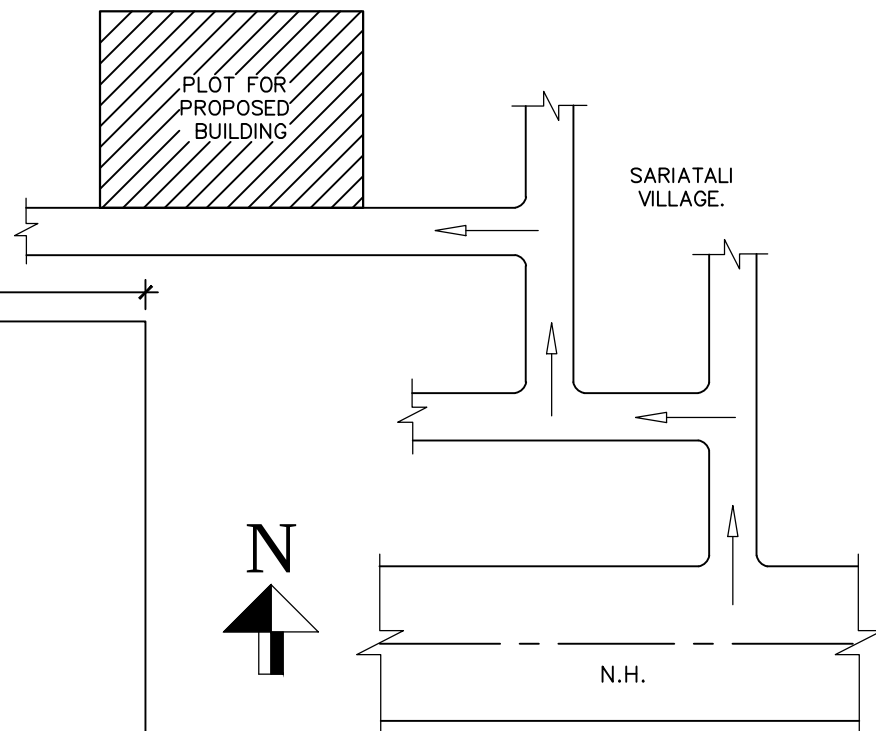
Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
44	Providing drain with cement concrete (1:3:6) 10cm thick sides 10cm thick bed over brick flat soling including 15mm thick cement plastering in prop. 1:3 finished with a floating coat of cement slurry as directed with necessary shuttering for sides and earth work in excavation of foundation trenches and refilling the sides after completion of work etc. as specified. 300mm wide and average 150mm deep with bed slope 1 in 150 with initial depth of 100mm.	R.M.	120.00			
45	PRE CONSTRUCTION ANTI - TERMITE TREATMENT Pre construction anti - termite treatment by applying in the entire levelled area after plinth filling and before laying floor by applying the emulsion @ 5 (five) litres per square meter of the surface to be spread with light rodding so as to ensure proper absorption by the filled up earth (supplying of necessary tools and accessories by the contractor) as per the direction of the Department complete. with aqueous emulsion having concentration 1:19 with chloropirophose solution (trichel or euivalent) and water, i.e. 1% solution.	Sq.M.	444.00			
Total				=Rs.		

Date:

Signature of the Contractor:



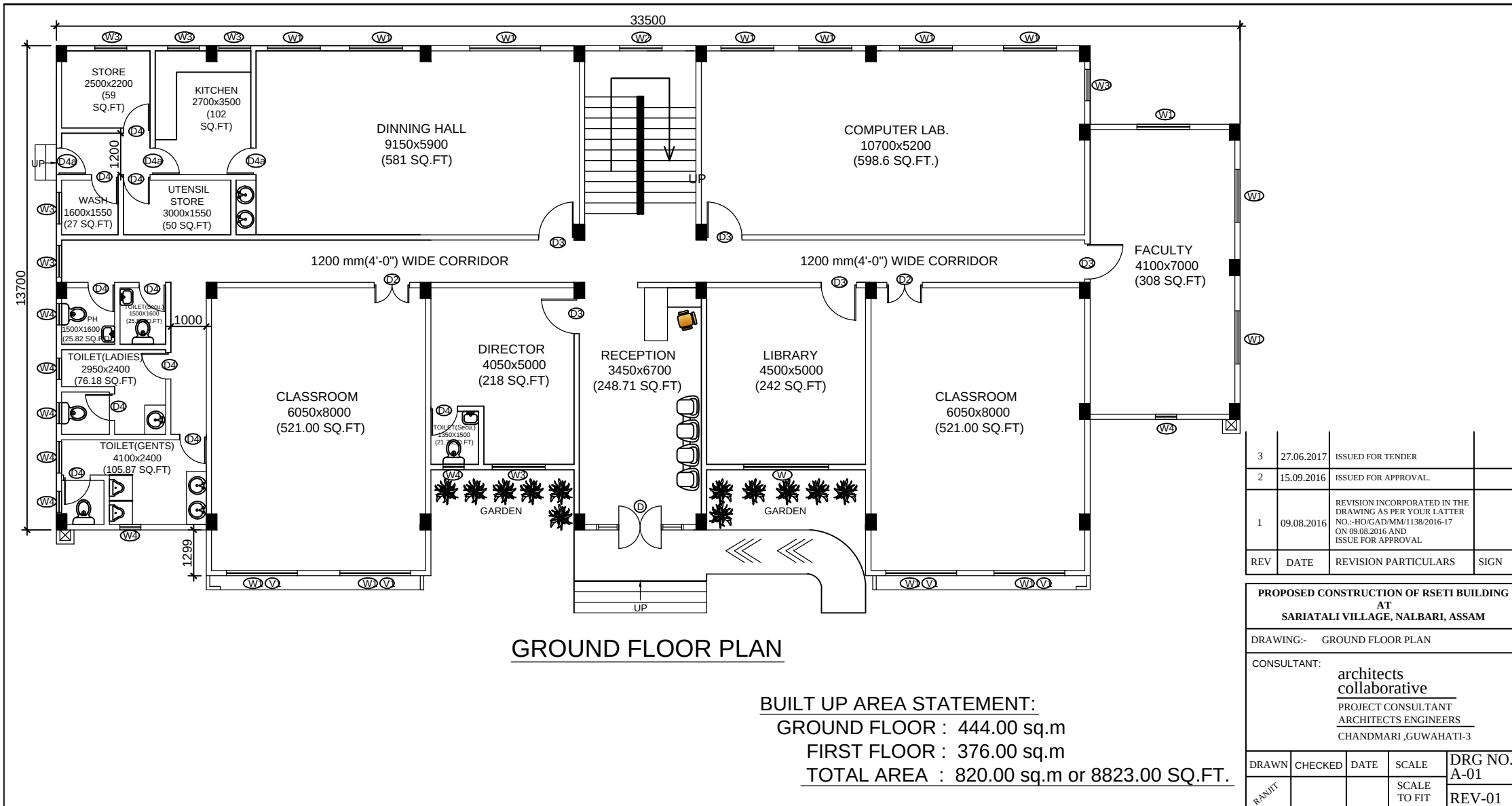
SITE PLAN

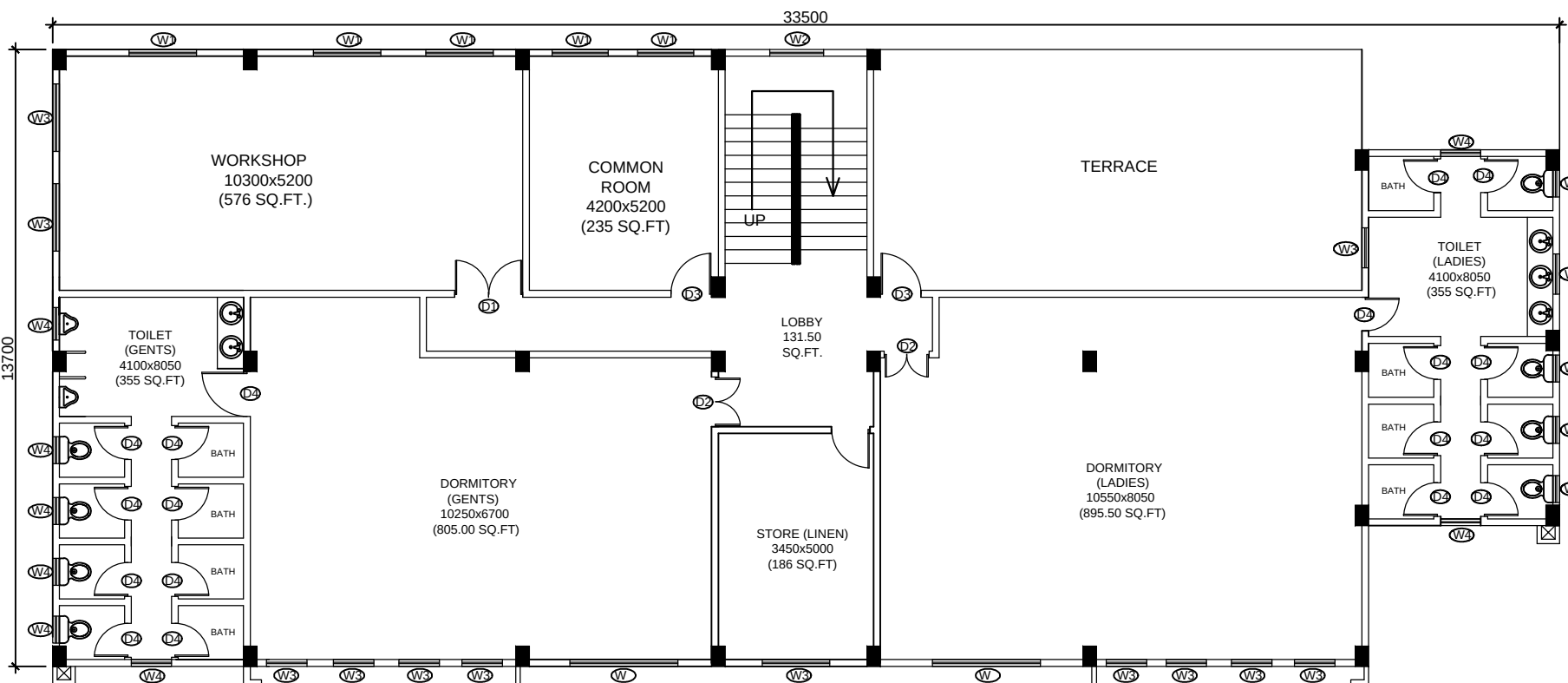


LOCATION PLAN
SCALE-1: 25

01	28.07.2016	REVISION INCORPORATED IN THE DRAWING AS PER YOUR LATTER NO.: -HO/GAD/MM/882/2016-17 ON 15.07.2016 AND ISSUE FOR APPROVAL	
REV	DATE	REVISION PARTICULARS	SIGN

PROPOSED CONSTRUCTION OF RSETI BUILDING AT SARIATALI VILLAGE, NALBARI, ASSAM				
DRAWING:- SITE PLAN & LOCATION PLAN				
CONSULTANT: architects collaborative PROJECT CONSULTANT ARCHITECTS ENGINEERS CHANDMARI, GUWAHATI-3				
DRAWN	CHECKED	DATE	SCALE	DRG NO. SP-01
Bidisha			TO FIT SCALE	REV-01





FIRST FLOOR PLAN

3	27.06.2017	ISSUED FOR TENDER		
2	15.09.2016	ISSUED FOR APPROVAL.		
1	09.08.2016	REVISION INCORPORATED IN THE DRAWING AS PER YOUR LATTER NO.:HO/GAD/MM/1138/2016-17 ON 09.08.2016 AND ISSUE FOR APPROVAL		
REV	DATE	REVISION PARTICULARS	SIGN	
PROPOSED CONSTRUCTION OF RSETI BUILDING AT SARIATALI VILLAGE, NALBARI, ASSAM				
DRAWING:- FIRST FLOOR PLAN				
CONSULTANT: architects collaborative PROJECT CONSULTANT ARCHITECTS ENGINEERS CHANDMARI ,GUWAHATI-3				
DRAWN	CHECKED	DATE	SCALE	DRG NO. A-02
RAMIT			SCALE TO FIT	
				REV-01



ELEVATION
SCALE=1:100

3	27.06.2017	ISSUED FOR TENDER	
2	15.09.2016	ISSUED FOR APPROVAL	
1	09.08.2016	REVISION INCORPORATED IN THE DRAWING AS PER YOUR LATTER NO.:HO/GAD/MM/1138/2016-17 ON 09.08.2016 AND ISSUE FOR APPROVAL	
REV	DATE	REVISION PARTICULARS	SIGN

PROPOSED CONSTRUCTION OF RSETI BUILDING
AT
SARIATALI VILLAGE, NALBARI, ASSAM

DRAWING:- ELEVATION

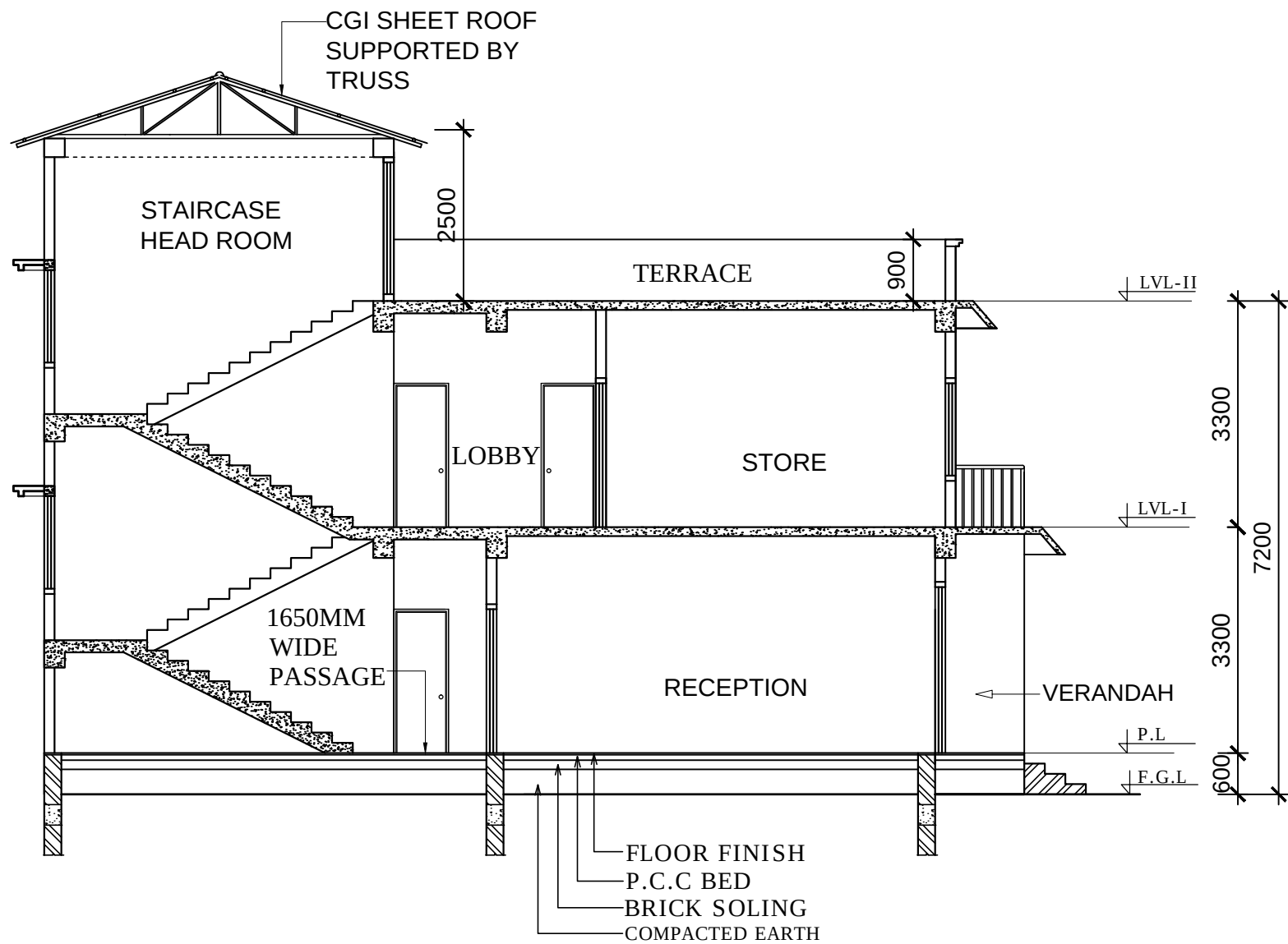
CONSULTANT:

architects
collaborative

PROJECT CONSULTANT
ARCHITECTS ENGINEERS

CHANDMARI ,GUWAHATI-3

DRAWN	CHECKED	DATE	SCALE	DRG NO. A-02
RAN/IT			SCALE TO FIT	REV-01



SECTION: A-A
SCALE=1:100

3	27.06.2017	ISSUED FOR TENDER	
2	15.09.2016	ISSUED FOR APPROVAL	
1	09.08.2016	REVISION INCORPORATED IN THE DRAWING AS PER YOUR LATTER NO.: -HO/GAD/MM/1138/2016-17 ON 09.08.2016 AND ISSUE FOR APPROVAL	
REV	DATE	REVISION PARTICULARS	SIGN

**PROPOSED CONSTRUCTION OF RSETI BUILDING
AT
SARIATALI VILLAGE, NALBARI, ASSAM**

DRAWING:- SECTION

CONSULTANT:

**architects
collaborative**
PROJECT CONSULTANT
ARCHITECTS ENGINEERS
CHANDMARI, GUWAHATI-3

DRAWN	CHECKED	DATE	SCALE	DRG NO.
RANIT			SCALE TO FIT	A-02
				REV-01

UCO BANK
PROPOSED CONSTRUCTION
OF
RSETI BUILDING
AT
SARAITALI VILLAGE NALBARI , ASSAM

BILL OF QUANTITIES

INTERNAL AND EXTERNAL ELECTRICAL WORKS

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
1.	Wiring in surface/ recessed PVC conduit FR (Finolex /RR Kabel /Nicco / Anchor or Equivalent Make as approved by the Deptt.) cable Wiring for light/fan/call bell point with 2x1.5 sq. mm. P.V.C. insulated single core unsheathed industrial (Multistrand) cable FR conforming to IS-694: 1990 with flexible bright annealed electrolytic copper conductor for voltage grade up to 1100 volts (Finolex /RR Kabel /Nicco / Anchor or Equivalent Make as approved by the Deptt.) in surface/ recessed conduit wiring system with 20mm dia 2mm thick / heavy rigid PVC IS: 9537 Part III conduit (Berlia/ AKG / Precision/ Presto Plast/Polycab/ MW or equivalent make as approved by the Deptt.) including 6 Amp flush type switch/ bell push (Anchor penta /Gold medal /Kolor kany.Kom/Havells or equivalent make as approved by the Deptt.) GI/ MS switch board (ISI marked) with phenolic laminated sheet cover ,ceiling rose (Anchor penta /Gold medal /Kolor kany.Kom/Havells or equivalent make as approved by the Deptt.) etc. complete					
	Short point upto 3.0 meter length	Per Point	57			
	Medium point upto 6.0 meter length	Per Point	69			
	Long point upto 10.0 meter length	Per Point	40			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
2.	Wiring to 5 a pin 6 Amps plug point with 1.5 sq. mm P.V.C. insulated single core unsheathed industrial (Multistrand) cable FR conforming to IS-694: 1990 with flexible bright annealed electrolytic copper conductor for voltage grade up to 1100 volts (Finolex /RR Kabel /Nicco / Anchor or Equivalent Make as approved by the Deptt.) in surface/ recessed 2 mm thick/ heavy rigid ISI marked IS: 9537 PART - III rigid PVC conduit (Berlia/ AKG / Precision/ Presto Plast/Polycab/ MW or equivalent make as approved by the Deptt.) wiring system including 5 pin 6 Amps flush type plug socket and 6 Amps F/T switch (Anchor penta /Gold medal /Kolor kany.Kom/Havells or equivalent make as approved by the Deptt.), GI/ MS switch board (I.S.I. mark with phenolic laminated sheet cover including earth continuity with 1.5 sq. mm. cable to third pin of the plug socket etc. as required complete, when placed elsewhere.					
	Medium point upto 6.00 metre length	Per Point	5			
	Long point upto 10.0 meter length	Per Point	8			
3.	Wiring for 5 pin 6 amp plug with 1.5 sq mm P.V.C. insulated single core unsheathed industrial (Multistrand) cable FR conforming to IS-694: 1990 with flexible bright annealed electrolytic copper conductor for voltage grade up to 1100 volts (Finolex /RR Kabel /Nicco / Anchor or Equivalent Make as approved by the Deptt.) including 5 pin 6 amp socket outlet (Anchor penta /Gold medal /Kolor kany.Kom/Havells or equivalent make as approved by the Deptt.)make) and 6 amp flush type switch (Anchor penta /Gold medal /Kolor kany.Kom/Havells or equivalent make as approved by the Deptt.)make) earthing the 3rd pin of the socket as required on the switch board in surface/ recessed P.V.C. conduit wiring system. When fitted on same board of light and fan.	Per Point	24			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
4.	Wiring for 5/6 pin 16 Amps power plug point with 4 sq. mm. P.V.C. insulated single core unsheathed industrial (Multistrand) cable FR conforming to IS-694: 1990 with flexible bright annealed electrolytic copper conductor for voltage grade up to 1100 volts (Finolex /RR Kabel /Nicco / Anchor or Equivalent Make as approved by the Deptt.) in surface/ recessed conduit wiring system including and fixing 5/6 pin 16 Amps flush type socket outlets and 16 Amps flush type switch (Anchor penta /Gold medal /Kolor kany.Kom/Havells or equivalent make as approved by the Deptt./ Havells make), GI/ MS switch board (I.S.I. mark with phenolic laminated sheet cover earth continuity with 2.5 sq. mm cable to the 3rd pin of the socket as required complete with 20 mm. dia. 2mm thick/ heavy rigid ISI marked IS: 9537 PART - III rigid PVC conduit (Berlia/ AKG / Precision/ Presto Plast/Polycab/ MW or equivalent make as approved by the Deptt.)					
	Extra long point up to 15.00 metre. length.	Per Point	10			
5.	CIRCUIT WIRING Wiring for drawing sub-main line with P.V.C. insulated single core unsheathed industrial (Multistrand) cable FR conforming to IS-694: 1990 with flexible bright annealed electrolytic copper conductor for voltage grade up to 1100 volts (Finolex /RR Kabel /Nicco / Anchor or Equivalent Make as approved by the Deptt.) PVC conduit (Berlia/ AKG / Precision/ Presto Plast/Polycab/ MW or equivalent make as approved by the Deptt.) including earth continuity in surface/ recessed 20 mm. dia. 2mm thick/ heavy ISI marked IS: 9537 PART - III rigid PVC conduit wiring system. With 2 x 2.5 sq. mm. + earth continuity with 1x1.5 sq. mm. in 20 mm. dia. 2mm thick/ heavy rigid PVC IS: 9537 Part - III conduit.	RM	720.00			
	With 2 x 4 sq. mm. + earth continuity with 1x2.5 sq. mm. cable in 20 mm. dia. 2mm thick/ heavy rigid PVC IS: 9537 Part - III conduit.	RM	30.00			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
	With 2 x 6 sq. mm. + earth continuity with 1x 4 sq. mm. cable in 25 mm. dia. 2mm thick/ heavy rigid PVC IS: 9537 Part - III conduit.	per mtr	160.00			
6.	Wiring for drawing sub-main line with P.V.C. insulated single core unsheathed industrial (Multistrand) cable FR conforming to IS-694: 1990 with flexible bright annealed electrolytic copper conductor for voltage grade up to 1100 volts (Finolex /RR Kabel /Nicco / Anchor or Equivalent Make as approved by the Deptt.) in surface/ recessed PVC 20 mm. dia. 2mm thick/ heavy ISI marked IS: 9537 PART - III rigid PVC conduit (Berlia/ AKG / Precision/ Presto Plast/Polycab/ MW or equivalent make as approved by the Deptt.) wiring system. With 4 x 10 sq. mm. + earth continuity with 2x6 sq. mm. cable in 40 mm. dia. 2mm thick/ heavy rigid PVC IS: 9537 Part - III conduit.	Metre.	40.00			
	FITTINGS AND ACCESSORIES (ALL PRODUCTS SHOULD BE ENERGY EFFICIENT AND ENVIRONMENT FRIENDLY)					
7.	Supplying and fitting of 18/20 Watt CFL lamp in the existing batten holder/angle holder/decorative bracket/bulk head fitting/ pendent holder etc. as specified and directed by the deptt.	Each	12			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
8.	Supplying and fixing of Call bell (Buzzer) including 5/ 6 amp capacity button piano type bell push switch including connection as approved by the Deptt.)as required.	Each	3			
9.	Supplying and fixing of bulk head fitting suitable for CFL lamp complete with all accessories including 20 watts CFL lamp and connection as approved by the Deptt.)as required.	Each	2			
10.	Supplying and fixing of polished Brass Bracket of 18 S.W.G, 25 cm long cast back plate and brass lamp holder complete including connection as approved by the Deptt.)as required Without Lamp	Each	12			
11.	Supplying and fixing of Frosted glass shade of 100 mm dia (Nominal Size as required.	Each	12			
12.	Supplying and fixing of Fan box (AKG or equivalent as approved by the Deptt.)with inbuild rod as required.	Each	46			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
13.	MCB DB (ABB, SCHNEIDER MG, LEGRAND, HAGER MAKE) & (SCHNEIDER NEO BREAK, C&S, Havells, INDOASIAN, HPL OR EQUIVALENT MAKE AS PPROVED BY THE DEPTT.) MCB IN-comer SPN DB Supplying with fitting and fixing sheet steel, phosphatised, powder painted dust & vermin proof Double door IP-43 surface mounting SPN MCB DB incorporated with bas-bar, Neutral link, Earth bar and din rail etc fitted on wall with grouting nuts & bolts as reqd. complete with making necessary connection as approved, specified and directed by the deptt. ABB, Schneider MG, legrand, Hager make) 8 way SPN Double Door	Each	1			
	12 way SPN Double Door	Each	5			
14.	MCB IN-comer TPN (Horizontal DB) Supplying with fitting and fixing sheet steel, phosphatised, powder painted dust & vermin proof Double door IP-43 double door surface mounting TPN MCB DB incorporated with bas-bar, Neutral link, Earth bar and din rail etc fitted on wall with grouting nuts & bolts as reqd. complete with making necessary connection as approved, specified and directed by the deptt. ABB, Schneider MG, legrand, Hager make) 4 way TPN (4+12) double door	Each	2.00			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
15.	MCB, MCCB, RCCB, RCBO (ABB, SCHNEIDER MG, LEGRAND, AND HAGER MAKE) & (SCHNEIDER NEO BREAK, C&S, Havells, INDO ASIAN, HPL OR EQUIVALENT MAKE AS PPROVED BY THE DEPTT.) MCB (Conform to IS / IEC 60898-1:200/ MCCB (Conform to IS/IEC 60947- RCCB (Conform to IS/IEC 12640 / 61008) Supplying with fitting and fixing single Pole 10 KA 240/415V 50Hz MCB of the following capacity complete with making necessary connection as approved, specified and directed by the deptt. C Series (Schneider MG, legrand, Hager make) 6 to 32A	Each	68			
16.	Supplying with fitting and fixing DP 10 KA 240/415V 50Hz MCB of the following capacity complete with making necessary connection as approved, specified and directed by the deptt. C Series (ABB, Schneider MG, legrand, Hager make) 6 to 32A	Each	6			
17.	Supplying with fitting and fixing 30/100/300mA sensitivity 240/415V 50Hz DP RCCB of the following capacity complete with making necessary connection as approved, specified and directed by the deptt. 100/300mA sensitivity DP RCCB (ABB, Schneider MG, legrand, Hager make) 25A	Each	6			
18.	Supplying with fitting and fixing 4P 10 KA 240/415V 50Hz MCB of the following capacity complete with making necessary connection as approved, specified and directed by the deptt. C Series (ABB, Schneider MG, legrand, Hager make) 40A	Each	2			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
19.	EARTHING Supply, installation & testing of G.I. earth station with perforated 40 mm dia and 4.50 Metre long heady duty G.I. pipe with necessary 40 mm dia. G.I. Fittings such as Socket, Tee, elbow, nipple and 50 mmx40 mm G.I. reducing socket for funnel including locking arrangement 300 mmx300 mmx6 mm hinged cover C.I. earth plate complete with digging of earth pit, construction of brick chamber and plastering of both inner & outer surface of wall as specified and directed by the deptt .	Each	2			
20.	Extra for using salt (5 K and Charcoal (64 K in pipe Earth Station pit to provide low impedance ground in location of high soil resistivity as and when required and specified by the Deptt.	Each	2			
21.	Supplying & laying of 6 SWG G.I. earth from Earth Electrode (below G.L.) to electrical switch gears or electrical machineries including making necessary connection as approved, specified and directed by the deptt.	Metre.	50.00			
22.	Supplying & laying of following size 25mmX5mm G.I. strips drawn on surface from earth electrode to Electrical switch gears, machineries etc complete with supply of G.I. nuts & bolts, screws etc including riveting, soldering & making necessary connection as approved, specified and directed by the deptt.	R.M.	30.00			
23.	CEILING FAN, EXHAUST FAN AND AIR CURTAIN Supplying including fitting fixing of following A.C. Ceiling fan complete with all accessories like down rod, canopy etc. of following sweeps with making necessary connection as approved by the Deptt.)as required complete and as directed by the Department [Without regulator]. Standard model 1200 mm Sweep Usha make)/ Standard model 1050 / 1200 mm Sweep Havells make)/ High speed 1200 mm sweep (ORIENT PSPO make)	Each	46			
24.	Supplying fitting and fixing of ceiling fan Regulator including complete connections etc. complete as required and as directed by the department. Electronic Registrance Type	Each	46			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
25.	U. G. CABLE AND CABLE WORKS Supply and laying of following size PVC/XLPE insulated and PVC sheathed 1.1 KV G Solid Aluminium conductor up to 10 sq mm balance stranded conductor, XLPE Insulated, cores laid up, PVC tape inner sheathed, Armour (Aluminium for single core up to 70 sq mm balance Aluminium strip, Galvanised for cables up to 2x10 sq mm.3x10 sq mm,4x6 sq mm balance all galvanised steel strip) , extruded PVC Type ST2 sheathed, 650/1100V grade as per IS 7908(Part 1) 1988 armoured U.G. cable U.G. cable laid in ground/partially in air (as required for termination over ground including excavation of cable trench up to depth of 75cm, refilling, protective brick covering, Sand cushioning etc complete handling of surplus spoil, debris et to proper place as specified and directed by the deptt. (Nicco/ Havells/ RPG/CCI/ Polycab/ Gloster/ Finolex make) . 3 & 1/2 Core A2XFY 70.00 Sq. mm.3 & 1/2 Core armoured U.G. cable	Mtr	40			
26.	Supply and laying of following size Solid Aluminium conductor up to 10 sq mm balance stranded conductor, XLPE Insulated, cores laid up, PVC tape inner sheathed, Armour (Aluminium for single core up to 70 sq mm balance Aluminium strip, Galvanised for cables up to 2x10 sq mm.3x10 sq mm,4x6 sq mm balance all galvanised steel strip) , extruded PVC Type ST2 sheathed, 650/1100V grade as per IS 7908(Part 1) 1988, LT armoured U.G. cable laid in pucca flooring, road crossing, drain crossing as per site requirement and partially in air to connection as approved by the Depts. the control switch, through medium duty G.I. pipe (Tata/ Nezone make or equivalent as approved by the Deptt) bend and socket including excavation and refilling the trench and making good damage done as specified and directed by the deptt. (Nicco/ Havells/ RPG/CCI/ Polycab /Gloster/ Finolex make) Core - 3 & 1/2 A2XWY A2XFY 70.00 Sq.mm 3&1/2 Core U.G. cable in 50mm dia medium duty G.I. pipe	Mtr	5.00			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
27.	Supplying including installation of cast iron cable marker as specified and directed by the deptt.	Each	5			
28.	Motor Pump Set Supplying including installation, connection as approved by the Deptt., testing and commissioning of CENTRIFUGAL MONOBLOCK PUMP SET complete as directed and specified by the deptt. 1 HP single Phase Centrifugal monoblock pump set (Crompton Greaves/ Aquatic/ CRI/ V-Guard make) 2900 rpm with DOL Starter (Crompton Greaves/ Control & Switch Gear/ BCH/ L& T / Siemens make) .	Each	1			
29.	LUMINAIRES Supplying with fitting fixing of CFL/Fluorescent luminaries complete with all accessories such as ballast, starter etc. directly on wall / ceiling including connection as approved by the Deptt.)with 1.5 sq mm P.V.C. insulated S.C. copper conductor as required and as directed by the department. Striplite luminaries complete with VPIT copper ballast/ Electronic ballast and decorative end cap and 1 X 36 / 40 watt Fluorescent tube.(Crompton Greaves make) Model- DSG1114LDB CROMGOLD / DSG1114LDBN CROM GOLD NEW / DSG1314EB CG GOLD / DSG 1414EB PLANET GOLD with Super Saver / Super Brite Lamp. Or equivalent (Equivalent will be selected by the deptt considering the mother items rate) PHILIPS/ WIPRO/ BAJAJ/ Havells/ HPL/ SOLAR/ JAQUAR make. [FL]	Each	29			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
30.	Supplying with fitting fixing of CFL/Fluorescent luminaries complete with all accessories such as ballast, starter etc. directly on wall / ceiling including connection as approved by the Deptt.)with 1.5 sq mm P.V.C. insulated S.C. copper conductor as required and as directed by the department. Sleek Box type luminaries complete with Electronic ballast and plastic holder brackets with 1 X 36 / 40 watt Fluorescent tube.(Crompton Greaves make) Model- DJB 1314LDB50 / DJBN1314EB CROMTEK with Super Saver / Super Brite Lamp or equivalent (Equivalent will be selected by the deptt considering the mother items rate) PHILIPS/ WIPRO/ BAJAJ/ Havells/ HPL/ SOLAR/ JAQUAR make. [TL]	Each	64			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
31.	MAIN LT PANEL Supplying and installation of metal enclosed wall/floor mounted front operated cubical type switch gear panel suitable for indoor installation conforming to IS: 8623 (Part I & II). Panel should be made of sheet steel and thickness not less than 2mm and structural steel having light section. The panel shall be completely dust tight and vermin proof and shall be painted with anti corrosive and anti condensation type two coats of primer and two coats of paint. All wiring shall be PVC insulated and PVC sheathed of 1100 volt grade of required size. The panel should have provision of entry of cable at the bottom and also provision of out going feeders from the bottom of the panel. The panel shall be incorporated with double busbar system. The bus bar shall be of high quality copper of uniform cross section. The panel shall consist of the following items (viz. Voltmeter, Ammeter, CT, indicating lamps, selector switch etc.) connected as per drawing and shall be flush mounted on the front of the panel. Incommer: 100A 4P 25KA MCCB- 1 No. Energy Meter - 1 no. Digital Ammeter - 1No. Digital Voltmeter - 1 No. CT -1 set. Switch Fuse Unit - 3 Nos. Selector Switch - 2 Nos. Indicating Lamp 1 Set Bus-Bars: 210 A TPN electrolytic Copper Bus Bar of uniform cross-section (25mmx5mm) – 1 set Outgoing: 40A 4P MCB – 4 Nos. 25A DP MCB – 9 Nos.	Set	1			

SI No.	Description	Unit	Qty	Rate		Amount
				In figure	In words	
32.	Supplying, installation, testing and commissioning of the following prewired CFL/Flourescent luminaries complete with all accessories such as ballast, starter etc. directly on wall/ceilling including connection with 1.5 sq. mm PVC insulated single core copper conductor as reqd. and as directed by the Deptt. Superior finish extruded aluminium body with anodised aluminium reflector and aluminium cross louver assembly. CFL Luminaires of make Bajaj Cat No. BSM 218 CFL WEBS 'L' type CFL 2 x 18W or equivalent inlcuding lamps etc. complete [CFL(C)]	Each	26			

= Rs. _____

Date:

Signature of the Contractor:

UCO BANK
PROPOSED CONSTRUCTION
OF
RSETI BUILDING
AT
SARAITALI VILLAGE NALBARI , ASSAM
BILL OF QUANTITIES

PART - B (SANITARY AND WATER SUPPLY INSTALLATION)

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
1	INDIAN TYPE WATER CLOSET Providing fitting and fixing vitreous water closet squatting pan (Indian type W.C Orissa pattern) with all fittings and fixtures complete including cutting and making good to the walls and floors wherever required. (Flushing Cistern to be paid separately) Indian type W.C Orissa pattern of size 580 x 440 mm White Parrware make	Each	7			
2	EUROPEAN TYPE WATER CLOSET Providing fitting and fixing white vitreous china pedestal type water closet (European type W.C pan 400mm high) with seat and lead ,CP brass hinges and rubber buffers CI/MS brackets , 40 mm dia flush band with fittings including painting of fittings and brackets, required. (Flushing Cistern to be paid separately) Parrware make White Petite (s/p)(Cat No. C0287/88) (inclusive of seat cover)	Each	6			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
3	PVC FLUSHING CISTERN Supplying, fitting and fixing PVC flushing cistern with all internal fittings with CI brackets including fitting and fixing standard size CP flush pipe, union clamps etc. complete as directed and specified (pipes will be measured separately) Parrware make White Tiger (Cat. No.C8260)	Each	13			
3	URINAL Providing fitting and fixing vitreous china flat back type lipped front urinal basin of with automatic flushing cistern with standard flush pipe and CP brass spreader and brass unions, etc. complete including painting of fittings and brackets, cutting and making good the walls & floors wherever required. Parrware make White Integrated EFS-AC with power source (Cat No. C8097)/ Integrated EFS-DC(Cat. No.C8098)	Each	4			
4	WASH BASIN Providing vitreous China wash basin with CI/MS brackets, C.P brass chain with plug,PVC waste pipe including painting of fittings and brackets, cutting and making good the walls wherever required. (Pillar cock, stop cocks, waste coupling are to be paid separately) Basin (without pedestal) Parrware make White Tapti Basin 500x360 (Cat. No.co424/410)	Each	13			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
5	KITCHEN SINK (STAINLESS STEEL) Providing fitting & fixing stainless steel kitchen sink of Parryware make with CI/MS brackets, C.P. brass chain with rubber plug, PVC waste pipe etc. complete including painting the fittings ,cutting &making good the walls wherever required. (Sink cock, stop cocks, waste coupling are to be paid separately Parryware Make Grace Deluxe Super (Bowl size-545x445x200) Glossy	Each	1			
6	MIRROR Providing fitting and fixing Mirror with plastic frame of size 500x400mm complete as directed and specified.	Each	13			
7	SHELF Providing fitting and fixing Glass Shelf complete as directed and specified. Glass shelf with C.P. guard rail Sona make (Cat. No.TR-0701) 525mm	Each	13			
8	SOAP TRAY,SOAP DISH,LIQUID SOAP DISPENSER AND LIQUID SOAP CONTAINER Providing, fitting and fixing recessed soap tray / soap dish complete as directed and specified. Parryware Make Wall Soap tray (Cat. No.C9951)	Each	13			
9	TOWEL RAIL,TOWEL RACK & TOWEL RING Providing, fitting and fixing CP towel rail complete as directed and specified. Sonar make Towel rail Diplomat 300 mm long (Cat.No. Tr-0605)	Each	13			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
10	WASTE COUPLING Providing, fitting and fixing Chrome Plated waste coupling complete as directed and specified. Sona Make Rupa 32mm (HT/FT) (Cat.No.WS-0801)	Each	14			
11	BOTTLE TRAP Providing, fitting and fixing Chrome Plated bottle trap complete as directed and specified. Sona Make Bottle trap indian 32mm (Cat.No. BT-0751)	Each	22			
12	PVC PIPES, BENDS, JUNCTIONS, TEES ETC. Supplying, fitting and fixing PVC pipes of 6 Kg/cm ² (Supreme/Prince) or other ISI approved including joining ,fitting and fixing wiyh clamps etc.as necessary complete at all levels including below G.L as directed and specified. (a) In exposed surfaces or in trenches. (i) 110mm dia. (ii) 75mm dia.	 R.M. R.M.	 121.35 171.60			
(b)	Concealed by chiselling or breaking brick wall/C.C./R.C.C and making good to the damages. (i) 110mm dia. (ii) 75mm dia.	 R.M. R.M.	 29.00 45.00			
13	Supplying, fitting and fixing 87.5 degree PVC bend of (Supreme/Prince) or other ISI approved including joining ,fitting and fixing etc.as necessary complete at all levels including below G.L as directed and specified. (a) In exposed surfaces or in trenches. (i) 110mm dia. (ii) 75 mm dia.	 Each Each	 10 10			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
(b)	Concealed by chiselling or breaking brick wall/C.C/R.C.C. and making good to the damages.					
(i)	110mm dia.	Each	15			
(ii)	75 mm dia.	Each	12			
14	Supplying fitting and fixing 87.5 degree PVC bend with door of (Supreme/ Prince) or other ISI approved including joining, fitting and fixing etc.as necessary complete at all levels including below G.L. as directed and specified.					
(a)	In exposed surfaces or in trenches.					
(i)	110mm dia.	Each	5			
(ii)	75 mm dia.	Each	5			
(b)	Concealed by chiselling or breaking brick wall/C.C/R.C.C. and making good to the damages.					
(i)	110mm dia.	Each	3			
(ii)	75 mm dia.	Each	3			
15	Supplying fitting and fixing 45degree PVC bend of (Supreme/Prince) or other ISI approved including joining , fitting and fixing etc. as necessary complete at all levels including below G.L. as directed and specified.					
(a)	In exposed surfaces or in trenches.					
(i)	110mm dia.	Each	3			
(ii)	75 mm dia.	Each	3			
(b)	Concealed by chiselling or breaking brick wall/C.C/R.C.C. and making good to the damages.					
(i)	110mm dia.	Each	3			
(ii)	75 mm dia.	Each	3			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
16	Supplying fitting and fixing PVC Plain single tee of (Supreme/ Prince) or other ISI approved including joining, fitting and fixing etc. as necessary complete at all levels including below G.L. as directed and specified.					
(a)	In exposed surfaces or in trenches.					
(i)	110mm dia.	Each	6			
(ii)	75 mm dia.	Each	4			
(b)	Concealed by chiselling or breaking brick wall/C.C/R.C.C. and making good to the damages.					
(i)	110mm dia.	Each	6			
(ii)	90mm dia.	Each	4			
17	Supplying fitting and fixing PVC single 'Y' of (Supreme/Prince) or other ISI approved including joining , fitting and fixing etc. as necessary complete at all levels including below G.L. as directed and specified.					
(a)	In exposed surfaces or in trenches.					
(i)	110mm dia.	Each	6			
(ii)	75mm dia.	Each	4			
(b)	Concealed by chiselling or breaking brick wall/C.C/R.C.C. and making good to the damages.					
(i)	110mm dia.	Each	4			
(ii)	75 mm dia.	Each	4			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
18	COWEL Providing fitting and fixing 50mm dia. HCI cowel with cement caulking complete as directed and specified.	Each	9			
19	GRATING Providing fitting & fixing C.P.Grating to the floors complete as directed and specified.					
(a)	110mm dia	Each	26			
20	MANHOLE COVER Providing fitting and fixing (600x600)mm 90mm thick C.I. Man hole cover and frame of 25 Kg. weight complete as directed and specified	Each	4			
21	SOAK PIT AND INSPECTION CHAMBER Construction of filter bed in soak pit including earth work in excavation of soil and then filling up of the trench with brick bats/Charcoal covered with earth over a layer of A.C. plain sheet above brick bat filling complete as directed. (sizes of soak pit may vary depending on the sizes and capacities of the septic tank as well as the number of users as mentioned in the table.	Cu.M.	2.00			
22	Construction of inspection pit inside measurement 450mm x450mm x450mm flush with 100mm diameter HCI/PVC pipes and cement concrete base in proportion 1:3:6 over flat brick soling, 12cm brick wall in cement mortar in proportion 1:4 finished with 13mm cement plaster in proportion 1:2 in side wall and floor. 450mm x450mm air tight C.I. inspection pit cover and frame complete including supplying of materials, necessary excavation of pit as directed.	Each	8			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
23	PIPING Supplying fitting and fixing SFMC (SAVOIR-FAIRE MANUFACTURING CO. PVT.LTD.) brand 3 layered (outer green coloured, UV Stabilised, middle black coloured and inner white coloured (with antimicrobial property) fusion welded P.P.R (Polypropelene Random Co-Polymer) pipes of following size with all necessary fitting such as bend , tee, elbow, reducer, plug and clamp etc. complete at all levels as directed and specified. In exposed surface or trenches 20 mm OD (PN-16) SFMC brand 3 layer P.P.R. pipe	R.M.	10.00			
	25 mm OD (PN-16) SFMC brand 3 layer P.P.R. pipe	R.M.	50.00			
	40 mm OD (PN-16) SFMC brand 3 layer P.P.R. pipe	R.M.	40.00			
24	AJAY FLOWGUARD CPVC PIPE Supplying fitting and fixing Ajoy Flowguard CPVC (Chlorinated Polyvinyl Chloride) pipes having thermal stability for hot and cold water supply including all CPVC plain and bruss threaded fitting including clamps at 1.00 m spacing including joining of pipes and fitting with one step CPVC solvent cement and testing of joints complete at all levels as directed and specified. (Note: Ball valve and union will be charged extra and does not comes under Accessories) Concealed by chieselling or breaking brick wall/ C.C. wall/ R.C.C. wall and making good to the damaged structure.					
(a)	20mm dia Using Tata (medium)	R.M.	30.00			
(b)	15 mm dia Using Tata (medium)	R.M.	87.00			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
25	BIB COCK Supplying fitting and fixing C.P. bib cock 15mm dia of approved brand directed and specified. (G.I. & C.P pipes will be measured separately) Essco make (Delux/Sumthing spl./Tropical) Bib cock short body	Each	21			
26	Supplying and fitting fixing C.P. pillar cock of 15mm dia of approved brand as specified and directed. Sona make Light type	Each	13			
27	SHOWER Supplying fitting and fixing overhead adjustable Chrome Plated (C.P.) spray shower 15 mm dia of Sona make with wall flange as directed and specified.(pipes will be measured and paid separately) Supreme shower with arm	Each	8			
28	VALVE Supplying and fitting gun metal country pit valve (full way valve) I.S.I. Make as specified and directed.					
(a)	40 mm dia.	Each	2			
(b)	25 mm dia.	Each	2			
29	Supplying and fitting ball valve as specified and directed..					
(a)	25 mm dia. (gun metal)	Each	2			
(b)	20mm dia. (gun metal)	Each	2			

Sl.No.	Specification of item of works	Unit	Qty.	Rate (in figure)	Rate (in words)	Amount
30	WATER TANK Supplying and placing plastic cylindrical vertical claused top (PCVC) tank of Sintex / Polycon / Patton make over the staggering with manhole cover with locking and cleaning arrangement including providing pads of size as required for inlet and outlet pipes 2000 litre capacity Sintex make	Each	2			
31	DEEP TUBE WELL (Provisional) Supplying, fitting and fixing manual water boring of size 150mm dia including all necessary pipes, submersible motor and other accessories complete as directed by the department.	Each	1			
=Rs.						

Date:

Signature of the Contractor:

UCO BANK
PROPOSED CONSTRUCTION
OF
RSETI BUILDING
AT
SARAITALI VILLAGE NALBARI ,ASSAM

SUMMARY

1	Part -A (CIVIL WORKS)	Rs.
2	Part-B (SANITARY AND WATER SUPPLY INSTALLATION)	Rs.
3	Part-C (ELECTRICAL WORKS)	Rs.
4	Boundary Wall , Gate & Barbed wire fencing	Rs.
GRANDTOTAL		Rs.
SAY		Rs.

(Rupees

only)

Date:

Signature of the Contractor: