CHIEF ENGINEER'S OFFICE

NORTHERN ZONAL OFFICE, NEW DELHI

PART – I

TENDER FOR BUILDERS WORK, WATER SUPPLY, SANITARY INSTALLATION, ELECTRICAL INSTALLATION AND OTHER ANCILLARY WORKS

FOR

CONSTRUCTION OF

OFFICERS'S QUARTERS BUILDING

AT

JAITARAN (RAJ.)

Issued to

M/S _____

_____

_____

Date of Pre-Bid Meeting : 08.02.2016 at 11.00 Hrs.

Last Date of Submission of tender : 16.02.2016 up to 15.00 hrs.

Date of opening of Technical bid : 16.02.2016 at 15.30 hrs.

Note: Contractors should sign all the pages of Tender Documents.

LIFE INSURANCE CORPORATION OF INDIA
NORTHEN ZONAL OFFICE,
NEW DELHI

TENDER FOR BUILDER'S WORK, WATER SUPPLY, SANITARY INSTALLATION, ELECTRICAL INSTALLATION AND OTHER ANCILLARY WORKS FOR CONSTRUCTION OF OFFICERS'S QUARTERS BUILDING AT JAITARAN (RAJ.)

PART – I

CONTENTS

CONDITIONS OF CONTRACT

1. INTERPRETATIONS:

1.1 In construing these Conditions, the Specifications, the Priced Schedule of Quantities, Tender and Agreement, the following words shall have the meanings herein assigned to them except where the subject or context otherwise requires:

1.2 "Employer" shall mean THE LIFE INSURANCE CORPORATION OF INDIA and his (their) heirs, legal representatives, assignees and successors.

1.3 "Chief Engineer" shall mean the person occupying the post of head of the Zonal Engineering Department of the Corporation.

1.4 "Corporation's Engineers" shall mean such Deputy Chief Engineers, Superintending Engineers and/or Executive Engineers of the Corporation, who shall from time to time be appointed by the Chief Engineer for supervising the work carried out by the Contractor or for any purpose in connection therewith:

1.5 The term "Site Engineer" shall mean the person appointed and paid by the Employer, acting under the order of the Corporation's Engineer to superintendent the work.

1.6 The Contractor shall mean the individual, firm or company whether incorporated or not, who is awarded the contract & shall include the legal representative of such individual or the persons composing such firm or company or the successors of such individual, firm or company & the permitted assignees of such individual, firm or company.

1.7 The "Site" shall mean the lands/buildings and/or other places on, in, into or through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.

1.8 "This Contract" shall mean the Articles of Agreement, these Conditions, the General Instructions to Contractor, General Preambles to Schedule of Quantities, Special Conditions, the priced Schedule of Quantities, the Specifications, the Appendices, the Drawings and other related correspondence.

1.9 "Act of Insolvency" shall mean any act of insolvency as defined by the Presidency Towns Insolvency Act, or the Provincial Insolvency Act or any amending Statute.

1.10 "Notice in Writing" or written notice shall mean a notice in written, typed or printed characters, sent (unless delivered personally or otherwise proved to have been received) by registered post to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered.

1.11 Words importing persons include Firms and Corporations, words importing the singular only also include the plural and vice versa where the context so requires.

1.12 The titles of the Clauses shall not affect or alter the meaning of Clauses and are solely for the purpose of facilitating reference.

1.13 The following abbreviations shall be followed for the designations of various LIC Officers:

DESIGNATIONS	**ABBREVIATIONS**
Executive Director (Engineering)	E.D.(E)
Zonal Manager	Z.M.
Chief Engineer	C.E.
Chief Architect	C.A.

Deputy Chief Architect	D.C.A.
Deputy Chief Engineer	Dy.C.E.
Superintending Engineer	S.E.
Senior Architect	S.A.
Executive Engineer	E.E.
Deputy Senior Architect	D.S.A.
Asstt. Secretary	A.S.

1.14 Wherever the words "approved", "directed", "as required", "selected" or words of like effect are used, it is to be understood that the approval/direction, requirement or selection of the Corporation's Engineer are intended unless otherwise specified.

1.15 The words "as described" shall mean the description in the Special Conditions, Specifications, General Instructions, Drawings etc. of this tender.

1.16 The words "allow" shall mean that the Contractor shall include in his rates for the particular matter referred to.

1.17 "Day Work" shall mean items of labour and/or materials which in the opinion of the Corporation's Engineer are not capable of being evaluated by the accepted method of measurement and analysis.

2. SCOPE OF CONTRACT:

2.1 The Contractor shall carry out and complete the works in every respect in accordance with this Contract and in accordance with the directions and to the satisfaction of the Corporation's Engineer. The Corporation's Engineer may issue further drawings and/or written instructions, details, directions and explanation in regard to:

a. The variation or modification of the Design, quality of works 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 Specifications;

c. The removal from the site of any materials brought thereon by the Contractor and the substitution of any other material thereof;

d. The removal and/or re-execution of any work executed by the Contractor;

e. The dismissal from the work of any persons employed thereupon;

f. The opening up for inspection of any work covered thereupon;

g. The amending and making good of any defects under relevant Clause giving details of defects after completion.

2.2 The Contractor shall forthwith comply with and duly execute all works comprised in such Instructions subject to the provisions of relevant specific conditions of the Contract. In the event of any dispute or difference of opinion the contractor shall refer the matter within 7 (seven) days of the issue of such instruction to the Chief Engineer whose decision shall be final & binding.

3. DISCREPANCIES:

3.1 If there are varying or conflicting provisions made in any one document forming part of Contract, the Chief Engineer shall be the deciding authority with regard to the intention of the document and his decision shall be final and binding on the contractor.

3.2 The several documents forming the Contract are to be taken as mutually explanatory of one another, and the order of precedence shall be as follows;

a) Special conditions

b) General preambles to schedule of quantities
c) General instructions
d) Conditions of contract

3.3 In case of discrepancies between the Schedule of Quantities, the specifications and/or drawings the following order of precedence shall be observed

(a) Description in Schedule of Quantities
(b) Specifications of relevant Trade
(c) Drawings; detailed drawings shall be followed in preference to small scale drawings and figured dimension in preference to scale.
(d) Indian Standard Specifications of `BIS'

4. DRAWINGS AND SCHEDULE OF QUANTITIES:

4.1 Two complete sets of the Drawings and Specifications and Schedule of Quantities shall be furnished by the employer to the contractor. Two copies of the additional Drawings, if any, shall be furnished within such time as the Chief Engineer may consider reasonable which may be necessary for execution of any part of the work. Such copies shall be kept on the work site and the CE and his representatives shall at all reasonable times have access to the same and they shall be returned to the EE by the Contractor on completion of the contract.

This Contract and the signed Drawings, Specifications and Schedule of Quantities shall remain in the custody of the Employer.

5. CONTRACTOR TO PROVIDE EVERYTHING NECESSARY FOR EXECUTION OF WORK:

5.1 Contractor shall provide everything necessary for the proper execution of the work according to the intent & meaning of the Drawings, Priced Schedule of Quantities and Specifications taken together, whether the same may or may not be explicitly shown or described therein provided that the same can reasonably be inferred there from and if the Contractor finds any discrepancy therein he shall immediately and in writing refer the same to the CE whose decision shall be final and binding on the Contractor.

5.2 The Contractor shall supply, fix and maintain at his cost during the execution of any work 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 the safety of any adjacent Roads, Streets, Cellars, Vaults, Ovens, Pavements, Walls, Houses, Buildings and all other erections, matters or things and the Contractors shall take down and remove any or all such Centering, Scaffolding, Staging, Planking, Timbering, Strutting, Shoring, etc., as occasion shall require or when ordered to do so, and shall fully reinstate and make good all matters and things disturbed during the execution of the work to the satisfaction of the Corporation's Engineer.

6. AUTHORITIES NOTICES AND PATENTS:

6.1 The Contractors shall conform to the provisions of any Acts of the Legislature relating to the work and to the Regulations and Bye-Laws of any Authority and or any Water, Lighting and other Companies and/or Authorities with whose system the structure is proposed to be connected and shall before making any variations from the Drawings or Specifications that may be necessitated by so conforming give to the CE written notice specifying the variations proposed to be made and the reasons for making them and apply for instructions thereon. In case the Contractor shall not within 7 (seven) days

receive such instructions, he shall proceed with the work conforming with the Provisions, Regulations or Bye-Laws in question.

6.2 In particular, the Contractors shall be responsible to Register themselves under the Contract Labour (Regulation & Abolition) Act 1970 and Rules there under and any amendment thereto; they must comply with and carry out all the provisions and obligations under the said Act and Rules and furnish all information to Employer as may be required by it and shall indemnify the Employer against any penalties/claims arising from any default on their part.

6.3 The Contractor shall arrange to give all notices required by the said Acts, Regulations or Bye-Laws to be given to any Authority and to pay to such Authority or to any Public Office all fee that may be properly chargeable in respect of the work and lodge the receipts with the Employer.

6.4 The Contractors shall indemnify the Employer against all claims in respect of patent, rights, and shall defend all actions arising from such claims unless he has informed the Chief Engineer before any such infringement and received his permission to proceed and shall himself pay all royalties, licence fees, damages, costs and charges of all and every sort that may be legally incurred in respect thereof.

6.5 The Contractor should observe that his work shall not cause any nuisance to the Public in general and to the neighbouring occupants in particular.

6.6 Should the Contractor desire to work on Sundays, Holidays and during night hours, permission in writing from the Corporation's Engineer must be obtained in time. It shall be the responsibility of the Contractor to obtain permission from Civil Authorities, if necessary.

7. SETTING OUT WORK:

7.1 The Contractor shall set out the work and shall be responsible for the true and perfect setting out of the same 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 cost rectify such error, if called upon, to the satisfaction of the Corporation's Engineer. The Contractor must not commence work until the outlines of the building and Centre line layout have been pegged out and approved by the Corporation's Engineer.

8. CONTRACTOR IMMEDIATELY TO REMOVE OFFENSIVE MATTER:

8.1 All soil, filth or other matter of an 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 some pit or place provided by him.

9. MATERIALS AND SAMPLES:

9.1 All the materials stores and equipment required for the full performance of the Contract must be provided through normal trade channels and must include octroi, excise and import duties, sales tax payable to all authorities and other charges. They shall be of approved quality and the best of their kind available and the Contractor must be entirely responsible for the proper and efficient carrying out of the work. The Contractor shall order all materials required for the execution of the work from local/outside sources as early as necessary to the satisfaction of the Corporation's Engineer and to ensure that such materials are on site well ahead of requirement for use in the work.

9.2 Before ordering such materials, the Contractor shall get samples of the materials approved well in time. Preference shall be given to ISI marked products and approved brands of requisite quality as mentioned in the tender. For materials, which are neither approved brands nor ISI marked, the same shall be got tested from approved

laboratories at the Contractor's cost before approval. Approved brand and ISI marked product will also be tested if desired by the CE and if the test results are satisfactory, the cost of testing shall be borne by the Employer otherwise by the Contractor. No claim will be allowed for delay to the progress of work caused by test. If called upon by the Executive Engineer the Contractor shall produce proof for having arranged for the supply of materials well in time.

9.3 The Contractor shall furnish well in time before work commences at his own cost, any samples of workmanship that may be called for by the Corporation's Engineer for his approval and any further samples in case of rejection until such samples are approved. Such samples when approved shall be the minimum standard for the work to which they apply. In case of items like suspended ceiling, partitions, etc. typical sample panels or proto-types shall be erected in position for approval before undertaking work. Rates quoted shall cover for such preliminary work.

10. ACCESS:

10.1 Any of the Corporation's Engineers or any persons authorised by any one of them shall at all reasonable time have free access to the work and/or the workshops, factories or other places where materials are being prepared or constructed for the Contract and also to any place where the materials are lying or from which they are being obtained and the Contractor shall give every facility to all of them necessary for inspection and examination and test of the materials and workmanship. Except the representatives of the Public Authorities, no person shall be allowed on the work at any time without the written permission of the Corporation's Engineer.

If any work is to be done at a place other than the site of the work, the Contractor shall obtain the written permission of the Corporation's Engineer for doing so.

11. CONTRACTOR'S SUPERVISION & MINIMUM REQUIREMENT OF TECHNICAL STAFF:

11.1 The Contractor shall either himself supervise the execution of the contract or may appoint a Competent Agent approved by the CE to act in his stead.

11.2 Where the contractor is not a qualified Engineer or even if he is so qualified, he cannot in the opinion of C.E., give his full personal attention to the works, he shall at his own expense employ person(s) possessing the qualification and experience as described hereunder as his accredited agent to supervise the works and to receive instructions from Corporation's Engineers. Any directions, instructions or notices given by the Corporation's Engineer to such supervisor(s) shall be deemed to be given to the contractors.

a. FOR WORKS COSTING UPTO Rs.100 LAKH :

A qualified resident Engineer having a Government recognised Diploma in Civil Engineering and minimum of 2 years experience on building construction site.

b. FOR WORKS COSTING MORE THAN Rs.100 LAKH & UPTO Rs.200 LAKH:

A qualified resident Engineer having a Recognised Degree in Civil Engineering or equivalent qualification and minimum of 2 years experience on building construction site/s or a recognised Diploma in Civil Engineering with minimum 5 years experience on such construction jobs.

c. FOR CIVIL WORKS COSTING MORE THAN Rs.200 LAKH :

i) A qualified resident Engineer having a Recognised Degree in Civil Engineering and minimum of 3 years experience of such major construction site/s or a recognised diploma in Civil Engineering with 8 years experience.

ii) In addition the contractor shall employ suitable number of supervisors with recognised degree / diploma in the relevant branches or recognised qualification & experience in the relevant trades for proper execution of the work as approved by the Chief Engineer.

d. The CE may vary any of the above qualification / experience at his discretion if so warranted by conditions prevailing and applicable to any particular work such as Air-conditioning, HT, Interiors etc.

e. RECOVERY FOR NON DEPLOYMENT OF ENGINEER/S AT THE SITE

If the contractor fails to employ suitable person(s) to supervise the work or fails to appoint replacement(s) when necessitated, amount as stipulated in the Appendix to the conditions of contract shall be recovered from the contractor for each Engineer and each supervisor for the period of non-employment.

12. DISMISSAL OF WORKMEN:

12.1 The Contractor shall, on the instruction of the Corporation's Engineer, immediately dismiss from the work any person employed thereon, who may, in the opinion of the Corporation's Engineer, be unsuitable or incompetent or who may misconduct himself and such person shall not be again employed or allowed on the work without the permission of the Corporation's Engineer.

13. DATES OF COMMENCEMENT AND COMPLETION:

13.1 The "Date of Commencement" shall be as stated in the Work Order and the Contractor shall thereupon and forthwith begin the work and shall regularly proceed with and complete the same on or before the "Date of Completion" stated in the Work Order, subject to the provisions for extension of time hereinafter contained.

14. ASSIGNMENT:

14.1 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 of interest therein nor shall he take a new partner without the written consent of the CE and no subletting shall relieve the Contractor from the full and entire responsibility of the Contract or from the active superintendence of the work during its progress.

15. DEVIATION, VARIATION, EXTRA/DEVIATED ITEMS AND PRICING:

15.1 The Contractor should note that unless otherwise stated, the tender is strictly on Percentage Rate basis. The quantities in the Schedule of Quantities approximately indicate the total extent of work and no variation i.e. additions, omissions or subtractions shall vitiate the Contract. No liability shall attach to the Employer for any error therein or variation there from.

15.2 The contractor may when authorized and shall when directed, in writing by the CE or the Corporation's Engineers, whom the CE may for that purpose appoint, add to, omit from, make alterations in, substitutions for, or vary the works shown upon the Drawings or described in Specifications or included in the priced Schedule of Quantities but the Contractor shall make no additions, omissions, alterations, substitutions or variations

without such authorization or direction. A verbal authority or direction by the CE, if confirmed by the contractor in writing within 7 (seven) days, be deemed to have been given in writing.

15.3 The rates of such altered, additional or substituted works shall be determined in accordance with the following.

a. The net rates or prices in the original tender shall determine the valuation of the extra work where such extra work is of similar character and executed under similar conditions as the work priced therein.

b. The net price of the items in the original tender shall determine the value of the items omitted. However, if omissions vary the conditions under which any remaining items of the work are carried out or if the amount of any omission relative to the amount of the whole of the Contract works or to any part thereof shall be such that in the opinion of the Chief Engineer, the net rate or price contained in the Priced Schedule of Quantities or Tender or for any item of work involves loss or expenses beyond that reasonably contemplated by the Contractor and is by reason of such omission rendered unreasonable or inapplicable, the Chief Engineer shall fix another rate or price as in the circumstance he shall think reasonable and proper.

c. If the rate for any altered, additional, or substituted item of work is not specified in the schedule of quantities, the rate for that item shall be derived from the rate for the nearest similar item specified therein.

d. If the rate for altered, additional or substituted item of work cannot be determined in the manner specified above, then such items of work shall be priced on the basis of coefficients of labour and materials as given in the latest CPWD rate analysis handbook and rates for labour and materials wherever applicable shall be the market rate prevailing at the time of execution.

e. Where such co-efficients are not available in C.P.W.D. rate analysis, the actual Labour/Materials involved and recorded by the Executive Engineer in executing the items shall be considered.

f. Where extra work cannot be properly measured or valued, the Contractor shall be allowed “Day Work” prices at the net rates stated in the Tender or the Priced Schedule of Quantities or, if not so stated, then in accordance with the local “Day Work” rates and wages for the district, provided that in either case vouchers specifying the date and time (and if required by the EE the names of workmen employed) and materials incorporated be delivered for verification to the EE or his representative at or before the end of the week following that in which the work has been executed. The EE is not bound to recognize the cost of materials furnished in vouchers; the CE at his discretion will fix the price of such materials based upon market value.

g. While fixing rates of extra items 15% (Fifteen percent only) shall be allowed over and above the cost of material, labour and all applicable taxes, cess, statutory levies (excluding Income Tax) to cover all supervision, overheads and profits. This shall not however apply where 100% advance is given by the employer for purchase of any material (such as cement, steel etc.). In such cases 3.75% of the cost of materials only shall be allowed as handling charges and 15% shall be allowed only on the labour cost apart from above mentioned taxes etc.

h. Where the quantities of any item in the schedule exceeds by 100% in foundation and in plinth, and 50% in super-structure (above plinth), these extra quantities over 100% & 50% respectively will be treated as extra items of work and priced accordingly as above. [Items such as roads, pavements etc. shall be considered as below plinth]. The

decision of CE for terming items below or above plinth is final & binding on the contractor.

i. For all extra items of work, the contractor should submit to the concerned Corporation's Engineer the necessary particulars along with his analysis and the rate he proposes to claim for consideration within a period of 4 (four) weeks from the time of cropping up of any authorized extra / deviated item. He shall also ensure that all the authorized claims are included in the final bill. If the contractor fails to submit his claim within the stipulated period or the period duly extended by the Corporation's Engineer, then the CE shall proceed to fix the rate for the item(s) and the same shall be final and binding on the contractor.

j. The Contractor shall note that Extra/Deviated items claim and/or any other claim whatsoever if submitted after submission of his Final Bill, will not be entertained and considered by the Employer. The Contractor shall not be allowed to make any Additions/ Alterations/ Revisions / Changes/ Modifications/ Variations in the final bill, after the final bill is submitted by him.

16. SUB-CONTRACTORS:

16.1 All specialist Merchants, Tradesmen and others, executing any work or supplying, fixing any goods for which provisional sums are included in the Schedule of Quantities and/or Specifications, who may be nominated or selected by the CE, who shall be the final authority are hereby declared to be Sub-Contractors and are herein referred to as nominated Sub-Contractors.

16.2 No nominated Sub-contractor shall be employed on or in connection with the work against whom the Contractors shall make reasonable objection or (save where the CE and the Contractor shall otherwise agree) who will not enter into a Contract providing:-

a. That the nominated Sub-Contractor shall indemnify the Contractor against the same obligation in respect of the Sub-Contractor 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 or his servants or agents or any misuse by him or them of any scaffolding or other plant or the property of the Contractor or under any Workmen's Compensation Act in force.

17. THIRD PARTY LIABILITY, DAMAGE TO NEIGHBOURING PROPERTY, LOSS OF MATERIAL AND WORKMEN'S COMPENSATION:

17.1 The Contractor shall be responsible for all injury to persons, animals or things, and for all damage to structural and/or decorative part of property which may arise from the operations or neglect of himself or of any Sub-contractor or any of his 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 his Contract. This Clause shall be held to include inter-alia, any damage to Building, whether immediately adjacent or otherwise and any damage to roads, streets, footpaths, bridges, or ways as well as all damage caused to the building, and the works forming the subject of this Contract by frost, rain, wind or other inclemency of the weather. The Contractor shall fully indemnify the Employer and hold him harmless in respect of all and any expenses arising from any such injury or damage to persons or property as aforesaid and also in respect of all and any claim made in respect of injury or damage under any acts of Government or otherwise and also in respect of any award or compensation or damages consequent upon such claim.

17.2 The Contractor shall fully indemnify the employer against any loss, damage or deterioration for whatever reason, of all materials brought at site and especially material supplied by or paid for partly or wholly by the employer.

17.3 The Contractor shall reinstate all damage and loss of every sort mentioned in this Clause so as to deliver up the whole of the Contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property of the third parties.

17.4 The Contractor shall fully indemnify the Employer against all claims which may be made against the Employer by any member of the Public or other third party in respect of anything which may arise in respect of the works or in consequence thereof.

17.5 The contractor shall at his own expense arrange to effect from the date of commencement & maintain till the date of virtual completion of contract, with any licensed general insurance company, a ***POLICY OF INSURANCE (Contractor's All Risk Policy)*** to cover all such risks detailed above viz. loss, damage & third party liability etc. The policy shall be of an amount as mentioned in Appendix to Conditions of Contract and in the joint names of the employer & contractor and shall be deposited with the employer and renewed as required from time to time during the currency of the contract.

17.6 The Contractor shall also fully indemnify the Employer against all claims which may be made upon the Employer, whether under the ***WORKMEN'S COMPENSATION ACT*** or any other ***STATUTE*** in force during the currency of this Contract or at Common law in respect of any Employee of the Contractor or any Sub-Contractor and shall at his own expense effect and maintain until the Virtual completion of the work, with "licensed General Insurance Company" a ***POLICY OF INSURANCE*** of adequate amount in the joint names of the Employer and the Contractor against such risks and deposit such policy or policies with the employer & renew the same as required from time to time during the currency of the Contract.

17.7 The Contractor shall be responsible for anything, which may be excluded from the Insurance Policies above referred to, and also for all other damage to any property arising out of or incidental to the negligence or defective carrying out of the Contract.

17.8 The amount of insurance to be taken for the above policies will be jointly decided between the contractor and the employer before issue of acceptance letter based on the tendered cost, nature of work, location of site, local hazards etc.

RECOVERY FOR NON EXTENSION OF INSURANCE POLICIES (WORKMEN'S COMPENSATION AND CONTRACTOR'S ALL RISK POLICY INCLUSIVE OF THIRD PARTY LIABILITY)

17.9 In default of the Contractor insuring as provided above, or having insured, failing to renew the same, as required, the Employer, on his behalf may so insure/renew and may deduct the premiums paid from any monies due or which may become due to the Contractor together with penalty amounting to Rs.10,000/- or double the premium amount whichever is more, for each extension of such policy.

17.10 The Contractor shall also fully indemnify the Employer in respect of any costs, charges or expenses arising out of any claim or proceedings at law and also in respect of any award of compensation of damages arising there from.

17.11 The Employer shall be at liberty and is hereby empowered to deduct fully the amount of any damages, compensation costs, charges and expenses arising or accruing any such claim of damage from any sum or sums due or to become due to the Contractor.

18. DELAY AND EXTENSION OF TIME:

18.1 If the works be delayed due to any of the following:

(a) by force majeure ,

(b) by reason of any exceptionally inclement weather,

(c) by reason of proceedings taken or threatened by, or disputes with, adjoining or neighbouring owners, or public authorities,

(d) by the work, or delays, of other Contractors or Tradesmen engaged by the Employer,

(e) by reason of any additional work or instruction ordered by the employer,

(f) by reason of Civil Commotion, local commotion of workmen or strike or lock-out affecting any of the building trades,

(g) in consequence of the Contractor not having received in due time necessary instructions from the CE for which he shall have specifically applied in writing,

(h) from other causes which the CE may certify as beyond the Control of the Contractor,

(i) by reason of non-payment of interim certificate at specified time,

then upon the happening of any such event causing delay the contractor shall immediately, give notice thereof in writing to the Corporation's Engineer, but shall nevertheless use constantly his best endeavours to make good this delay.

18.2 Request for extension of time shall be made by the contractor well in advance but at least 30 days before scheduled date of completion along with revised programme for completion of the work**.**

18.3 In case of strike or lockout the Contractor shall give written notice thereof to the CE as soon as possible but he shall nevertheless constantly use his endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the CE to proceed with the work.

18.4 The CE shall make a fair and reasonable assessment of the delay and grant extension of time accordingly. Such extension shall be communicated to the contractor by the Corporation's Engineer within 3 (Three) months of the date of receipt of such request. Non-application by the contractor for extension shall however not be a bar for giving fair and reasonable extension which shall be as decided by the CE.

18.5 The decision of the CE as communicated by the Corporation's Engineer to the contractor on the extension of time shall be final & binding.

18.6 No claim in respect of compensation or otherwise, howsoever arising, as a result of extension granted under the above conditions shall be admissible.

18.7 *REWARD FOR EARLY COMPLETION:*

18.7(a) If the Contractor completes the work 3 months earlier in all respects with respect to the final date of completion stated in the "Appendix to Condition of Contract" and the Chief Engineer certifies in writing that in his opinion the same has been completed, 0.5% of Final Contract Sum stipulated in the original contract shall be rewarded.

If the contractor completes the work in less than 3 months in advance in all respects with respect to the final date of completion stated in the "Appendix to Condition of

Contract" and the Chief Engineer certifies in writing that in his opinion the same has been completed, 0.1% of Final Contract Sum stipulated in the original contract shall be rewarded.

19. DAMAGE FOR NON-COMPLETION:

19.1 If the Contractor fails to complete the work by the date of completion stated in the "Appendix to Condition of Contract" or within time properly extended under Clause (18) hereof and the CE certifies in writing that in his opinion the same ought, reasonably so, to have been completed, the Contractor shall pay or allow the Employer the sum named in the Appendix as "Liquidated Damages" for the period during which the said works shall so remain incomplete and the Employer may deduct such damages from any money due to the Contractor. In case liquidated damages in accordance with the above provision accrue to maximum limit as mentioned in the Appendix to the Conditions of the Contract, the Chief Engineer shall be at liberty to rescind the Contract and to get it completed entirely at the risk and cost of the Contractor through any other agency he decides to appoint. All extra expenses incurred shall be recoverable from the money due to Contractor or lying to his credit with the Employer against the present or any other Contract.

20. FAILURE BY CONTRACTOR TO COMPLY WITH CE'S INSTRUCTIONS :

20.1 If the Contractor after receipt of written notice from the CE, requiring compliance with such further Drawings and/or his instructions, fails within 7 (seven) days to comply with the same the CE may employ and pay other persons to execute any such work whatsoever as may be necessary to give effect thereto and all additional costs incurred in connection therewith shall be deducted from any money due or to become due to the Contractor.

21 MEASUREMENT OF WORK:

21.1 All items having a financial value shall be entered by the Corporation Site Engineers or by an Engineer authorized for the purpose, in the Measurement Book (MB). All measurements and levels shall be taken jointly by the Site Engineer or his authorized representative and by the Contractor or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by both the parties in token of their acceptance. If any of the measurements recorded are objected by any one of the party a note shall be made to that effect with reason, signed by both parties and referred to Corporation Engineer whose decision in the matter shall be final and binding..

21.2 If the contractor or his authorized representative does not attend for joint measurements periodically for the completed works ,then the site engineer shall take measurements after giving notice in writing of at least 3 (three) days. Measurement recorded in the absence of contractor shall be intimated with a copy of such measurements to the contractor. If the contractor fails to countersign or record objections within a week from date of measurement then, such measurements recorded in his absence by the Site Engineer shall be deemed to be accepted by and binding on the Contractor.

21.3 The Contractor shall, without any extra charge provide all assistance with every appliance, labour and other things necessary for taking measurements and recording levels including test checking of such measurements by any person authorised by the Employer.

21.4 All work shall be measured net as fixed in its place. All measurements of 'cutting' shall be held to include for the consequent wastage on the materials used.

21.5 Except where any general or detail description of the works expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items for which procedure is not covered in the specification, measurement shall be taken in accordance with the relevant Standard Method of measurement issued by BIS and if for any item no such standard is available then a mutually agreed method shall be followed.

21.6 Measurements of all hidden/concealed items of work including extra items if any, such as, work in foundations including excavations, plinth filling, masonry, concrete etc. steel in all R.C.C. work, pipe to be encased etc. shall be jointly recorded by the Site Engineer or his authorised representative and the Contractor's Site Engineer, before they are covered up. Immediately after the work is ready for measurements, Contractor will give specific notice to the Site Engineer for recording the measurements. If the Site Engineer or his authorised representative fails to record the measurements, the Contractor will refer the matter to the Corporation's Engineer for instructions, but in no case shall cover up work without the latter's permission.

22. PAYMENTS:

22.1 The Contractor shall be paid by the Employer, from time to time, by instalment under Interim Certificate to be issued by the Corporation's Engineer to the Contractor on account of the work executed, as mentioned in the Appendix to the Conditions of Contract however subject to recoveries under this Contract. The Interim Certificate shall be based upon Interim Bills or Running Account Bills to be prepared by the Contractor and supported by the detailed measurements. Adequate references, sketches and cross references wherever necessary are also to be provided with detailed measurements. The Corporation's Engineer may allow inclusion in the Interim Certificate such amount as he may consider proper on account of materials delivered upon the site by the Contractor for use in the work but not incorporated in it.

22.2 Provided always that the issue by the Corporation's Engineer of any Certificate during the progress of the works or after their completion shall not relieve the Contractor from his liability in cases of fraud, dishonesty or fraudulent concealment relating to the work or materials or any matter dealt with in the Certificate in case of all defects and insufficiencies in the work or materials which a reasonable examination would not have disclosed. No Certificate of the Corporation's Engineer shall in itself be conclusive evidence that any work or materials to which it is related are in accordance with the Contract;

22.3 Payment upon the Corporation's Engineer's Certificate shall be made within the periods named in the Appendix "Period for honouring Interim Certificate" after such a Certificate has been delivered to the Employer;

22.4 The CE shall have power to withhold any Certificate if the work or any parts thereof are not being carried out to his satisfaction. However, if the final certificate is not issued within the period as mentioned under Clause No.22.5, 26 due to Audit para by CTE etc., the amount involved for such items of deficient work as decided by Chief Engineer would be with held. The same would be allowed as agreed upon by the CTE & the Chief Engineer and the final certificate would accordingly be issued and final bill passed. For such with held amount, a simple interest @ 6% per annum shall be paid to the contractor along with the said payment. Such interest will be calculated from the last date (as mentioned in Appendix to Conditions of Contract) for honouring final certificate till the date of payment.

22.5 The measurements and valuation in respect of the Contract shall be completed within the "period of Final Measurement" stated in the Appendix or if not so stated then within six months of the completion of the contract works as defined in Clause (26) hereof. No further claim shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished.

22.6 The final certificate shall be based on the submission of final measurements or overall measurements of the work (to be taken if so directed by Corporation's Engineer) with all relevant details similar to 22.1 above. The CE may direct the Contractor to resubmit details if the same are found incomplete to issue the final certificate and his decision to accept the details is final and binding on the Contractor.
Final Certificate shall be issued by the CE after the conditions are met with as per 22.4, 22.5, 22.6 and 26 and contractor's submission of **No Claim certificate cum receipt** as per the Proforma given in Appendix to Conditions of Contract.

23. SECURED ADVANCE AGAINST MATERIALS

23.1 The Contractor shall be entitled to be paid advance along with interim bill against materials which are not perishable and which are in the opinion of Corporation's Engineer, required for the works and have been brought on site for incorporation in the work but have not been so incorporated and are safeguarded against loss due to any cause whatsoever, (refer clause no-17). The amount of such advance against materials shall be arrived at on the following basis:

a) 80% of the market value of materials required for the work and brought on site.
OR

80% of the cost of such materials (brought on site) as derived from the relevant accepted tender rate for the particular item involving such materials;
which ever is lower.

b) Such advance payment made against materials shall be recovered from or adjusted from the interim bills as and when the materials are utilized in the work.
Examples of certain perishable materials on which no advance shall be paid are Sand, Paint, Bitumen, Hard Boards/Soft Boards and other paper products, Petroleum Products, Coal Tar, Insulating Boards etc.

23.2 In case of dispute, the decision of the Chief Engineer on whether advance payment can be made against specific materials shall be final and binding.

24. UNFIXED MATERIALS AND EQUIPMENTS:

24.1 All tools, plants and materials brought to the site by the Contractor shall vest in the Employer and shall not be removed from the site of works except by permission of the Corporation's Engineer in writing. The Employer shall have a lien on these materials and plants.

25. REMOVAL OF IMPROPER WORK:

25.1 The Corporation's Engineer 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 as may be specified in the order, of any materials, which in their opinion are not in accordance with the Specifications or instructions, the substitution of proper materials and the removal and proper re-execution of any work executed with materials or workmanship not in accordance with the Drawings and Specifications or Instructions and the Contractor shall forthwith carry out such an order at his own cost. In case of default on the part of the Contractor to carry out such an order, the CE shall have the

power to employ other persons to carry out the same and all expenses consequent thereon or incidental thereto as certified by the Corporation's Engineer shall be borne by the Contractor and may be deducted from any amounts due or that may become due to the Contractor.

26. VIRTUAL COMPLETION:

26.1 The work shall be completed in accordance with the Contract and to the entire satisfaction of Chief Engineer. All unused materials, tools, plants, scaffoldings, temporary structures, hutments and things belonging to the Contractor shall be removed and the site of works cleared of rubbish and all waste materials by the contractor at his own expenses and delivered up tidy to the employer. After completion of the work, the contractor will serve a written notice to the CE to this effect. The Chief Engineer after satisfying himself shall thereupon approve the virtual completion. The Defect Liability Period shall commence from the date of such certification.

27. DEFECTS AFTER COMPLETION:

27.1 The defects, shrinkage, settlements or other faults, which may appear within "the Defects Liability Period, stated in the "Appendix to the Conditions of Contract" or if not stated then, within 12 (twelve) months after virtual completion of the work, arising on account of materials or workmanship not in accordance with the Contract shall, upon the directions in writing of the Corporation's Engineer and within such reasonable time specified therein, be amended and made good by the Contractor at his own cost unless the CE shall decide that he ought to be paid for such amendment and for making good, and in case of default, the CE may employ and pay other persons to amend and make good such defects, shrinkage, settlement or other faults, and all damages, loss and expenses consequent thereon or incidental thereto shall be recovered from any monies due or that may become due to the Contractor. The CE may in lieu of such amending and making good by the Contractors, deduct from any money due or that may become due to the Contractor, a sum to be determined by the CE equivalent to the cost of amending such work. Should any defective work have been done or materials supplied by any Sub-Contractor employed on the work, who has been nominated or approved by the CE as provided in Clause No.16 the Contractor shall be liable to make good in the same manner as if such work or material had been done or supplied by the Contractor and been subjected to the provisions of this Clause and Clause No.2 hereof. The Contractor shall remain liable under the provision of this Clause notwithstanding the payment of any Certificate or the passing of any accounts.

28. PROVISIONAL SUMS, APPLICATION OF:

28.1 For all the work listed under items for which provisional sums are provided in the tender, the CE reserves the right to invite separate tenders or select or order from any manufacturer or firms at his discretion and reserves to himself the right of paying direct to persons or firms for any such work. The Contractor will not have any claims over these items, but if tenders are invited for such items, he will also be invited to quote along with others.

28.2 If ordered by the CE, Contractor shall be required to carry out provisional sum items at the same conditions and rates as applicable for this Contract.

29. OTHER PERSONS ENGAGED BY THE EMPLOYER:

29.1 CE reserves the right to execute any work not included in this Contract, which he may desire to have carried out, by other persons and the Contractor shall allow all reasonable facilities and the use of his scaffolding and plant for the execution of such work, but is not required to provide any special plant or materials for the execution of such work except by special arrangement with the Employer. Such work shall be carried out in such manner as not to impede the progress of the work included in the

Contract and the Contractor shall not be responsible for any damage or delay which may happen to or be occasioned by such work.

30. SUSPENSION BY THE CONTRACTOR:

30.1 If the Contractor except on account of any legal restraint upon the Employer preventing the continuance of the work, shall suspend the work or in the opinion of the CE shall neglect or fail to proceed with due diligence in the performance of his part of the Contract or if he shall make default in respect of Clause No.2, the Employer shall have the power to give notice in writing to the Contractor requiring that the work be proceeded within a reasonable manner and with reasonable dispatch. Such Notice shall purport to be a notice under this clause. After such notice is 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 belonging to him, which shall have been placed thereon for the work and the Employer shall have a lien upon all such plant and 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 given to proceed with the work as therein prescribed, the CE may proceed as provided in Clause No.31.

31. DETERMINATION OF CONTRACT BY EMPLOYER:

31.1 If the Contractor (being an individual or a firm) commit any "Act of Insolvency" or shall be adjudged as Insolvent or shall make an assignment or composition of the greater part in number or amount of his creditors or shall enter into a deed of assignment with his creditors, or being an Incorporated Company shall have an order made against him or pass an effective resolution for winding up either compulsorily or subject to the supervision of the Court or Voluntarily or if the official Assignee of the Contractor shall repudiate the Contract or if the official Assignee or the Liquidator in any such winding up shall be liable within 7 (seven) days after notice to him requiring him to do so, to show to the reasonable satisfaction of CE that he is able to carry out and fulfil the Contract and if required by the CE to give security therefore or if the Contractor (whether an Individual Firm or Incorporated Company) shall suffer execution to be issued or if the Contractor shall suffer any payment under this Contract to be attached by or on behalf of any of the creditors of the Contractors or if the contractor shall assign or sublet the Contract without the consent in writing of the CE first obtained or if the Contractor shall charge or encumber this Contract or any payment due or which may become due to the Contractor there under, or if the CE shall certify in writing that in his opinion the Contractor,

a. has abandoned the Contract, or

b. has failed to commence the work, or has without any lawful excuse under these conditions suspended the progress of the work for 7 (seven) days after receiving from the CE written notice to proceed, or

c. has failed to proceed with work with such due diligence and failed to make such due progress as would enable the work to be completed within the time agreed upon, or

d. has failed to complete the work within the stipulated date including authorised extensions or

e. has failed to remove the materials from the site or to pull down and replace the work within 7 (seven) days after receiving a written notice from the Corporation's Engineer that the said materials or work were condemned or rejected or

f. has neglected or failed persistently to observe and perform all or any of the acts, matters, or things, by this Contract to be observed and performed by the Contractor for 7 (seven) days after written notice shall have been given to the Contractor requiring the Contractor to observe or perform the same, or

g. has to the detriment of good workmanship or in defiance of the CE's instructions to the contrary sub-let any part of the Contract.

then and in any of the said causes, the CE notwithstanding any previous waiver, after giving 7 (seven) days notice in writing to the Contractors, determine the Contract, but without thereby affecting the powers of the CE or the obligations and liabilities of the Contractor, the whole of which shall continue to be in force as fully as if the contract has not been so determined and as if the work subsequently executed had been executed by or on behalf of the Contractor. And further, the Employer, his agents or servants, may enter upon and take possession of the work and all plant, tools, scaffolding, sheds, machinery, steam and other power, utensils and materials, lying upon the premises or the adjoining lands or road and use the same as his own property or may employ the same by means of his own servants and workmen in carrying on and completing the work or by employing any other Contractors or other person or persons 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 Contractor, other persons or person employed for completing and finishing or using the materials and plant for the work. When the work shall be completed or as soon thereafter as convenient, the CE shall give a notice in writing to the Contractor to remove his surplus materials and plant and should the Contractor fail to do so within a period of 14 (Fourteen) days after receipt thereof by him, the Employer may sell the same by public auction and shall give credit to the Contractor for the amount so realised. The CE shall thereafter ascertain and certify in writing under his hand what (if anything) shall be due or payable to or by the Employer for the value of the said plant and materials so taken possession of by the Employer and the expense or loss which the Employer shall have been put to in getting the work to be so completed, and the amount, if any, owing to the Contractor and the amount, which shall be so certified shall thereupon be paid by the Employer to the Contractor or by the Contractor to the Employer, as the case may be and the Certificate of the CE shall be final and conclusive between the parties.

32. TERMINATION OF CONTRACT BY CONTRACTOR:

32.1 If payment of the amount payable by the Employer under any Certificate of the EE shall be in arrears as unpaid for 60 (sixty) days after notice in writing requiring payment of the amount with interest of aforesaid shall have been given by the Contractor to the Employer, or if the work be stopped for six months under order of the CE or by any injunction or other order of any Court of Law, then and in any of the said cases, the Contractor shall be at liberty to determine the Contract by notice in writing to the Employer and he shall be entitled to recover from the Employer payment for all the work executed and for any loss, he may sustain upon any plant or material supplied or purchased or prepared for the purpose of the Contract.

32.2 In arriving at the amount of such payment, the net rates contained in the Contractor's original tender shall be followed or where the same may not apply, valuation shall be made in accordance with Clause No.15 hereof.

33. DETERMINATION OF CONTRACT DUE TO ABANDONMENT OR REDUCTION IN SCOPE OF WORK:

33.1 If at any time after the acceptance of the tender, the Employer shall for any reasons whatsoever not require the whole or any part of the works to be carried out, the CE shall give notice in writing to the Contractor who shall have no claim to any payment of compensation or otherwise whatsoever on account of any profit or advantage which he might have derived from the Execution of the whole of the works.

The Contractor shall be paid at contract rates for the full amount of work executed and in addition:

a. The cost at site of all surplus approved materials collected for incorporation in the work, which the Contractor does not wish to retain and which shall thereafter become the property of the Employer.

b. Where the Contractor desires to retain the surplus of approved materials (excepting materials supplied by the Employer or obtained in Employer's name, which shall, in any case, be returned to the Employer) the cost of handling and cartage charges for removal from the site to a reasonable distance not exceeding 25 kms.

c. If upon the determination of the Contract under this condition, the Contractor is of the opinion that he has suffered hardship by reason of the operation of these conditions, he may refer the circumstances with full details to the Chief Engineer, who on being satisfied that such hardship exists or has existed, shall make such allowance, if any as in his opinion is reasonable, and his decision shall be final, conclusive and binding.

34. DISPUTES TO BE FINALLY DETERMINED BY CHIEF ENGINEER:

34.1 The Instruction, Decision, Opinion, Direction, Certificate or Valuation of the CE with respect to all or any of the matters under Clause (2), (3), (5), (6), (9), (14), (15), (18), (23), (27), (30), (31) and (33) hereof (which matters are herein referred to as EXCEPTED MATTERS) shall be final and conclusive and binding on the parties hereto and shall be without appeal. Any other Decision, Opinion, Direction, Certificate or Valuation of the CE or any refusal of the CE to give any of the same shall be subject to the right of Arbitration and review as given under Clause No.36.

35. SECURITY DEPOSIT AND PERFORMANCE GUARANTEE AND EMD:

35.1 Amount towards Security deposit shall be calculated as per details given under Serial No.10 of "APPENDIX TO CONDITIONS OF CONTRACT" in Part - II of the tender. Security Deposit can be either in Cash or in the form of Bank Guarantee.

In case of cash option, the EMD shall be retained as part of Security Deposit and balance Security Deposit shall be accumulated through deductions from Running Account Bills at 7.5% (maximum) of gross amount of bill. In case of Bank Guarantee option, the Contractor shall furnish one Bank Guarantee for full amount of Security deposit valid till end of defects liability period OR, Two Bank Guarantees of like amounts each equal to half the Security deposit; one valid till virtual completion and the other till end of defects liability period.

Amount towards Earnest Money deposit (EMD) shall be deposited as per details given in "APPENDIX TO CONDITIONS OF CONTRACT" in Part - II of the tender. If the lowest tenderer withdraws his tender before the expiry of validity period or before the issue of letter of Acceptance, whichever is earlier, or makes any modification in the terms and conditions of the tender which are not acceptable to the department, then the EMD shall be forfeited as stipulated in the "APPENDIX TO CONDITIONS OF CONTRACT".

35.2 Performance Guarantee under Serial No.10 of "Appendix to Conditions of Contract" shall be only in the form of Bank Guarantee valid upto scheduled date of completion.

35.3 The Bank Guarantee/s shall be from any Nationalised / Scheduled Bank approved by the Chief Engineer, which is located at the Zonal Office Headquarters of L.I.C within whose jurisdiction the work falls or at the place of work.

The Chief Engineer/ Dy. C.E. may also permit the contractor to furnish the Bank Guarantee/s from a location other than the above where a Branch/ Divisional Office of the Corporation exist.

35.4 Bank Guarantee/s (BGs) against Security Deposit (SD) and Performance Guarantee (PG) shall be executed as per the specimen pro-forma at Annexure B and C. The Bank Guarantee/s against Security Deposit (SD) shall be submitted within 21 (twenty one) days from the date of issuance of letter of acceptance or within 21 (twenty one) days from the extended date as may be extended by the Chief Engineer. The Bank Guarantee/s against Performance Guarantee (PG) shall be submitted within **10 (ten) days** from the date of issuance of letter of acceptance.

35.5 In case of failure by the contractor to furnish the Bank Guarantee against Performance Guarantee as per Cl.35.2 by the stipulated date, Employer shall without prejudice to any other right or remedy available in law, be at liberty to cancel the tender which may entail forfeiture of the Earnest Money of contractor as stipulated in "Appendix to Conditions of Contract".

35.6 50% of the Security Deposit (cash option) shall be refunded after the certificate of virtual completion is issued to the contractor & provided that the employer has no claim for forfeiture of part or whole of the said deposit.

35.7 Balance 50% of Security deposit will be refunded to the contractor after the satisfactory completion of the defects liability period, subject to deductions for any appropriations thereof required to be made by the employer as per the conditions of contract.

35.8 If one Bank Guarantee in lieu of total Security Deposit is furnished, the same will be released only after the successful completion of Defects Liability period subject to any appropriations as aforesaid.

35.9 If two Bank Guarantees in lieu of Security deposit are furnished, the First Bank Guarantee will be released after the certificate of Virtual completion is issued to the contractor and second shall be released after the satisfactory completion of Defects Liability Period subject to any appropriations as aforesaid.

35.10 Bank Guarantees towards Performance Guarantees (where applicable) shall be released after the virtual completion is issued.

35.11 Contractor shall keep the Security Deposit and Performance Guarantee, where applicable, replenished to its full value whenever any recovery or appropriation there from occurs. The employer reserves the right to do so from any money(s) due to the contractor lying with them.

35.12 The Contractor should note that no interest will be allowed on any part of the Security deposit.

35.13 No deductions will be effected from the bills when the total security deposit is paid in the form of Bank Guarantee(s) and the E.M.D shall be refunded after acceptance of Bank Guarantee(s).

35.14 In the event of failure by the contractor to submit Bank Guarantee(s) by the specified / extended date, recovery of Security deposit shall be effected from the R.A Bills. However, where the contractor fails to furnish Bank Guarantee against Performance Guarantee the matter shall be dealt with as per Cl. 35.5 above.

35.15 In all cases of Bank Guarantees, there shall be further provision of claim period of 6 months. If the contract period gets extended for any reason whatsoever, the contractor shall obtain the required extensions to the Bank Guarantee(s).

36. SETTLEMENT OF DISPUTES, ARBITRATION:

36.1 All disputes and differences of any kind whatsoever arising out of or in connection with the Contract or the carrying out of the work (whether during the progress of the work or

after its completion and whether before or after determination, abandonment or breach of the Contract) shall be referred by the Contractor, in the first instance for their settlement, by Chief Engineer/ Dy.C.E.- in-charge within 15 (fifteen) days of any such matter arising. The CE/ Dy.C.E.- in-charge shall upon receipt of such reference, convey his written instructions or decision within 30 (Thirty) days to the contractor.

If the decision given so by the Chief Engineer is not acceptable to the contractor due to legitimate reason, a consensus will be arrived through the DISPUTE RESOLUTION COMMITTEE (DRC), which will be constituted by LIC of India.

If the contractor is still not satisfied with the decision of the Chief Engineer based on the DRC report in any matter, other than EXCEPTED MATTERS, then and in any such case, the Contractor shall within 30 (Thirty) days after receiving notice of such decision give a written notice to the Employer requiring that such matters in dispute (other than EXCEPTED MATTERS) be arbitrated upon.

Such written notice shall specify the matters which are in dispute or difference of which such written notice has been given and no other shall be and is hereby to be referred to the Arbitration. In case the Contractor fails to serve the written notice on any or all the issues in dispute within 30 (Thirty) days the decision conveyed by the CE shall be taken as final, binding and conclusive and shall not be open to arbitration.

36.2 Any disputes or differences that the employer may have with the contractor shall also be referred to Arbitration.

36.3 All disputes between the parties to the contract (other than those for which the decision of the CE or any other person is by the contract expressed to be final & binding) shall after written notice by either party to the contract to the other of them be referred to sole arbitration by an Arbitrator to be appointed by the Executive Director (Engineering), which shall be final and binding.

36.4 If the arbitrator so appointed resigns his appointment or vacates his office or is unable or unwilling to act due to any reason whatsoever, the appointing authority shall appoint a new arbitrator in his place.

36.5 The Sole Arbitrator shall determine all matters in disputes other than EXCEPTED MATTERS (referred in Cl.No.34) which shall be referred to the Sole Arbitrator.

36.6 The references to arbitration by contractor on the matter of withholding by the Employer the certificate for interim payment can take place during the currency of the contract. However, on other kinds of disputes, unless both the parties agree in writing, reference of such disputes to arbitration shall not take place until after the completion or alleged completion of the work or termination or determination of contract.

36.7 It is a term of the contract that the person invoking Arbitration shall state the facts supporting his claim, the points at issue and the relief or remedy sought.

36.8 It is also a term of the contract that if the contractor does not make any demand for arbitration in respect of any claims within 120 days of receiving the intimation from the Corporation that the final bill is ready for payment, the claims if any received after 90 days period shall be absolutely barred from reference to the Arbitrator.

36.9 The Arbitration shall be conducted in accordance with the provisions of the Arbitration and Conciliation Act 1996 or any statutory modifications or Amendment to it from time to time.

36.10 In all cases Arbitration shall give separate award for each dispute or difference referred to him. The Arbitration shall decide each dispute in accordance with term of the contract and give a reasoned award. The venue of arbitration shall be in accordance

with Arbitration Act. However, it may preferably be at L.I.C. of India, Zonal Centre or Place of Work Site.

36.11 The work under contract shall continue during the Arbitration proceedings and no payment due or payable to the contractor shall be withheld on account of such proceedings.

36.12 The Arbitration is deemed to have entered on the reference on the date he issues notice to both the parties calling them to submit their statement of claims and counter statement of claims.

36.13 Any fees payment/ reimbursements payable to the Arbitrator shall be shared equally by both the parties.

36.14 The Contractor hereby also agrees that Arbitration under this Clause shall be a condition precedent to any right of action in Law Courts under the Contract.

37. LUMP SUM ADVANCE (APPLICABLE TO CONTRACT COSTING Rs.25 LAKHS AND ABOVE)

37.1 Loan will be available if required by the Contractor, and may be given as under on submission of application by him subject to other conditions being fulfilled.

37.2 A lump sum amount not exceeding 10% in two instalments (5% + 5%) of the Contract accepted amount may be advanced against a Bank Guarantee and at the interest rate as specified in Appendix to the Conditions of Contract. The advance shall be utilised by the Contractor for the purpose of this Contract only and for no other purpose.

37.3 The Bank Guarantee (Proforma at Annexure 'C') shall be for the equivalent amount of loan 'plus' simple interest at specified rate plus 1% of loan amount to cover costs. The Bank Guarantee shall be from any Nationalised or Scheduled Bank preferably located at Zonal Head Quarters of LIC or place of work and shall be valid till the date of completion as specified in Appendix to Conditions of Contract.

37.4 The amount of loan can be sanctioned to the Contractor on specific request as per terms of the contract and will be limited to 10% in two instalments (5% + 5%) of the Contract accepted amount.

37.5 Recovery of the sums advanced by way of loan as above and of interest, thereon shall be made by deduction from the Contractor's running account bills in suitable percentages in relation to the progress of work after, 10% of the work is completed, subject to the condition that entire amount of loan with interest thereon shall be fully recovered by the time the work amounting to 80% of the Contract sum is completed. Provided that if at any time the Contractor fails to execute the Contract to the satisfaction of the Employer for any reason whatsoever, the Employer shall be entitled to recall forthwith the entire amount so advanced with interest, cost and legal expenses, etc. and/or recover the whole/balance amount as the case may be, from the bill if any, payable to the Contractor or by enforcing the Bank Guarantee.

37.6 Whenever extension of time is granted to the Contractors for the completion of the project and where the loan is not fully recovered, Contractor shall furnish fresh Bank Guarantee for extended period of Contract for the outstanding loan amount together with specified simple interest for the remaining period and 1% of outstanding loan amount towards costs.

37.7 Whenever the full amount of loan plus interest has been fully recovered, the Bank Guarantee shall be released.

37.8 If the situation so warrants a second loan will be available if required by the contractor subject to the following conditions :

a) At least 50% of the first loan stands recovered
b) The amount of the loan shall not exceed 5% of the balance amount of work.
c) The sum of amount outstanding plus amount of second loan shall not exceed 5% of the total value of work.

37.9 All other conditions applicable to lump-sum advance shall apply for the Second loan also.

GENERAL INSTRUCTIONS TO CONTRACTORS

1. DRAWINGS:

1.1 Drawings shall be kept open for inspection at places as mentioned in the letter to the contractor from the Chief Engineer. Drawings generally include the site plan, floor plans, elevations and sections of the proposed work.

2. INSPECTION OF SITE:

2.1 The Tenderer shall visit and examine the site of work and satisfy himself as to the nature of the existing roads or other means of communication, the character of the soil and of the excavations, the correct dimensions of the work and facilities for obtaining materials and shall obtain generally his own information on all matters affecting the execution of the work. No extra charge made, in consequence of any misunderstanding or incorrect information on any of these points or on the grounds of insufficient description will be allowed. All expenses incurred by the Tenderer in connection with obtaining information for submitting this tender including his visits to site and efforts in compiling the Tender shall be borne by the Tenderer and no claims for reimbursement thereof shall be entertained.

3. WHOLE WORK TO BE COMPLETED IN THE SPECIFIED COMPLETION PERIOD:

3.1 The whole work is to be completed within the completion period stated in the Appendix to Conditions of Contract or the extended date of completion, if any. The Contractor will be required if necessary, to work overtime to complete the work by the stipulated date. No extra will be allowed on the Contract sum for such overtime work.

4. TIME AND PROGRESS CHART:

4.1 The contractor shall prepare and submit a master programme in the form of Time and Progress Chart of all activities required to be executed for completion of the work in all respects within 15 (fifteen) days of the communication of acceptance of the tender, to the Corporation's Engineer. The Time and Progress chart shall be fitted within the specified overall period of completion (as stated in Appendix to Conditions of Contract). If the Contractor does not submit the Time and Progress Chart, the employer may be at liberty to prepare the Time & Progress Chart which shall be accepted in full in letter and spirit to maintain the pace of the progress of the work.

In addition to the above if the Contract Sum is Rs. 15 crore and above, the contractor has to submit monthly progress report of the work in a computerised form to the Corporation's Engineer. This progress report should contain the following:-

(a) Construction Schedule of the various components of the work through a bar chart for the next three months period.

(b) Progress Chart of various components of the work which are planned and achieved for the preceding 3 months and reasons for deviation if any should be mentioned.

(c) Details of the technical persons available at the site along with their designation.

(d) Targeted figure for financial achievement vis-à-vis planned and mentioning the broad details of all the Running Account Payment received.

(e) A statement showing the extra/ substituted/ deviated items submitted by the contractor and the items pending for sanction/ decision by the department.

(f) Quality assurance and quality control test conducted during the month with the results thereof.

(g) Details of hindrances if any.

4.2 Ancillary work should be so started that all such work is completed before the specified overall contractual period of completion.

4.3 The Contractor shall assume full responsibility for any delay in delivery of materials by Merchants or nominated Sub-Contractors not having completed the work in accordance with the Time and Progress Chart. Such excuses shall not form any criterion for extension of time, or any claims by the Contractor.

5. BENCHES:

5.1 The Contractor is to construct and maintain proper benches to indicate the inter-section of all main walls in order that the lines and levels may be accurately checked at all times. The Contractor shall provide suitable stones with flat tops and build the same in concrete for temporary or permanent benchmarks. All the pegs for setting out the work and fixing the necessary levels required for the execution thereof shall, if desired by the Corporation's Engineer likewise, be built in masonry at such places and in such a manner as the Corporation's Engineer may determine. Contractors' rates shall cover for these factors.

6. DRAWINGS ON SITE:

6.1 The Drawings maintained on the site are to be carefully mounted on boards of appropriate size and covered with a coat of approved transparent varnish or laminated at the cost of the Contractor. They are to be protected from the ravages of termites, ants, silver fish and other insects.

7. ORDER OF WORK:

7.1 The Chief Engineer reserves the right to fix the order in which the various items of work involved in this Contract is to be executed and Contractor shall comply with the same. There shall be no extra claims on account of this.

8. WORKMANSHIP:

8.1 The Work calls for a high standard of workmanship combined with speed.

9. REJECTED WORKMANSHIP OR MATERIALS:

9.1 Any workmanship, or materials not complying with the specific requirements or approved samples, or which have been damaged, contaminated or deteriorated, must be removed immediately from the site and replaced at the Contractor's expense as directed.

10. QUOTED RATES:

10.1 Contractor should note that unless otherwise stated the tender is strictly on **PERCENTAGE** Rate basis and his attention is drawn to the fact that his quoted percentage rates should be correct, workable and, self supporting.

11. WATCHING AND LIGHTING:

11.1 The Contractor from the time of being placed in possession of the site must allow for watching, lighting and protecting the work, the site and surrounding, properly by day and night on all days including Sundays or other holidays, at his own cost.

12. WATER:

12.1 The rates quoted by the Contractors shall include for providing all water required for the work including that required by special tradesmen and Sub- Contractors and pay all charges required by Local Municipal or other Authorities. Water must be clean, fresh, pure and free from earth, vegetable or organic matters, acid or alkaline substance in solution or suspension. The Contractors shall make their own arrangements for water supply. If supply from the Municipality or other local bodies be inadequate, the Contractor should provide tube well or wells or open well at his own cost. The Contractors must execute any temporary plumbing and pay all fees and charges. All health regulations in force shall be strictly observed by the Contractor and pay all necessary charges.

13. ELECTRICITY:

13.1 The Contractor shall arrange with the concerned Electricity Supply Authorities for a temporary meter and supply to the site and shall provide all temporary wiring, power and lighting points for the whole of the works and clear away when no longer required. He shall pay all charges for the same and for electricity consumed, including that consumed by Sub-Contractors. The Contractor should submit disconnection & no dues certificate from the supplying authority along with his final bill.

14. OFFICE FOR CORPORATION'S ENGINEER ON SITE:

14.1 The Contractor shall at his cost, provide a separate office (of suitable size) for the Corporation's Engineer/s on site with writing tables, chairs, electric lights and fans, drinking water arrangements, etc. as directed by the Executive Engineer and clear away at completion of work and make good all work disturbed and pay all charges. The Contractor shall also provide facilities for having the Corporation Engineer's office cleaned every day and kept in good and hygienic condition.

15. OFFICE ACCOMMODATION FOR CONTRACTOR'S STAFF :

15.1 The Contractor shall, at his cost, provide, fit-up and maintain in an approved position proper office accommodation for his representative and staff, which offices shall be open at all reasonable hours to receive instructions, notices or communications and clear away on completion and make good all work disturbed.

16. SECURITY AND PROTECTION:

16.1 The Contractor shall at his cost, provide any necessary temporary enclosures, gates, entrances, etc. for the protection of the work and materials and for altering and adapting same as may be required and removing at completion of the works and making good all works disturbed.

16.2 During inclement weather, the Contractor shall suspend concreting or plastering for such time as the Corporation's Engineer may direct and shall protect such work in course of execution from damage by approved measures.

16.3 Should the work be suspended by reason of rain, strike, lock-outs or any other cause, the Contractor shall at his cost take all precautions necessary for the protection of the work and shall make good any damage arising from any of these causes.

16.4 The Contractor shall at his expense cover-up and protect from injury from any cause, all new work and supply all temporary doors protection to windows, and any other requisite protection for the whole work executed, whether by himself or special tradesmen of Sub-Contractors and any damage caused must be made good by the Contractor at his own expense.

16.5 All fences, trees, shrubs, grasses, lawn and other surfaces around the buildings or approaches thereto, which are required to be maintained are to be kept free from damage due to operations in connection with the work, at Contractor's expense.

16.6 The Contractor shall, at his expense, protect all projecting sills, jambs, copings, stone or concrete treads and mouldings and all concrete steps, wood work and joinery and the like from injury during the progress of the work.

16.7 The Contractor shall at his cost, protect joinery and make good all damages to the same from any cause whatsoever during the performance of the Contract and leave perfect to the satisfaction of the CE at completion. Before giving possession, the Contractor must see that all doors, windows and ventilation etc. work easily and shall make all necessary adjustments for such smooth working.

17. SANITATION:

17.1 The Contractor shall at his cost provide adequate latrine facilities and keep the same in a clean and hygienic condition to the satisfaction of the Public Health Authorities and shall cause such latrine and night soil to be cleared away whenever necessary and shall make good all works disturbed by these conveniences.

18. MINIMUM WAGES ACT:

18.1 The Contractor shall pay rates of wages and observe hours of work and conditions of employment to existing rules under Minimum Wages Act. Further, it shall be Contractor's responsibility to ensure that he pays his workmen wages, which are not lower than the minimum prescribed by the Union Government and State Government in which area this Contract, is being operated.

19. SHEDS FOR MATERIALS:

19.1 The Contractor shall at his cost provide and maintain proper approved sheds for the storage and protection of materials etc. and other work that may be executed on the site including the tools and materials of Sub-Contractors and remove on completion. Sheds for storage of Cement are to have floors raised from the ground.

20. TEMPORARY ROADS:

20.1 The Contractor shall, at his expense, provide such temporary roads on the site as may be necessary for the proper performance of the Contract and for his own convenience but not otherwise. Upon completion, such roads shall be broken up and levelled where so required by the Drawings at Contractor's expense unless the CE shall otherwise direct.

21. OBJECTS OF VALUE AND ANTIQUITY FOUND ON SITE:

21.1 All objects of value or antiquity found on the site shall remain the property of the Employer and such findings shall be immediately reported to the Chief Engineer.

22. WORKS AND SITE TO BE KEPT AND DELIVERED UP CLEAN:

22.1 All shavings, cuttings and other rubbish as it accumulates from time to time during the progress of the work and at completion, including that of Sub- Contractor and special tradesman to be cleared and carted away. All rejected materials shall be removed. Contractor's quoted rates shall allow for these factors.

23. USEFUL EXCAVATED MATERIALS:

23.1 Any sand, gravel, moorum or rock taken from excavation will remain the property of the Employer and in the event of it not being allowed to use in the work, the Employer reserves the right to dispose it off in any way he wishes or to direct the Contractor to cart it away as ordinary materials.

23.2 Should suitable sand or gravel or moorum or rock be found in the excavations and the Contractor be allowed to use the same in the work, in place of materials to be brought by him from outside he will be required to pay the Employer the full market value of the same.

24. SIGN BOARD AND HOARDINGS:

24.1 The Contractor shall not affix or place any placards or advertisement of any description or permit the same to be affixed or placed in or upon any hoarding, gantry, buildings or structure other than that approved by the Chief Engineer.

25. SCIENTIFIC AND MEASURING INSTRUMENTS:

25.1 Theodolite, levels, prismatic compass/chain, steel and metallic tapes and all other surveying instruments found necessary on the works, shall be provided by the Contractor at his expense for the due performance of this Contract as instructed by the Corporation's Engineer.

26. TOOLS FOR MASONS:

26.1 Every bricklayer or plasterer on the work shall be provided with suitable level, battens, trowels, wooden floats and breaking hammers for cutting bricks and templates, to enable him to carry out the work in a neat and workman like manner and each gang of brick layers or plasterers not exceeding six in number shall be provided with a suitable measuring rule, a plumb bob, a spirit level and a square in addition to the above mentioned, all to be to the approval of the Site Engineer.

27. CONTRACTOR'S MISTERIES AND SUPERVISORS:

27.1 The Contractor's Misteries and the Supervisors on the works shall carry with them a suitable measuring rule, a measuring tape, a spirit level, a plumb bob and a square and shall check the work of the bricklayer, plasterers, and carpenters and joiners to see that the work is being done according to the Drawings and Specifications. The Corporation's Engineer/Supervising Staff will use any and all measuring instruments or tools belonging to the Contractor as he chooses, while checking the work executed or being executed on the works.

28. NO OVERLOADING OF SLABS:

28.1 Floors of buildings under construction shall not be loaded by stacks of materials during construction without the prior approval of Corporation's Engineer. It is important that no

load comes on the reinforced concrete floors until they are at least three weeks old and at no time must the load placed upon them exceed the load for which they are designed.

29. ALTERNATIVE ITEMS:

29.1 In regard to alternative items, if any, specified in the Schedule of Quantities, Contractor should note that the Employer reserves the right to order the Principal item or its alternatives at the CE's discretion.

30. ATTENDANCE ON SUB-CONTRACTORS:

30.1 Co-ordination: The Contractor shall be responsible for the co-ordination of all the work including that of Sub-Contractors, for arranging runs of all services and working to the requirements and layout of the specialist trades, in all matters necessary for the complete execution of the work.

30.2 Rates quoted by the Contractor shall be inclusive of all attendance on Sub- Contractors or other Contractors nominated by the Employer. Contractor must allow for provision of the use of his scaffolding to Sub-Contractors and for its retention until such time all relevant Sub-Contract works are completed.

30.3 The Contractor shall accept liability for and bear the cost of the supply of all necessary water, electricity, lighting, watching etc. for the Sub-Contractors work.

30.4 The Contractor must allow in his rates for making good any holes and chases left by the Sub-Contractors or other Contractors nominated by the Employer before the Builder's Work is completed and handed over.

30.5 The Contractors shall, at all times, give access to workmen employed by the local or other authorities or any men directly 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 directed by the Chief Engineer, as may be required, to enable such workmen to lay or fix pipes, electric wiring, special fittings etc. Contractor's quoted rates shall allow for these factors.

31. OCCUPATION BY EMPLOYER:

31.1 The Employer reserves the right to occupy the works by sections as completed, as may be considered by the Chief Engineer both practicable and reasonable and without hindrance to the Contractor's progress.

32. TAXES, DUTIES, LEVIES AND DEDUCTION AT SOURCE:

32.1 The contractor shall be responsible to pay all statutory levies imposed by the State and Central Government such as Income Tax, Sale Tax on works contract, Value Added Tax (VAT), Excise Duty, Octroi, Labour Cess and any other applicable taxes etc. and the rates quoted in the tender shall allow for the same.

32.2 Liabilities towards Service Tax for Contractor and Employer shall be in accordance with relevant provisions of the Finance Act, 2012 or any amendment issued by concern Authority from time to time.

32.3 Rates are inclusive all the taxes excluding service tax and contractors will be responsible for payment of applicable service tax (contractor's part) to concerned authority, which will be reimbursed to contractor on production of proof of, payment of Service Tax deposited.

32.4 All the bidders are requested to submit a copy of the Service Tax Registration Certificate issued by the Central Excise department.

32.5 Deduction at source of Income Tax, Sales Tax on works contract, Labour Cess etc. shall be made by LIC of India as per the provisions prevailing from time to time from the Running Account or Final Bills and remitted to the concerned Taxation Authorities/ State Government on behalf of the contractor.

ANNEXURE – 'A'

PROFORMA FOR

ARTICLES OF AGREEMENT

(Applicable for Contracts with completion period more than Six Months)

ARTICLES OF AGREEMENT made at..... this……..... day of……. ..... 20..... between THE LIFE INSURANCE CORPORATION OF INDIA, a body corporate constituted and established by the Life Insurance Corporation Act, 1956 (Act 31 of 1956) and having its Central Office at "Yogakshema", Jeevan Bima Marg, Mumbai and ITS Zonal Office at Jeevan Prakash Building (2nd Floor), 25, K.G. Marg, New Delhi - 110001 hereinafter called the Employer (which expression shall include its successors and assignees wherever context or meaning shall so require or permit) of the one part and M/s ……..... (hereinafter called **"The Contractor"**) of the other part.

WHEREAS the Employer is desirous of constructing the……...

and has prepared drawings and specifications and the Schedule of Quantities which have been signed by or on behalf of the parties hereto.

AND WHEREAS the Contractor has agreed to execute upon and subject to the conditions and instructions set forth herein (hereinafter referred to as **"the said Conditions")** the works shown upon the said drawings and /or described in the said Specifications and included in the said Abstract Schedule of Quantities at the item rates therein set forth amounting to the contract sum of Rs…….. 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 works shown upon the said Drawings and described in the Specifications and/or the priced Schedule of Quantities.

2. The Employer shall pay the contractor the said Contract Amount or such other sum as shall become payable for the items and in the manner hereinafter specified in the said conditions.

3. The said Conditions and Appendices thereto shall be read and construed as forming part of this Agreement, and the parties hereto shall respectively abide by and submit themselves to the conditions and perform the Agreement in their part respectively in such conditions contained.

4. All disputes arising out of or in any way concerned with this Agreement shall be deemed to have arisen in **New Delhi** and only the Courts in **New Delhi** shall have jurisdiction to determine the same.

5. The contract comprises :-

i) Tender Documents Serial Pages……..

ii) Subsequent Correspondence Serial Pages……

iii) Architectural Drawings Serial Pages ……..

6. Only (…….) alterations have been made in these documents and as evidence that these alterations were made before the execution of Contract Agreement, they have been initialled by the contractor and ……

……. Engineer, ……. Zone, Life Insurance Corporation of India ……. The said officer is hereby authorised to sign and initial on the Employer's behalf, the documents forming part of this contract.

7. IN WITNESS WHEREOF THE Official Seal of the LIFE INSURANCE CORPORATION OF INDIA, _____ ZONE, was thereto affixed and signed on its behalf by the Chief Engineer and by _____ on behalf of the Contractor/s on the dates respectively mentioned against their signatures in the presence of the witnesses whose signatures are also appended.

In the presence of

CHIEF ENGINEER

Signature : .....

Name :.....

Address : .....

FOR AND ON BEHALF OF THE

LIFE INSURANCE CORPORATION

OF INDIA

Date :…….

2. Signature : .....
Name : .....
Address : .....

In the presence of .....

1. Signature : .....
Name :.....

Address : .....

FOR AND ON BEHALF OF THE

CONTRACTOR

M/S ……..

Date :…….

2. Signature : .....
Name : .....
Address : .....

ANNEXURE – 'B'

LIFE INSURANCE CORPORATION OF INDIA

(Refer Clause No. 35 of Conditions of Contract)

FORM OF BANK GUARANTEE IN LIEU OF SECURITY DEPOSIT

IN INDIVIDUAL CONTRACTS

To

THE LIFE INSURANCE CORPORATION OF INDIA

In consideration of the Life Insurance Corporation of India having its _____ Zonal Office at _____ in the State of _____ (hereinafter called **'the Corporation'** which expression shall unless repugnant to the subject or context include its successors and assignees) having agreed under terms and conditions of contract (vide its acceptance letter No._____ dated_____) made between _____*_____

(hereinafter called the said Contractor) and the Corporation in connection with _____ (hereinafter called **'the said contract'**) to accept a Deed of Guarantee and Indemnity as herein provided for Rs._____ from the _____**_____ in lieu of the Security Deposit to be made by the contractor and/or in lieu of the deduction to be made from the Contractor's bills, for the due fulfillment by the said contractor of the terms and conditions contained in the said contract, we the _____ (hereinafter referred to as **'the said Bank'**) and having our office at _____ do hereby undertake and agree to indemnify and keep indemnified the Corporation from time to time to the extent of Rs._____ (Rupees _____ only) against any loss or damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by the Corporation by reason of any breach or breaches by the said contractor in respect of the said contract or of any of the

terms and conditions contained in the said contract, or in respect of all its claims for money and / or material found due and recoverable from the said contractor and to unconditionally pay the amount claimed as such by the Corporation on demand and without demur to the extent aforesaid.

2. We, the said Bank further agree that the Corporation shall be the sole judge of and as to whether the said contractor has committed any breach or breaches of any of the terms and conditions of the said contract and the extent of loss, damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by the Corporation from time to time on account thereof and the decision of the Corporation in this respect shall be final and binding on us.

3. The Corporation shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee or Indemnity from time to time to vary any of the terms and conditions of the said contract or to extend time of performance by the said contractor, or to postpone for any time and from time to time any of the powers exercisable by it against the said contractor and either to enforce or forbear from enforcing any of the terms and conditions governing the said Contract or securities available to the Corporation and the said Bank shall not be released from its liability under these presents by any exercise by the Corporation of the liberty with reference to the matters aforesaid or by reason of time being given to the said contractor or any other forbearance, act or omission on the part of the Corporation or any indulgence by the Corporation to the said contractor or of any other matter or thing whatsoever, which under the law-relating to sureties would but for this provision have the effect of so releasing the Bank from its liability.

4. It shall not be necessary for the Corporation to proceed against the contractor before proceeding against the Bank and the Guarantee and Indemnity herein contained shall be enforceable against the said Bank, notwithstanding any security which the corporation may have obtained or obtain from the contractor shall at the time when proceedings are taken against the Bank hereunder be outstanding or unrealized.

5. Notwithstanding anything contained in any of the foregoing clauses the liability of the Bank under this Guarantee shall not exceed Rs. _____ (Rupees _____ only). The guarantee shall remain in force till_____. If any extension of time be granted to the contractor, we undertake to extend the guarantee with the consent of the contractor. Unless a claim or demand under this guarantee is made or presented to the Bank within six months from the expiry date, all the rights of the Corporation under this Guarantee shall cease and the Bank shall be released and discharged from all liability hereunder.

6. We, the said bank lastly undertake not to revoke this guarantee and indemnity during its currency except with the previous consent of the Corporation in writing and agree that any change in the constitution of the said contractor or the said Bank shall not discharge our liability hereunder.

For and on behalf of the Bank

(Name and Designation)

The above Guarantee is accepted by the

LIFE INSURANCE CORPORATION OF INDIA.

For and on behalf of the LIC of India

(Name and Designation)

Dated:

Note No.1 ∗ : FILL IN AS APPLICABLE

A) For Proprietary concerns:-

Shri _____ son of _____ resident of _____ carrying on business under the name and style of _____ at _____ (hereinafter called **'the said contractor'** which expression shall unless the context requires otherwise include his heirs, executors, administrators and legal representative).

OR

B) For Partnership concerns:-

1. Shri _____

   son of _____

   resident of _____

2. Shri _____

   son of _____

   resident of _____

carrying on business in partnership under the name and style of _____ of _____ at _____ (hereinafter collectively called **'the contractor'** which expression shall unless the context requires otherwise include each of them and their respective heirs, executors, administrators and legal representatives)

OR

C) For companies :-

M/S / Shri _____ a company under the Companies Act 1956 and having its registered office at _____ in the state of _____ (hereinafter called **'the said contractor'** which expression shall unless the context requires otherwise include its successors and assignees).

Note No.2:

**** Please fill in the name and address of Bank.**

ANNEXURE – 'C'

LIFE INSURANCE CORPORATION OF INDIA

(Refer clause 37 of Conditions of Contract)

FORM OF BANK GUARANTEE TO SECURE A LUMP SUM ADVANCE

To

THE LIFE INSURANCE CORPORATION OF INDIA

In consideration of the Life Insurance Corporation of India having its_____ Zonal Office at_____ in the State of_____ (hereinafter called 'The Corporation' which expression shall unless repugnant to the subject or context include its successors and assignees) having agreed under the terms and conditions of contract vide its acceptance letter No. _____ dated _____ made between_____*_____

_____

_____

hereinafter called the said Contractor and the Corporation in connection with_____
(hereinafter called the said 'contract'), to make at the request of the contractor a lump sum advance of Rs._____ for utilizing it for the purpose of contract on his furnishing a guarantee acceptable to the Corporation, we the _____**_____ Bank (hereinafter referred to as 'the said Bank') a company under the companies Act, 1956 and having our registered office at _____ do hereby guarantee the due recovery by the Corporation of the said advance together with interest and costs thereon according to the terms and conditions of the said contract. If the said contractor fails to utilize the said advance for the purpose of the contract and/or the said advance together with interest thereon as aforesaid is not fully recovered by the Corporation, we the said Bank hereby unconditionally and irrevocably undertake to pay to the Corporation on demand and without demur to the extent of the sum of Rs._____.

1. We, the said Bank further agree that the Corporation shall be the sole judge of and as to whether the said contractor has not utilized the said advance or any part thereof for the purpose of the said contract and the extent of loss or damage caused to or suffered by The Corporation on account of the said advance together with interest and costs thereon not being recovered in full and the decision of the Corporation in this respect, shall be final and binding on us.

2. The Corporation shall have the fullest liberty without affecting in anyway the liability of the Bank under this Guarantee or Indemnity, from time to time to vary any of the terms and conditions of the said contract or the advance or to extend time of performance by the said contractor or to postpone for any time and from time to time any of the powers exercisable by it against the said contractor and either to enforce or forbear from enforcing any of the terms and conditions governing the said contract or the advance or securities available to the Corporation and the said Bank shall not be released from its liability under these presents by any exercise by the Corporation of the liberty with reference to the matters aforesaid or by reason of time being given to the said contractor or any other forbearance, act or omission on the part of the Corporation or any indulgence by the Corporation to the said contractor or of any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of so releasing the Bank form its such liability.

3. It shall not be necessary for the Corporation to proceed against the contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security which the Corporation may have obtained or obtain from the contractor shall at the time when proceedings are taken against the Bank hereunder be outstanding or unrealized.

4. Notwithstanding anything to the contrary hereinbefore contained the Bank's liability hereunder shall not exceed Rs._____ (Rupees _____) in the aggregate. This Guarantee shall remain in force till the _____ day of the year 20…and the Bank's liability hereunder will cease to be operative unless any claim is lodged with the Bank within 6 (six) months thereafter.

5. We, the said Bank lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the Corporation in writing and agree that any change in the constitution of the said contractor or the said Bank shall not discharge our liability hereunder.

For and on behalf of the Bank.

(Name and Designation)

The above Guarantee is accepted by the Life Insurance Corporation of India.

For and on behalf of the

LIFE INSURANCE CORPORATION OF INDIA

(Name and Designation)

Note No.1 ∗ **:** FILL IN AS APPLICABLE

A) For Proprietary concerns:-

Shri _____ son of _____ resident of _____ carrying on business under the name and style of_____ at _____ (hereinafter called 'the said contractor' which expression shall unless the context requires otherwise include his heirs, executors, administrators and legal representative).

OR

B) For Partnership concerns:-

1. Shri_____

   son of _____

   resident of _____

2. Shri _____

   son of _____

   resident of _____

carrying on business in partnership under the name and style of _____of _____ at _____(hereinafter collectively called 'the

contractor' which expression shall unless the context requires otherwise include each of them and their respective heirs, executors, administrators and legal representatives)

OR

C) For companies:-

M/S / Shri _____ a company under the Companies Act 1956 and having its registered office at _____ in the state of _____ (hereinafter called 'the said contractor' which expression shall unless the context requires otherwise include its successors and assignees).

Note No.2 ** : Please fill in the name and address of Bank.

TRADE SPECIFICATIONS FOR BUILDER'S WORK

1. EXCAVATIONS AND EARTHWORK

1.1 **General:** The excavation will generally refer to open excavation of foundations (including basement if necessary) wet or dry.

1.2 **Examine the site**: The contractor shall visit and ascertain the nature of the ground. to be excavated and the work to be done and shall accept all responsibility for the cost of the work involved.

1.3 **Clearing the Site:** The site on which the structure is to be built shown on the drawing and the area required for setting out and other operations, like roads, drains, sheds, etc, should be cleared and all obstructions, loose tones, materials and rubbish of all kinds, stumps, brush wood and trees removed as directed, roots being entirely grubbed up. The materials obtained will be the property of the LIC and materials considered useful by the Corporation's Engineers will be handed over to the LIC. Rejected materials will be removed by the Contractor to his own dump at his own cost.

1.4 **Ground levels and site level plan :** Before starting the excavations, the requisite block levels of the entire plot shall be taken by the contractor in consultation with the Corporation's Engineer and a proper record of these levels kept, which shall be jointly signed by the Contractor and the Corporation's Engineer. A block level plan showing all the ground levels of the pit shall be prepared and shall be jointly signed by the Contractor and the Corporation's Engineer.

1.5 **Setting out:** After clearing the site and preparing the site level plan, the contractor will set out the centre lines of the building or other involved works & get the same approved from the Corporation's Engineer. It shall be the responsibility of the contractor to install substantial reference marks, bench marks etc. and maintain them as long as required by the Corporation's Engineer. The Contractor will assume full responsibility for proper setting out, alignment, elevation and dimension of each and all parts of the work.

1.6 **Excavation and Preparation of Foundation for Concreting**: Excavation shall include removal of all materials of whatever nature at all depths and whether wet or dry necessary for the construction of foundation and sub. structure (including mass excavation for basement where applicable) exactly in accordance with lines, levels, grades and curves shown on the drawings or as directed by the Corporation's Engineer. The bottoms of excavations shall be levelled both longitudinally and transversely or stepped as directed by the

Corporation's Engineer.

Should the Contractor excavate to a greater depth or width than shown on the drawings or as directed by the Executive Engineer, he shall at his own expense fill the extra depth or width with cement concrete in proportion as directed by the Executive Engineer but in no case with concrete of mix lesser than 1:4:8 cement concrete...

The Contractors shall report to the Executive Engineer when the excavations are ready to receive concrete. No concrete shall be placed in foundations until the Contractor has obtained the Executive Engineer's approval. In case, the 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 get the dimensions of the strata payable decided from the Executive Engineer. If no specific provision is made in the Schedule of Quantities it will be presumed that excavation shall be in all types of soil and the Contractors rate cover for the same.

After the excavation is passed by the Executive Engineer (and before laying the concrete) the Contractor shall get the depth and dimensions of the excavations and levels (and nature of strata if applicable as per Schedule of Quantities, like hardrock, soft rock etc.) and measurements recorded from the Corporation's Engineer on site.

1.7 **Shoring:** The sides of the excavations should be timbered and shored 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 proper design of the shoring to hold the sides of the excavation in position and ensure safety from slips and prevent damage to work and property and injury to persons. The shoring shall be removed as directed after the items for which it is required are completed.

1.8 **Protection:** All foundation pits, well pits and similar excavations shall be strongly fenced and marked with red lights at nights in charge of watchmen 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, property and the people in the vicinity shall be taken by the Contractor at his own cost, he being entirely responsible for any injury and damage to property caused by his negligence or accident due to his constructional operations.

1.9 **Stacking of Excavated Materials:** All materials excavated will remain the property of the LIC and rate given in the schedule of quantities for excavation includes sorting out of useful materials and stacking them on site as directed. Materials suitable and useful for backfilling, plinth filling or levelling of the plot or other use shall be stacked in convenient place but not in such a way as to obstruct free movement of men, animals and vehicles or encroach on the area required for constructional purpose.

1.10 **Backfilling:** All shoring and form work shall be removed after necessity ceases and trash of any sort shall be cleaned out from excavation. All space between foundation masonry or concrete and sides of excavation shall be refilled to the original surface with approve excavated materials in layers, 15 cm to 30 cm in thickness, watered a rammed. The filling shall be done after concrete or masonry is fully and done in such a way as not to cause undue thrust on any part the structure. Where suitable excavated material is to be used for refill, it shall be brought from the place where it was temporarily stacked used in refilling.

No excavation or foundations shall be filled in or covered up until at measurements of excavations, masonry concrete and other works below ground level are jointly recorded.

Black cotton soil shall not be used for backfilling or in plinth filling.

1.11 **Dewatering:** Rate give in the schedule of quantities 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 diverting surface flow if any by bunds or other means. Pumping out water shall be done in such approved manner as to proclude the possibility of any damage to the foundation trenches, concrete or masonry' or any adjacent structure. When water is met in foundation trenches or in basement excavations, pumping out water shall be from an auxiliary pit of adequate size dug slightly outside the building excavations. The depth of the auxiliary pit shall be more the working foundation trench levels. The auxiliary pit shall be refilled with approved excavated materials after the dewatering is over.

The excavation shall be kept free from water (1) during inspection and measurement, (2) when concrete and / or masonry are in progress and till they come above the natural water level, and (3) till the Corporation's Engineer Considers that the concrete/mortar is

sufficiently set.

1.12 Surplus Excavated Materials: All excavated materials certified as surplus and not useful shall be removed by the Contractor from the site in an approved manner to his own dump at his own cost.

1.13 Rates given in schedule of quantities shall Include : Apart from other factors mentioned elsewhere in this contract; rates given in the schedule of quantities for the item of excavation shall also include for the following:

(i) Clearing site

(ii) Setting out works as required and setting up bench marks and other reference marks.

(iii) Providing shoring and strutting and subsequently removing the same.

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

(v) Excavation at all depths (unless other wise specified in the Schedule of Quantities) and removal of all materials of whatever nature wet or dry and necessary for the construction of foundational / basement etc. and preparing bed for laying concrete.

(vi) Sorting out useful! excavated materials and conveying beyond the structure and stacking them neatly on the site for backfilling or reuse as directed.

(vii) Backfilling the trenches alongside masonry or concrete with approved excavated materials upto the natural ground level including watering and ramming.

(viii) Necessary protection including labour, materials and equipment to ensure safety and protection against risk or accident.

(ix) Removal of surplus excavated materials as directed to Contractor's own dump

(x) Drilling of small holes as directed to explore the nature of substratum if necessary

1.14 Measurements for Excavation : Excavation for foundation of columns beams walls and the like shall be measured and paid net as per drawing dimensions of concrete (bed concrete where so specified) at the lowest level in regard to length and breadth and depth shall be computed from the concerned excavation levels and ground levels taken before excavation Any additional excavation required for working space. form work. planking dewatering and

strutting etc. shall not be measured and paid for separately but rates quoted for excavation shall include for all these factors. No increase in bulk after excavation shall be made.

1.15 **Earth Filling In Plinth:** If there Is approved surplus earth after backfilling the sides of excavation, the same will be used for plinth filling if required. Any additional approved earth if required for plinth filling the same shall be brought on to the site buy the Contractor from outside. The borrow pits shall not be opened on the site. Filling in plinth shall be done in layers of 15 cm to 30 cm thick each layer being consolidated by ramming & watering. Black cotton soil shall not be used for plinth filling.

Filling in plinth shall be measured net as in position after consolidation height or depth of filling being measured from original ground level to top of earth filling after consolidation

2. CONCRETE & STEEL REINFORCEMENT

A. Cement Concrete :

2.1 **General: P.C.C. shall mean Plain Cement Concrete.**

R.C.C. shall mean Reinforced Cement Concrete.

2.2 Constant and strict supervision of all items of the construction is necessary during the progress of work, including proportioning, mixing and placing of concrete. Supervision is also extremely important in checking the reinforcement and its placing. before being covered.

2.3 Contractor shall finalise the details in consultation with the Clerk of work as per which form work is proposed to be carried out and also the details of planning of concreting operations including adequacy of acceptable materials, testing of mixer and vibrator for ascertaining that they are in working condition, availability of test cube moulds, slump test apparatus etc.

2.4 **SAMPLES AND TESTS:** Every facility shall be provided to enable the Corporation's Engineers to obtain samples and carry out tests on the materials and construction. If these tests show that any of the materials or construction do not comply with the requirements of this specification, the Contractor will be responsible for the costs of the tests and the replacement of the defective materials and/or construction.

2.5 **REJECTED MATERIALS.:** All materials which have been damaged contaminated or have deteriorated or do not comply in any way with the requirements of the specification shall be rejected and shall be removed immediately from the site at the Contractor's own expenses.

2.6 **LOADING OF FLOOR SLABS :** Materials shall not be stored or stacked on suspended floors and roofs without the Corporation's Engineer's prior approval.

2.7 **CO-ORDINATION:** The Contractor shall be responsible for the co-ordination with sub-contractors or other contractors for incorporating any inserts or electrical conduit pipes, fixing blocks, chases, holes etc. in concrete members .as required. The contractor shall ensure that these requirements have been approved by the Corporation's Engineer before concreting operations are put in hand. All fixing blocks chases, Inserts, holders etc to be left in the concrete shall be of sizes specified and be accurately set out and placed before pouring concrete. The contractor's rates quoted for concrete items shall include for all these factors. Holes or chases shall not be cut in concrete without prior approval of the Corporation's Engineer.

2.8 **INSERTS IN CONCRETE :** Contractor should note that he shall provide necessary wooden lugs, sleeves, etc. for his own works to be made for which no extra payment will be made. He will have to provide if so directed. any' inserts, wooden lugs, sleeves for other contractor's work such as Electrical Contractor, Plumbing Contractor, A.C. Contractor, Contractor of lifts. etc. for which he will be entitled for payment but in case the other contractors provide such inserts, then he will have to take proper measures (at his expense) and take care not to disturb their work while laying concrete.

2.9 Contractor shall provide work-site-testing equipment for aggregate and concrete such as test sieves, balances, slump cones, test cube moulds etc.

2.10 **MATERIALS :**

ALL MATERIALS SHALL BE OF APPROVED QUALITY

2.11 **CEMENT:**

(a) Ordinary Portland Cement 33 'Grade shall conform to the I.S. Specification IS 269:1989 and ordinary Portland Cement 43 Grade shall conform to IS : 8112 : 1989.

(b) The cement shall be stored in such a manner as to permit of easy access for proper inspection in a suitable weather-tight building to

protect the cement from dampness and to minimize warehouse deterioration. The shed shall be built at the cost of the contractor. Care shall be taken to see that (i) there is no leakage from side walls and (ii) windows are not provided. The plinth level of the shed shall be raised and the surrounding ground shall drain the surface water away from the shed. The floor of the shed shall consist of wooden planks resting on base prepared of dry bricks laid on edge. The bags should not be piled against the wall. A space of 30 cm shall be left all around between exterior walls & piles. The bags shall be placed closed together in the pile to reduce circulation of air as much as possible. The bags should not be. piled more than 10. The bags shall be arranged in header and stretcher fashion so as to lessen the danger of toppling.

When removing the bags for use "first in, first out" rules shall be applied. For this purpose, consignment as it comes in for storage, shall be stacked separately and a placard bearing date of arrival shall be pinned to the pile.

(c) Contractor shall be fully responsible for the quality of cement brought at the work site. The contractor shall satisfy himself that the cement brought to the work site conforms to the requirements of relevant Indian Standard and shall procure manufacturer's certification to this effect in his own interests. In case the contractor has any doubt regarding the quality of cement brought on work site it is upto him to have it tested at his own expense and make sure that cement is of right quality.

(d) In case Corporation's Engineer gets any doubt about quality of cements he can order the contractor to have cement tested or he can take samples in the presence of contractor from cement bags stored at work site and forward them to a government approved laboratory for testing. In respect of charges for testing in such a case. Contractor will be paid the charges, provided the cement conforms to the specified I.S. Standards.

(e) Cement concerning of which there is doubt, shall not be used pending testing and satisfactory results. All cement not conforming to specifications and rejected by Corporation's engineer and cement that is stored at site for a period longer than three months and deteriorated, damaged or set shall not be allowed to be used. All such cement shall be immediately removed from work site by the contractor. The cost of all such cement shall be borne by the

Contractor.

2.12 Aggregates: Aggregates shall conform to IS : 383/1970 and shall be from approved sources.

2.13 Fine Aggregates:

(a) The fine aggregate- Sand shall be hard, strong, dense, durable, clean with uncoated grains. The maximum size of the particles shall be 4.75mm (3/16 in.) and shall be graded down. The sand shall not contain any harmful material such as iron pyrites coal, mica, silt, clay, alkali, sea shells, organic impurities. loam etc. or in case of reinforcement or detrimental to concrete. Aggregates which are chemically reactive with the alkalies of the cement, shall not be used. The maximum quantity of deleterious materials shall not exceed the limits specified in the relevant I.S. Specification. Silt and dust present in natural sand shall be limited to 3% by weight. In case it is more than 3%, it shall be washed at site, Presence of mica in sand shall not be more than 1% by weight.

(b) Grading : The natural sand used for work shall have a grading conforming to one of the three grading zones given in following (table IA)

TABLE "1A" GRADING OF FINE AGGREGATES

(In accordance with IS : 2386/1963 Part I)

Sieve	Percentage passing for		
	Zone I	Zone II	Zone III
10 mm	100	100	100
4.75 mm	90-100	90-100	90-100
2.36 mm	60-95	75-100	85-100
1 .18 mm	30-70	55-90	75-100
600 micron	15-34	35-69	60-79
300 micron	5-20	8-30	12 -40
150 micron	0-10	0-10	0- 10

When grading falls outside the limits of any particular zone of sieves. (other than 600 micron IS sieve), by a total amount not exceeding 5% - It shall be regarded as falling within the grading Zone.

2.14 Coarse Aggregates :

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

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

(c) In selecting the aggregate the contractor shall satisfy that the source is suitable for regular supply and a watch shall be maintained that the particle shape and grading remain reasonable uniform throughout the progress of work.

(d) Contractor shall arrange to supply coarse aggregates in single sizes, confirming in the case of each nominal size, to the grading given in the following table (table-1 B) under column 'A', the single sizes shall be combined in suitable proportions to get desired overall grading of aggregates. The Corporation's Engineer at his discretion, may allow the use of "Graded Aggregates" of nominal size, to conform to the grading in the limits specified in the table1 B under column "B"

(e) Size of Aggregates

(i) (Nominal maximum size of aggregates in beams and columns should be restricted to 5 mm less than the minimum cover to the reinforcement whichever is less.

(ii) Where reinforcement is widely spaced as in slabs. nominal maximum size of aggregate of 20 mm may be used.

(iii) In no case the maximum size of aggregate to be greater than one quarter of the minimum thickness of the member so as to facilitate concrete to be placed without difficulty to summoned all reinforcement.

(iv) Generally on reinforced concrete work, nominal maximum sIze of 20 mm is considered suitable.

(f) **Grading :** It can be assumed as a rough guide that from 45 percent to 75 percent of the total aggregate (fine plus coarse) should pass through a sieve of aperture size equal to one half of the maximum size of coarse aggregate.

(g) Stock-piling of aggregate or storage of aggregates :

Aggregates shall be stored at site on a hard and dry patch of ground preferably levelled and rolled. Piles of sand and piles of different sizes coarse aggregate shall be stored in separate stock piles with height preferably not exceeding 1.25 to 1.5 metres. A bottom layer of aggregates of 10 cms. deep shall be left undisturbed while removing the material for use.

If the aggregates are stored at site for a long time there is accumulation of dust. The contractor is required to sieve the aggregate before use, if advised by Corporation's Engineers. Washing the aggregates by means of hose pipe is not permitted. silt and fine dust permitted in coarse aggregate is only upto 1 % by weight.

2.15 **WATER:** Water used for both mixing and curing shall be potable and free from injurious amounts of deleterious materials which are likely to effect the strength or durability of concrete. Water containing any sugar shall not to allowed for use. Also water which falls to satisfy the following requirements shall not be used :

(a) To neutralise 200 ml. sample of water, it should not require more than 10 ml. of 0.1 normal HCL.

(b) To neutralise of 200 ml. sample of water, it should not require more than 2 ml. of 0.1 normal NaOH.

(c) Water should not contain solids in excess of the following

Organic	200 mg / litre
Inorganic	3000 mg / litre.
Sulphate (as SO 4)	500 mg / litre.
Chloride (as cl)	2000 mg / litre for P.C.C.
	1000 mg / litre for R.C.C.
Suspended matter	2000 mg/litre

The pH value of water shall be between 6 to 8.

2.16 MIXES OF CONCRETE : Concrete used shall be in volumetric mix such as 1:4:8, 1:3:6, 1:2:4, 1:1.5:3, 1:1:2 etc.

2.17 BATCHING: The quantity of cement shall be determined by weight. Batching of cement and water shall be specified in the tender.

2.18 **(a)** In proportioning concrete the quantity of cement shall be determined by weight. One bag of cement containing 50 Kgs. of cement shall be assumed to contain 35 litres (1.20 Clt.). The quantities of fine and coarse aggregates and water shall be determined by volume. If fine aggregate is moist allowance shall be made for bulkage in accordance with Appendix 'E'

(b) The water cement ratios shall not be more than those specified in Table II below. In case mechanical vibrators are used water content shall be suitably reduced, without reducing cement content, to avoid segregation. Water content specified in Table II may be increased under exceptional circumstances where workability of concrete produced poses difficulties of placement and compaction. Prior permission of Corporation's Engineer shall be obtained for this purpose, when the water content is increased in the manner indicated above. The cement content also shall be increased in proportionately so that water cement ratio given in table II is maintained. Cost of extra cement shall be born by the contractor.

TABLE 1-B COARSE AGGREGATES

Is Sleve Designation	COLUMN 'A' Percentage passing-for single sized aggregates of nominal size						COLUMN 'B' Percentage passing for graded aggregates of nominal size			
	62mm	40mm	20mm	16mm	12.5mm	10mm	40mm	20mm	16mm	12.5mm
80mm	100	-	-	-	-	-	100	-	-	-
63mm	85-100	100	-	-	-	-	-	-	-	-
40mm	0-30	85-100	100	-	-	-	95-100	100	-	-
20mm	0-5	0-20	85-100	100	-	-	30-70	95-100	100	100
16mm	-	-	-	85-100	100	-	-	-	90-1 00	-
12.5mm	-	-	-	-	85-100	100	-	-	-	90-1 00
10mm	0-5	0-5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85
4.75mm	-	-	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36mm	-	-	-	-	-	0-5	-	-	-	-

Table - II

Mix. of Concrete	Quantity of water per 50 Kg. of cement Max. litres.
1.3:6	34
1:2:4	32
1:1½:3	30
1:1:2	27

(c) Allowance shall be made for surface water present in the aggregate while computing the content. Surface water shall be determined by one of the field methods described in IS:2386 (part 3)/1963, In the absence of exact date, with the approval of the Corporation's Engineer the amount of surface water may be estimated from the values given in Table III below :

TABLE III SURFACE WATER CARRIED BY AVERAGE AGGREGATE.

Aggregate	Approximate quantity of surface water in litre/Cu.M.
Very wet sand	120
Moderately wet sand	80
Moist sand	40

Coarse the aggregate lesser water it will carry.

Most gavel or crushed rock 20 to 40.

2.19 Workability: Workability of concrete should be controlled by direct measurement of water content making allowance for any surface Water in the fine and coarse aggregates. The slump test or compacting factor test shall be carried out at intervals as directed by the Corporation's Engineer. The slump test is suitable for slump of 5 cm to 15 cm.

MIXING AND PLACING OF CONCRETE: MEASUREMENT OF MATERIALS

2.20. Cement: Cement shall be batched by weight even though aggregates are batched by volume. Where the weight of the cement is determined by accepting the maker's weight per bag. A number of bags as directed by Corporation's Engineer shall be weighed separately to check the net weight.

2.21 Aggregates:

(a) The quantities of fine and coarse aggregates shall be determined by volume. The proportions of aggregates (i.e. ratio of fine aggregate to coarse aggregate) shall be adjusted from upper limit to lower limit progressively as the gradding of the fine aggregated becomes, finer and maximum size of coarse aggregate becomes larger.

(i) For an average grading of fine aggregate i.e. zone II of IS:2386/1963 - Part I the ratios of fine aggregates to coarse aggregates shall be

Maximum size of coarse aggregate	Maximum size of coarse aggregate
10 mm	20 mm
1 : 1½	1 :2

For fine aggregates within other grading zones of ratio shall be increased as the fine aggregate gets finer, that , passes from Zone 1 to Zone III.

(ii) For the maximum size of coarse aggregate 20 mm the ratios of fine aggregate to coarse aggregate shall be (Zone as per IS:2386/ 1963 - Part I).

Zone I	Zone II	Zone III
1:1½	1:2	1:3

(b) The measuring boxes prepared for measuring the aggregate shall be of correct size. The measuring boxes are required to be certified by Corporation's Engineer before they are used on site. Internal dimensions of the boxes shall be generally 35 cm x 25 cm x 40cm. Heaping of aggregates over the boxes is prohibited. Aggregates shall be filled in only upto the brim of the boxes and struck off horizontally with a timber or steel bar. Allowance for bulkage for sand shall be made as determined by Corporation's Engineer. Refer Appendix E.

2.22 Water: Water shall be measured by volume in calibrated tanks/vessels having a conical shape narrow at top. Water shall not be measured using ordinary uncalibrated buckets, which are wider at top and narrower at the base. The measurement of water to control and maintain a constant water cement ratio is of utmost importance and adequate attention to this and by the contractor to the satisfaction of Corporation's Engineer, shall be given.

2.23 Mixing of Concrete :

(a) Machine Mixing: Concrete shall be mixed in a mechanical mixer, having an optimum speed which yields good concrete that is neither inadequately mixed nor showing tendency of segregation. This avoids frequent washing. A small amount of water shall be fed first followed by all solid materials Remainder of water shall

be added after the solids. Mixing shall be continued until there is uniform distribution of materials and the mass is uniform in colour and consistency. The mixing time shall be counted after all the materials are in drum and shall be in accordance with IS:1791/1968 but in no case mixing shall be done for less than two minutes.

(b) **Hand Mixing** : Hand mixing shall not be permitted except for unimportant structural members and purely at the discretion of the Comporation's Engineer. Hand mixing will not be permitted for concrete going into columns. When hand mixing is permitted, it shall be ensured that the mixing is continued until the mass is uniform in colour and consistency. The contractor shall use 10% extra cement for hand mixing for which no extra payment will be made. Hand mixing when permitted shall be done on platform.

2.24 **Transporting :** Concrete shall be handled from the place of mixing to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of the ingredients. It shall be deposited as nearly as practicable in its final position to avoid rehandling or flowing. Wet concrete discharged from each batch of mixer shall be neatly collected and transported. Remnants from earlier batches shall be rejected and removed.

2.25 **Placing :** The concrete shall be placed in position and compacted before that initial setting time and shall not be disturbed subsequently.

Concreting shall be carried out continuously upto construction Joints, the position and arrangement of which shall be predetermined.

When the work has to be resumed on the surface which has hardened, it shall be thoroughly backed, swept clean, wetted and covered with a layer of mortar composed of cement and sand in the same ratio as the cement and sand in the concrete mixture. This mortar shall be freshly mixed and placed immediately before placing of the concrete. Concrete shall be placed in shuttering by shovels or other approved implements and shall not be dropped from a height, say greater than 1 M or handled in a manner which will not cause segregation. Concrete which has already set shall not be allowed to be incorporated in the work even after adding cement and remixing.

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

Shuttering for concrete shall be rigidly constructed of approved material and shall be true to the shape and dimensions described on the working drawing. Faces in contact with concrete shall be free from adhering grout, projecting nails, splits and other defects. Joints shall be sufficiently tight to prevent the leakage of cement grout and to avoid the formation of fins and other blemishes. Shuttering shall be secured so as to be strong enough to retain the correct shape during consolidation of concrete. Shuttering shall be true to line and braced and strutted to prevent deformation under the weight

and pressure of the wet concrete, constructional loads, wind and other forces. The shuttering on the sides of the beams and soffits of slabs can be removed without disturbing the beam bottoms. Repropping of beams shall not be permitted. Immediately prior to placing of the concrete, the shuttering shall be well wetted.

2.27 Protection and Placing in Layers : Concrete shall be placed in single. operation to the full thickness of slabs, beams and similar members and shall be placed in horizontal layers not exceeding 1 m deep in walls, columns and similar members. Concrete after placing shall be protected by use of covering to the approval of the Corporation's Engineer during first stages of hardening against high winds, hot sun and/or rain or surface water. No shock or vibrations shall be allowed to be imparted to the forms supporting fresh concrete.

2.28 Compaction: Concrete shall be thoroughly compacted during operation of, placing and carefully worked around the reinforcement embedded fixtures and into corners of form work. The use of mechanical vibrators is strongly recommended. Sufficient number of vibrators including standby of adequate capacities shall be used for compaction of concrete. Vibrators shall be carried out by trained men and in the presence of a qualified supervisor trained in the use of vibrators and vibrated concrete. In certain portions where vibration is not effective, careful rodding and tamping shall be carried out and sufficient men employed to ensure that thorough consolidation takes place. Where manual compaction becomes necessary the workability of the mix should be controlled to suit such made of compaction subject of course, to compliance of strength requirements specified.

2.29 Continuous Concreting : Concreting shell be carried out continuously upto predetermined positions of construction joints. The positron and arrangement for construction joints shall be approved by the Corporation's Engineer Rest pauses for meals etc. shall be subject to the Corporation Engineer's approval.

2.30 Packing Bound Reinforcement : In the case of reinforced concrete work, the concrete shall be carefully consolidated round the reinforcement and care shall be taken to ensure that reinforcement is not displaced during the placing and compaction of concrete. If reinforcement moves out of Its place it must be brought back to position immediately.

2.31 Vibration of Concrete :

(a) Number and size of vibrations : Vibrators shall be of sturdy construction, adequately powered and capable of transmitting to the concern not less than 3500 impulses per minute when operating under load. The vibration shall be sufficiently tense to cause the concrete to flow or settle readily into .place and visibly affect the concrete over a radius of at least 450 mm (18) when used In concrete having slump of 25 mm A sufficient number of vibrators (at least one vibrator for a rate of concreting of 1.5 Cu. M or 50 CU.Ft. per hour) shall be employed so that vibrating through the entire volume of each layer of concrete

and complete compaction are secured.

(b) Manipulation of vibrators : Internal vibrators shall be kept constantly moving in the concrete and shall be applied at points uniformly placed not farther apart than the radius over which the vibrator is visibly effective. The vibrator shall not be held in one location long enough to draw out a pool of grout from surrounding concrete. The vibration shall be such that the concrete becomes uniformly plastic and there shall be atleast 200 seconds of vibration per square metre (20 seconds of vibration per Sq.Ft. of surface of each layer of concrete, computed on the basis of visibly effected radius and taking overlap into consideration. Vibrations shall be stopped when an bubbles have practically ceased coming to the surface.

2.32 CURING: All concrete work shall be kept constantly wet for a minimum period of seven days after concreting Horizontal surfaces shall be kept covered with water ponded by means of bunds and vertical surfaces like those of columns, fins, etc by burlaps kept constantly wet by water sprays. Mere sprinking of water on vertical surfaces without sacks or burlaps will not be allowed. In respect of concrete made out of Pozzalana cement curing shall be continued for another eight days vjz. fifteen days in all.

2.33 TRAINED SUPERVISOR: It is essential that the contractors supervisor who is in charge of the construction and all concrete work, whether reinforced or not, shall be skilled in this class of work and shall superintend personally the whole construction and pay special attention to :-

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

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

(c) Sizes and positions of reinforcements.

2.34 STRENGTH REQUIREMENTS OF CONCRETE: Where ordinary portland cement is used, the compressive strength requirements for various mixes of concrete shall be as given in Table IV. It shall be the contractor's responsibility to obtain specified strengths for the various mixes of concrete.

TABLE IV - STRENGTH REQUIREMENTS OF CONCRETE

(All values in Kg/Sq. Cm.)

All tests conducted in accordance with IS : 516-1959

Concrete Mix	Minimum compressive strength on 15 cm. cubes at 7 days (Works Test only)	Minimum compressive strength of 15 cm. cubes at 28 days (works test Only)
1:3:6	70	100
1:2:4	100	150
1:1½:3	135	200
1:1:2	170	250

Note : **WORKS TEST : A test-** conducted in an approved laboratory on the specimens made on the works out of the concrete being used on the works.

2.35 Criteria Regarding Strength: Although the works test cubes are specified to be conducted at the age of 7 and 28 days, in all cases 28 days compressive strength specified in Table IV shall alone be the criteria for acceptance or rejection of concrete.

2.36 CLASSIFICATION OF CONCRETE OF LOWER OR HIGHER STRENGTH THAN SPECIFIED : If concrete made in accordance with the proportions given for a particular mix does not yield the specified average strength of three cubes at 28 days' (refer table V for acceptance criteria) such concrete shall be dealt as stated in the criteria for acceptance of concrete.

2.37 Test Cubes :

(a) Concrete used for preparing works test cubes shall represent quality of concrete incorporated in the work. The concrete for preparation of one set of six cubes shall be taken from one batch of mixed concrete discharged from mixer. The cubes shall be moulded in accordance with Indian Standard Code of Practices.

(b) The cubes shall be cured as per IS Code of Practices. The entire operation of ,casting, arranging and despatch of cubes to laboratory will be carried out by the Contractor under the joint supervision of the Corporation's Engineer and Contractor's Engineer.

Out of six cubes, three cubes shall be tested at an age of seven days and the other three at the age of 28 days in a laboratory approved by the Chief Engineer.

(c) The cubes shall be initialed jointly by Contractor's representative and the Corporation's Engineer with a piece of wire or nail, so that an indentation of the initials is left on the cubes.

(d) The contractor shall arrange to transport the cubes to the laboratory and arrange to have the test results forwarded (in duplicate) directly from the laboratory' to the Corporation's Engineer. The contractor shall bear all expenses in connection with the preparation of test cubes like cost of moulds, cost of concrete, labour and transportation charges to the approved laboratory etc. The charges for testing shall be paid initially by the contractor to the laboratory.

(e) A register shall be maintained at site by the Corporation s Engineer with the following details entered and initialled by the contractor and the Corporation's Engineer :-

(i) Date and time of casting.

(ii) The mix of concrete

(iii) Reference to specific structural member receiving the batch of concrete from which the cubes were cast

(iv) Mark on cubes.

(v) Water cement ratio by weight and slump.
(vi) Crushing strengths as obtained at the end of seven days for three cube out of a set of six and at the end of 28 days for the other three cubes.
(vii) Laboratory in which tested and reference to test certificate
(viii) Any other information directed by the Chief Engineer

(f) A record of the quantity of concrete incorporated in the work that is represented by the quality of concrete of the set of cubes along with the description of the structural members where such concrete has been deposited shall be maintained. For floor beams and slabs, such record shall be supported by a drawing on which the areas of concreting carried out and representing the set of cubes taken out shall be properly demarcated with cube references entered in the drawing at the relevant portions. This record shall be initialed by the contractor and maintained by the Corporation's Engineer.

TABLE V :- ACCEPTANCE CRITERIA, TESTS ETC. FOR CONCRETE

(Ref. : Para 2.37 and 2.38)

<table>
<tr><th colspan="4">AGGREGATE</th><th colspan="6">CONCRETE</th></tr>
<tr><td colspan="3">Separation</td><td>Tests</td><td colspan="3">Batching</td><td colspan="5">Test</td></tr>
<tr><td rowspan="3">Fine</td><td rowspan="3">Coarse</td><td rowspan="3">Grad-ing</td><td rowspan="3">Moisture determi-nation</td><td rowspan="3">Cement</td><td rowspan="3">Aggre-gates</td><td rowspan="3">Workabi lity</td><td colspan="5">Strength (Works Test Only)</td></tr>
<tr><td colspan="2">Minimum number of Specimens(15 em cubes</td><td colspan="2">Minimum Frequency</td><td rowspan="2">Criteria for Acceptance</td></tr>
<tr><td>7 days Compressive Strength Test</td><td>28 days Compressiv e Strength Test</td><td>In Terms of Quantity</td><td>In Terms of Period</td></tr>
</table>

One Size	-Single Sized aggregate in two sizes (20mm 10 mm) for maximum 20mm size aggregates or in three sizes (40mm, 20mm 10mm) for max 40mm sized aggregates or if approved by EE graded aggregates conforming to Table under Para 2.14 (d)	After Stand-ard has been estab-lished when variat-ion is sus-pected	When Varia-tion in moisture is sus-pected e.g. rain	By Weight	By Volume	As frequen cy as directe d by the corpo-ration's Engine ers.	**3**	**3**	for each50 M^3 of concrete or part thereof at more frequent intervals if directed by E.E.	As decided By E.E.	Refer Para2.38

g) **Samples size and acceptance criteria:** All tests shall be carry out in accordance with IS :516-1962. The number at lest specifications required, the frequency of sampling and the criteria for acceptance of a concrete of a specified mix shall be in accordance with the Table V Ordinary concrete.

2.38

Standard of Acceptance: The average compressive strength of the three specimens tested at seven days shall satisfy the specified strengths given in Table IV, for the appropriate mix. As a guidance the difference between the maximum and the minimum strength of the three specimens shall not exceed 15% of the average strength. In case seven days tests result is not satisfactory all further work structurally interlinked with the concrete represented by the samples shall be stopped unless otherwise decided by Chief Engineer,

II. **Twenty eight days test :** Acceptance criteria of twenty-eight days shall be as follows :

(a) If the average compressive strength of three cubes is more than the compressive strength indicated in Table IV, the concrete shall be accepted at full rates.

(b) If the average compressive strength of three cubes is less than the specified but not less than 85% of the specified strength, the concrete may be accepted at reduced rates at the discretion of the Chief Engineer.

(c) If the average compressive strength of three cubes is less than 85% of the specified strength, Chief Engineer shall reject and get dismantled the defective portion of the work represented by the samples alongwith the structurally connected work as considered necessary at the risk and cost of the contractor.

In case of (b) and (c) above, Chief Engineer, if he so decides may order the additional tests like core test, ultrasonic test, rebound hammer test, load test of structure or part of structure etc. All the charges in connection with these additional tests shall be borne by the contractor. If on the basis of those additional tests the Chief Engineer is satisfied about the structural adequacy of the concrete. he may accept the work at reduced rates.

2.39 **Concrete Ordered to be Dismantled** : Where the Chief Engineer does not accept the poor or defective concrete and orders the same to be dismantled, the contractor shall dismantle such concrete at his expense . and reconstruct the same to the Chief Engineer's satisfaction. Concrete thus dismantled will not be measured and paid for. The additional work if any, required to be carried out for reconcreting, shall be to the contractor's account.

2.40 **Concrete Retained with Rectification :** Where the Chief Engineer in order to save time and where he considers adequate, orders that defective concrete be

strengthened as directed by him the contractor shall carry out all rectification measured to Chief Engineer's approval at his expense. The concrete thus strenghtened and accepted shall however, be paid at reduced rate, (for mixes of concrete be refer Table IV under para 2.34).

2.41 Quality of Defective Concrete Represented by cubes : In all cases of defective concrete as revealed by works test cubes strength failing below the specified strength, the quantity of concrete thus affected and represented by the cubes shall be decided by the Chief Engineer whose decision shall be final and binding on the contractor.

2.42 Honey Combing:

(a) Where honeycombed surfaces are noticed in the concrete, the contractor shall not patch up the same until examined by the Corporation's Engineer and decision given regarding the acceptance with rectification or rejection of the same. If contractor patches up such defects without the knowledge of the Corporation's Engineer, the Corporation's Engineer will be at liberty to order demolition of the concerned concrete members to the extent he considers necessary. In such case, the contractor at his expense, shall reconstruct demolished work. .Demolished work shall not be measured and paid for.

(b) If in the opinion of the Corporation's Engineer the honeycombing is harmful to the structure and where so directed by the Chief Engineer, the full structural members affected by honeycombing as decided by Chief Engineer shall be dismantled and reconstructed to Chief Engineer's approval at contractor's expense. The demolished concrete will not be measured and paid for.

(c) Such honeycombed areas which are not severe in the opinion of Corporation's Engineer and to be retained with rectification shall be dealt with as under :

Patches are first treated with the coat of thin grout composed of 1 Part of cement and 1 part of sand and then filled with mortar similar to that used in the concrete. The mortar is placed in layers not more than 10 mm thick arid each layer is given a scratch finish to secure bond with the succeeding layer.

2.43 OTHER DEFECTS: Any other defects in concrete shall be made good as directed by the Chief Engineer at contractor's expense.

2.44 DEVALUATION OF RATES FOR CONCRETE NOT CONFORMING TO SPECIFIED STRENGTH: In case of average compressive strength being less than the specified strength but upto 85% of the specified strength, the rate payable shall be in the same proportion as average compressive strength bears to the specified compressive strength.

In case average compressive strength of concrete is less than 85% of the specified strength (but the same is accepted to be retained in the structure, the rate payable

shall be 85% of the quoted rate minus 1-1/2 times the further percentage reduction below 85% strength.

(Note: While working out the devaluation only the concrete component of the rate excluding shuttering shall be taken into account for calculation).

2.45 CONSTRUCTION JOINTS

(a) **Location:** The contractor shall submit sketches showing the location where he proposes to provide construction joints and get them approved from the Corporation's Engineer prior to concreting.

(b) **Stop boards :** All vertical construction-joints shall be formed with proper wooden stop-board at. the joint. Where directed, the joints shall be rebated or joggled and be of approved shape.

(c) **Stop Boards :** Wherever water bars/stops are specified, the same shall be provided as per drawing or as directed. It is necessarily to ensure that water bars form continuous disphragms. When P.V.C. water bers/stops are provided the joints shall be properly heated and fused as per manufacturers specifications.

2.46 CONSTRUCTION JOINTS IN BASEMENT

(a) **Location and formation :** Contractor shall prepare a drawing showing the proposed construction joints and have it approved by the Corporation's Engineer. After such approval, it is necessary to place stop boards, well in advance, at predetermined positions and carry out the concreting right up to the stop boards.

(b) Particular care is required to form and treat construction joints in basement in order to ensure water tightness for which contractor shall be responsible.

(c) Joints in the base slab: Joints in base slabs and beams of a basement shall be so located that the joint is paralled to the principal reinforcement Where it is unavoidable and is at right angle to the principal reinforcement, the joint shall be in the middle of the span of the slab or beams.

(d) **Formation vertical joints :** Vertical construction joints in base slab and wall of basement shall be formed by using vertical stop-boards in predetermined positions. P. V. C. water bars shall be provided for vertical joints in walls.

(e) **Formation horizontal joints :** Horizontal joints in wall shall be rebated and care shall be taken to establish a proper and good bond between the hardened concrete and freshly laid concrete produce a watertight joint which shall be contractor's responsibility. P.V.C. water bars shall be provided for horizontal joints in walls.

(f) **Wall slab junction :** Each layer must be compacted before placing the next layer.

Concrete in the splays at the junction of the wall and the slab shall be placed without joints at the time of concreting the slab.

2.47 Treatment of Construction joints in basement:

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

(b) When the surface has not fully hardened, the laitence shall be .removed by scrubbing the wet surface with wire bristle brushes, care being taken to avoid dislodgement of aggregate particles. The surface shall be thoroughly wetted and all free water removed. The surface shall then be thoroughly wetted and free water removed. The surface shall be coated with thick neat cement grout.

(c) Care shall be taken to obtain good bond between the hardened and freshly placed concrete. Careful ramming and moulding of concrete around the water bar is very important.

2.48. Construction joints in Superstructure

(a) **Columns:** A joint shall be formed horizontally at the top of a foundation and 75 mm below the lowest soffit of the beams meeting at the head of the column or 12 rnm below the tip of anchor bar projected from the floor beam into the column where one or more beams meet, concrete shall be placed without a joint i.e. concrete in the joint shall be poured alongwith floor concrete.

(b) **Beams :** Concrete in the beam shall be placed, throughout without a joint but if the provision of a joint is unavoidable, the joint shall be vertical and at the middle of the span.

(c) **Slabs:** A joint in the slab shall be verticle. and parallel to the principal reinforcement. Where it is unavoidable and at right angles to the principal reinforcement the joint shall be vertical and at the middle of the span.

(d) **Treatment of construction joints :** Same as for construction joints in basement i.e. 2.47 above.

2.49 Expansion Joints :

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

(b) Expansion joints are meant to provide discontinuity in the structure. Care shall be taken to ensure this discontinuity by having clear joints throughout the length and height of the expansion joints. There shall be no connection between two sides of an expansion joint except like fillers, G.I. Strips etc.

(c) Filler material for expansion joints shall be Shalltex joint filler as manufactured by

M/s Shalimar or other equal and approved make and of appropriate thickness. The filler material shall extend to the entire depth of a joint except for a distance of 25 mm from the exposed faces.

(d) Contractor shall ensure that expansion joints are made watertight and that no leakages occur through these joints for which he shall be responsible.

2.50 WATER TIGHT CONCRETE : Concrete IN all basement works such as basement base slab and beams wall etc. water tanks and the like where concrete of 1:1.5:3 mix or richer mix is specified, will be considered as watertight concrete whether so specially mentioned or not in the Shedule of quantities. In respect of such concrete, it shall be the contractor's responsibility to ensure that the resulting construction is water tight. If it is not, the contractor shall carry out at his own cost, all necessary remedial measures which the Chief Engineer directs .

2.51 FORM WORK :

MATERIALS AND DESIGN :

(a) The formwork shall be of timber or plywood or steel. If any particular material or materials be specified in the Schedule of Quantities for formwork such particularly specified material or materials shall be used in work. The form work shall be so constructed as to remain sufficiently rigid during placing of the concrete and shall be sufficiently tight to prevent loss of liquid from the concrete. The forms shall have sufficient strength and rigidly to hold concrete and withstand the pressure of remaining and vibration without excessive deflection of the prescribed lines and more so when the concrete is vibrated. The surface of all forms in contact with concrete shall be clean, rigid, watertight and smooth. Suitable devices shall be used to hold corners, adjacent ends and edges of panels of other forms together in accurate alignment.

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

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

(d) Temorary openings shall be provided at the base of column forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is deposited.

(e) Vertical Shuttering:

The vertical shuttering shall be carried down to such solid surface as is sufficiently strong to afford adequate support and shall remain in position until the newly constructed work is able to support itself. Props shall be securely braced against latest defection. Where timber props are used like bullies, they shall be of a minimum diameter of 10 cm and shall be straight and adequately strong. The spacing of such struts shall be designed to carry loads imposed on it without undue deflection of the members supported; by the props. The spacing of props shall be approved by the Corporation Engineer and any alterations suggested by him shall be carried out at contractor's expense. Bracing shall be provided as directed without extra cost. The rates given in the schedule of quantities shall include for providing props and struts for any height shown in the working drawings issued to Contractor from time to time.

2.52 WATER TIGHTNESS: It is the contractor's responsibility to ensure that the forms are checked for water tightness just before concreting operation starts and to make good any deficiencies.

2.53 CLEANING AND TREATMENT OF FORMS : All rubbish, particularly, chippings, savings and saw-dust, shall be removed from the interior of the forms before the concrete is placed and the form work in contact with the concrete shall be cleaned and thoroughly wetted or treated with an approved composition. Care shall be taken that such approved composition is kept out of contact with the reinforcement.

2.54 STRIPPING: Forms shall be left in place until their removal is authorised by the Corporation's Engineer and shall then be removed with care so as to avoid injury to concrete. In no circumstances shall forms be struct until the concrete reaches a strength of atleast twice the stress to which concrete may be subjected at the time of striking. The strength referred to shall be that of concrete using the same cement and aggregate with the same proportions, and cured under conditions of temperature and moisture similar to those existing on the work. Where possible, the form work shall be left, longer, as it would assist the curing.

2.55 STRIPPING TIME: In normal circumstances (generally where temperature are above 20℃) and where ordinary cement is used, forms shall be struck after expiry of the following, periods given in table VI.

TABLE - VI

Location		Striking time in days for	
		Ordinary Portland Cement	Pozzolana Cement
(a)	Vertical sides of walls, slabs, beams and columns	2	4
(b)	Bottoms of slabs upto 4.5M span.	7	14
(c)	Bottoms of sllabs above 4.5 M span, bottoms of beams upto 6M span and arch rib bottom upto 6M Span.	14	21
(d)	Bottoms of beams over 6M span and arch rib bottoms above 6M span.	21	30

Note: 1 In case the shuttering for the part of the structure is supported or suspended from the shuttering of the concrete member already cast then the shuttering of the concrete member (already cast) supporting the new shuttering shall not be removed until the concrete of the supported/suspended member is matured.

Note 2 : Special care shall be taken while striking of the shuttering for canopies (ii) Chajjas (iii) Cantilever slabs and beams and (iv) retaining walls, so as to ensure stability of these structural elements. Relevant notes given in the structural drawings in this connection shall be strictly followed.

2.56 FORM WORK IN LIFTS FOR CONTINUOUS SURFACE : Where forms for continuous surface are placed in successive units (as for example in columns or walls), the forms shall fit tightly over the completed surfaces so as to prevent leakage or mortar from the concrete and to maintain accurate alignment of the surface.

2.57 PROCEDURE FOR REMOVING THE FORM WORK : All form work shall be removed without such shock or vibration as would' damage the reinforced concrete. Before the soffit and struts are removed, the concreate surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened. Proper precautions shall be taken to allow for the decrease in the rate of hardening that occurs with all cements in the cold weather. For cantilevers props shall be removed from the tip towards support. Special notes given in relevant structural drawing shall be strictly adhered to in order to avoid mishaps.

2.58 TOLERANCES: The following shall be the maximum permissible tolerances:

(a). On general setting out dimensions up to 4M in length, a tolerance up to 3 mm will be allowed.

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

(c) On the cross sectional dimension of clumns, beams, slabs, facias, chajjas, mullions, grills, fins, leaves and such other members tolerance of more than 2 mm will not be allowed.

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

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

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

2.59 THE RATES GIVEN IN THE SCHEDULE OF QUANTITIES FOR CONCRETE TO INCLUDE : The rates given in the schedule of quantities for providing and laying cement concrete in various grades or proportions in the Schedule of Quantities shall, apart from any other factors specified elsewhere in the tender documents, include for the following,

(a) For all factors and method of work described in these specifications:

(b) For all materials, labour, tools and plants, scaffolding etc., mixing, conveying and placing concrete in position, ramming, vibration, trowelling, curing providing necessary scaffolding and removing the same after the work is complete.

(c) Unless otherwise specified in the Schedule of Quantities the cost of concrete items, shall not include for providing and fixing form work as

described inclusive of erecting, propping to required heights, bracing, providing stays, struts, bolts, nuts and everything necessary to keep the forms rigid, smoothening the surface to receive concrete as per detailed drawings, striking and stripping form work after the concrete is cured, tacking the concrete surface required to receive plaster etc.

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

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

(f) Rates given in the schedule of quantities for concrete items shall cover for any shape of structural members like columns, beams facias, fins, louvres, etc. and of cantilevere beams, slabs etc., as per detailed final drawings including providing slopes to slabs, beams, chajjas, canopies ate. wherever required.

(g) Formation and treatment of construction and expansion joints (where water bars like P.V.C. water bars, strips or joint fillers like "Shalitex" or other equal and approved make are specified, such materials shall be paid for separately) :

(h) Fixing all inserts like pipes, plugs, forming holes, etc. as desaibed.

(i) For volumetric batching;

(j) For taking out dowel bars, fan hooks etc. through shuttering;

(k) In cases where at the junctions of beams, columns, slabs the composition of concrete mix or specified strength be different for columns, beams and slabs, then in such cases only the richer concrete among those specified for in all those members shall be used at the junctions and rate quoted for columns, beams and slabs or any members entering such junctions shall allow for the same. Rate shall also cover for spill over of richer concrete in beams to natural angle of repose of wet concrete required from practical considerations, while concreting the junctions;

(l) For forming chamfers, bands and drip moulds in columns, beams, labs, chajjas, fascias, sills coping etc. and where shown in the drawings or as directed.

(m) For work at all levels.

APPENDIX "E'

(To be read with Clause no.2.18(a)

Field method of determining the necessary adjustment for the bulking of fine aggregate.

Moisture cause loosely filled sand to occupy a larger volume than it would occupy it dry. It is therefore necessary to increase the volume of sand by the percentage bulking. The correction shall be made on the following lines :

In a 250 CU.Cm. measuring cylinder pour the sample of fine aggregate (sand) to be used at site, consolidate if by shaking, until it reaches 200 CU.Cm. mark. Then fill the cylinder with water and stir the sand well. The water must be sufficient to completely submerge the sand. The sand surface will be seen below its original level. Suppose the surface is at the mark 'X" CU.Cm. The percentage of bulking of sand due to moisture shall be calculated from the formula :-

$$\text{Percentage bulking ' K'} = \frac{200 - X}{X} \times 100$$

Therefore,

$$\text{True Volume} = \frac{100 \times \text{Measured Volume}}{\text{'K} + 100}$$

B. STEEL REINFORCEMENT:

2.60 MILD STEEL BAR :

Mild Steel reinforcement bars shall conform to I.S. 228-1962 "Standard Quality" or I.S. 432-1962 "Grade 1". Other qualities of steel shall not be acceptable.

High Strength Cold Twisted Deformed Bars : Wherever deformed high strength reinforcement bars are specified the Contractor shall use ribbed! deformed bars conforming to IS: 1786/1985.

2.61 **Cleaning of Reinforcement :** Before steel reinforcement is placed in position, the surface of the reinforcement shall be cleaned of rust, dust, grease and other objectionable substances.

2.62 **Cutting of Reinforcement :** Before the reinforcement bars are cut the Contractor shall study the lengths of bars required as per Drawings and shall carry out cutting only to suit the sizes required as per drawings.

2.63 **Placing and Securing :** Reinforcement bars shall be accurately placed and secured in position and firmly supported or wedged by precast concrete

blocks of suitable thickness, at sufficient close intervals, so that they will not sag between the supports or get displaced during the placing of concrete or any other operation of the work. It is most important to maintain reinforcement in its correct position without displacement and to maintain the correct specified cover. Contractor shall be responsible for all costs for rectification required in case the bars are displaced out of their correct position.

2.64 **Binding Wire:** The reinforcement shall be securely bound wherever bars cross or wherever required with annealed steel binding wire of size not less than 0.90 mm and conforming to I.S. 280-1962.

2.65 **Welding :** Welding of bars shall not be carried out unless specially authorised in writing by Chief Engineer.

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

2.67 **Inspection of Reinforcement :** No concreting shall be commenced until the Corporation's Engineer has inspected, the reinforcement in position and until his approval has been obtained. A notice of at least 24 hours shall be given to the Corporation's Engineer by the Contractor for inspection of reinforcement. If in the opinion of the Corporation's Engineer any material is not in accordance with the specification or the reinforcement is incorredly 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 Corporation's Engineer and to his entire satisfaction.

2.68 **Net Measurements :** Reinforcement shall be placed as shown on the structural drawings and payment will be made on the net measurements from the drawings. Only such laps, dowls, chairs and pins In reinforcement as approved by the Executive Engineer or shown on drawings shall be paid for the Contractor shall allow in his quoted rate for all wastage which will not be paid for.

2.69 **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 reinforcement bar, 25 mm or twice the diameter

of such rod or bar, whichever is greater.

(b) For a longitudinal reinforcing bar in a beam, 25 mm or the diameter of such rod or bar, which ever is greater.

(c) For tensile, compressive, shear or other reinforcement in a slab, 13 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, 13 mm or the diameters or such reinforcement whichever is greater.

(e) For main reinforcement in isolated footings (side and bottom) clear cover shall 40 mm

(f) For column has clear cover shall be 40 mm unless otherwise specified in drawing.

(g) For bars in slabs of strip footings and mat foundations, the clear cover shall be 30 mm, Beam bars shall be placed over slab bars in respect of beam and slab type foundations.

2. 70 **Stock Piling of Steel:** Steel required shall be stockpiled well in advance of need in the work. Contractors shall stockpile 1/3 requirement within 15 days of commencement, 2/3 requirement at 1/4 contract time and full requirement at 1/2 contract time.

2.71 Rates given in schedule of quantity for Reinforcement shall in Addition to any Factors Mentioned Elsewhere Shall Also Include For :

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

(b) Cost of binding wire required as described.

(c) Cost of precast concrete cover blocks to maintain Cover and holding reinforcement in position.

(d) For fabricating and fixing reinforcement in any structural members irrespective of its location, dimensions and level.

(e) Removal of rust and every other undesirable substance, using wire brush etc., as described.

(f) Stock piling of reinforcement as described.

(g) Work at all levels.

3. BRICK WORK

3.1 Bricks :

(a) The bricks shall be table moulded chimney burnt best quality. of regular and uniform size, shape and colour, uniformly well burnt throughout but not overburnt. They shall have plane rectangular faces with parallel sides and sharp, straight and right angled edges. They shall be free from cracks or other flaws. They shall have a frog of 10 mm depth on one of their flat faces. The bricks shall be Chimney burnt of class designation 100, sub class (a) conform to latest relevant T.S. specification.

(b) They shall give a clearn metallic ringing sound when struck.

(c) They shall show a fine grained, uniform, homogeneous and dense texture on fracture and be free from lumps of lime, aminations, crakcs, airholes, soluble salts causing efflorescence or other defects which may in any w.ay impair their strength, durability, appearence or usefulness for, the purpose intended. They shall not any part under burnt. They shall not break when thrown on the ground on their flat face in a saturated condition from a height of 60cm.

(d) The size of brick shall be 23x11.5x7.5 cm. Only bricks of one standard size shall be used on one work unless specially permitted by the Executive Engineer, in part of Eastern Zone (i.e. West Bengal, Assam and Bihar etc.) bricks which are commonly of size 25x12.5x7.5cm. shall be used. The following tolerances are permitted in the standard conventional size adopted on a particular work.

Length	-	Plus or minus 3mm (about 1/8")
Breadth	-	Plus or minus 1.5mm (about 1/16")
Depth	-	Plus or minus 1.5mm (about 1/16")

(e) After immersion in water, absorption by weight shall not exceed 20 per cent of the dry weight of the brick when tested according to I.S.S. No. 1077-1957.

(f) Unless otherwise specified the load to crush the brick when tested according to I.S.S. No. 1077-1957 shall not be less than 75 Kg/sq. cm.

3.2 Mortor : Unless otherwise specified, mortar for brick work shall be composed of 1 part of cement to 5 parts of coarse approved sand for walls of one brick thick (i.e. 23 cms) and over and one part of cement to 4 parts of coarse approved sand for half brick thick walls. Other specifications for mortar in brick work shall be as per I.S.S. No. 2116-1965.

The particulars size grading of sand in mortars for unreinforced masonry work shall be within the lists specified below :-

I.S. Sieve designation	Percentage by weight Passing I.S. Sieve
4.75mm	100
2.36 mm	90-100
1.18 mm	70-100
600 micron	40-100
300 micron	5-70
150 micron	0-15

3.3 Construction Details :

(a) **Soaking:** All bricks shall be immersed in water for two hours, before being put into work so that they will be saturated and will not absorb water from the mortar.

(b) **Bats:**, No bats or cut bricks shall be used in the work unless absolutely necessary, around Irregular opening or for adjusting the dimensions of different couse and for closers, in which case. full bricks shall be laid at corner, the bats being placed in the middle of the courses.

(c) **Laying:** The bricks shall be laid in mortar to line level and shapes shown on the plans, slightly pressed and thoroughly beded in mortar arid all joints shall be properly flushed and packed with mortar so that they will be completely filled with mortar and no hollows left any where, Bricks shall be handled carefully so as not to damage their edges. They should not 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 is one course and the next below shall not come over one another and shall not normally be nearer than quarter of a brick length. For battered faces bedding shall be at right angles to the face. Fixtures, plugs, frames etc. If any, shall be built in at places shown in the plans while laying the courses only not later by removal of bricks already laid.

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

The verticality of the wall and horizontality of the courses shall be checked very often with plumb-bob and spirity level respectively.

d) **Joints :** Joints shall not exceed 10mm (about 3/6") in thickness and this thickness shall be. uniform throughout, the joints shall be raked out not less than 10mm (about 3/8") deep? when the mortar is green where pointing is to be done. When the brick surfaces are to be plastered, the joints shall be raked

to a depth of 5mm when the mortar is green , so as to provide good key to plaster.

e) **Uniform Raising :** Brick work shall be carried up regular in all 'cases where the nature of work will admit, not leaving any part 60 crn. lower than another. But where building at different level is necessary the breaks shall . be stopped so as to give late a uniform level and effectual bond, Horizontal courses should be to line and level and even and face plumb or to batter as shown on the plan. The rate of laying masonry may be upto a height of 80 cm per day if cement mortar is used and 45 cm. (about 18") if lime mortar is used.

3.4 **Scaffolding :** will be double or single as is warranted for the particular work.

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

3.5 Curing : All brick work shall be kept well watered for 14 days after laying where puzzalona cement is used for mortar, the curing shall be extended by one week at the contractor's expenses.

3.6. Exposed work : Where exposed brick work is specified, the usual specifications for the "Brick Work" as mentioned above will be applicable for "Exposed Brick Work" but in addition specially selected bricks shall be used for facing, ensuring regular and clean faces of uniform colour. No bricks which are broken, chipped indicating wrinkled on which have irregular edges or corners shall be used. Depending on the quality of bricks and if instructed by the corporation's engineer, the exposed face of every brick shall be rubbed before laying without extra charges. Wooden fillets 10 mm thick and 10 mm wide shall be placed at the edge of joints so that no mortar comes on the surface of the bricks and a regular thickness of joints is maintained. The surface shall be rubbed down with brushes or bricks if necessary, and thoroughly washed. No mortar shall be allowed to stick to the surface which shall be left clean to the Corporation's Engineer's satisfaction with all joints even and true to straight line, double scaffolding shall be used in exposed brick work.

3.7. Reinforcement in half brick thick walls : Half brick and brick-on-edge walls shall be provided with reinforcement consisting of 2 nos of 6 mm dia M.S. round bars of 500 mm long (each) as dowels, embedded in mortar 15 mm thick at every fourth course and securely anchored at their ends, where the partition bonds with the cross walls. The cost of reinforcement in half brick wall and brick on edge wall shall be paid separately unless otherwise stated in the Schedule of Quantities.

3.8 Rates given in the schedule of quantities shall include : Apart from other factors mentioned elsewhere in this contract, the rate given in the schedule of quantities for items of brick work shall include for the following :

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

(b) Erecting and removing of all scaffolding, ladders and plant required for the execution of the work to the height and depth and shapes as shown on the plan or as ordered by the Engineer.

(c) Constructing brick work to lines, levels, batters, pillars, curves and to any position or shape , any to height or levels including raking of joints and housing frames, fixtures etc.

(d) Curing the Brick Work.

3.9 Measurements :

(a) Half brick work and brick on edge walls shall be measured in Sqm unless otherwise mentioned.

(b) One brick thick wall and thicker walls shall be measured in Cu.M . Brick wall upto and including 3 bricks in thickness should be measured in multiples of half bricks in walls and the thickness of brick wall exceeding 3 bricks will be measured actually and limited to the width specified.

(c) No deductions or additions shall be made on any account for :

(i) Ends of dissimilar materials (i.e. joints, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps etc) upto 500 cm in section and

(ii) Openings upto 0.1 sqm in section

Note : In calculating the area of openings, any separate lintels or sills be included along with the size of the openings but the end portions of the lontels shall be excluded and extra width or rebated reveals, if any shall be excluded.

(iii) Wall plates and bed plates, and bearing of stabs, CHAJJAS and the like which the thickness does not exceed 15 cm and the bearing does not extend over the full thickness of the wall.

4. WOOD WORK AND JOINERY

4.1 Timber :

(i) Unless otherwise specified, all timber for frames and shuters for doors, windows, ventilators cupboards. etc. shall be first class. sound, well seasoned, C.P. Balarshah or other equivalent and approved teak and shall be free from knots, shakes, fissures, flaws, sun cracks and other defects. The planed surface shall be smooth and free from blemishes and discolourations.

(ii) All timber for carpentary and joinery in touch with masonry or concrete shall be coal tarred or creosoted before fixing. All rough frame work in partitions, suspended ceiling and veneering to wallis etc. shall be treated with approved wood preservative 'Bison or other equivalent and approved as per manufacture's instructors and specifications. The rates quoted shall provide for such treatments.

(iii) All fully fabricated timber shall be air seasoned on site of work for a period of not less than two months to allow for any shrinkages that may take place. The preparation of timber for joinery is to commence simultaneously with the beginning of the project work generally and should proceed continuously until all the wood work is prepared and fixed/stached on or near the site as the case may be.

4.2 Holdfasts : Three holdfasts shall be fixed to each post of the door frame and two to each post of the window frame, Unless otherwise mentioned in the items, the M. S. Holdfasts shall be of the size 300x35 mm and 6mm thick and shall be fixed to the frames by means of screws and not nails. The other end of the holdfast shall be fixed into jumbs with 1 :2:4 PCC of dimensions as directed.

Whenever asked for, Rawl plugs of bolts as directed shall be used for rough grounds framing hangers etc.

The rates quoted for wood and joinery shall allow for all types of holdfast as directed. (Horns in frames shall be cut and shall not be used as holdfasts).

4.3 Workmanship and Construction :

(i) The workmanship shall be first class and to the approval of the Executive Engineer. Scantlings and boardings shall be accurately sawn and shall be of acquired width and thickness. All carpenter's work shall be worught except where otherwise descibed. The workmanship and joinery shall be accurately set cut in strict accordance with the drawings and shall be framed together and securely fixed in approved manner and with properly made joints.

All work is to be property tanoned, shouldered. wedged. planned. braded etc. and properly glaged with' approved quality glue to the satisfaction of the Executive Engineer.

(ii) **Screws :** All screws to be used in wood work and joinery shall be of brass or stainless steel or C.P. Brass as specified.

(iii) **Tolerances:** 1.5: m.m. {1/1.6"} will be allowed for each wrought face of the size specifiad except where described as "finished" In which case they shall hold to the full dimensions.

(iv) **Protection :** All wood work and joinery edges of timber frams etc. shall be protectd from being damaged during construction by the contractor. '

(v) If it is decided by the employer to provide antitermite treatment, the building contractor shall **co-**ordinate his work suitably as directed by the executive engineer.

(vi) Door/window frames shall have cut rebates, Planted rebates shall not be permitted.

4.4 Wooden Flush Door Shutters (Solid Core Type) : .Solid Core flush Shutters shall be of commercial or Teak veneered type as specified. in the item.

An approved sample shall be deposited in the office of the Corporation Engineer on site for reference. The shutters will be provided with lipping. Finished thickness of the shutter shall be as mentioned in the item.

4.5 Teak wood Panelled Shutters : Solid wood panels for shutter shall be of pattern and size as specified. Whether possible each pannel shall be in a single width piece. But where two, pieces the used, width of each pieces should not be less than 12.5 cm in order to avoid warping, splitting and cracking, normally pieces not exceeding 20cm. In width should be used. When made from more than one piece, the pieces shall be jointed with a continuous tongued and grooved joint and glued together and reinforced with metal dowels. The grains of solid panel shall run along the longer dimension of the panel. Panels shall be framed in to groovers in the full depth of the grooving leaving an air space of 1.6mm and the laces shall be clearly filled to the sides of the groove. Mouldings to the edges of panel openings shall be at the joints

4.6 Fixtures and Fastenings : Unless otherwise specified in the Schedule of Quantities, each shuter shall be hung with minimum three but things of approved quality 'size and make with specified screws and the Contractor's rate shall cover for providing and fixing hinges to the shutters. Unless otherwise specified in the Schedule Quantities, other fittings, if ordered, shall be paid separately as prime cost items.

4.7 Finishing : The wood work shall be finished by 2 or more coats Painting , French polishing or wax polishing as specified in the item.

4.8 Rates given in schedule of quantities shall includes : Apart from other factors mentioned elsewhere in this Contract, the rate given in schedule of quantities for item of wood work and joinery shall include for the following :

(i) All labour, materials and equipments for carrying out the work.

(ii) Providing and fixing frames and shutters, fastenings and fixtures.

(iii) Bison or other equivalent wood preservative treatment to rough frame work in portions, suspended frame work in ceilings and timber veneering to walls etc.

(iv) Coal tarring of embedded parts of wood work in masonry & concrete.

(v) 2 or more Coats Synthetic Enamal painting (Unless otherwise specified) of approved colour including primer from the list approved manufacturers and to the satisfaction of corporations engineer.

4.9 Mode of Measurement : Timber Door / Windows shall be measured in Sq. M. over door windows frames unless otherwise specified.

5. BRICK ON EDGE SOLING :

5.1 Bricks : The brick unless otherwise specified shall be locally available overburnt bricks and shall be approved, sound, hard, tough, durable, dense, ,clean, free from soft spots, cracks, decay and other defects. Brick bats shall not be used.

5.2 Preparation of Sub-Grade : All the fillings shall be watered and compacted to get maximum consolidation. All necessary trimming or filling for the laying of the soiling in and required grade shall be done. The subgrade shall be marked by stakes and strings for the required depth for laying of the soling.

5.3 Laying of Soling : The bricks shall be laid on edge (unless otherwise specified) touching each other. Bricks shall be laid in parallel rows breaking bond or in Herringbons bond pattern as directed All bricks shall be laid closely in position and firmly embedded, true to line and gradient as required, the joints shall be filled by sand as directed.

5.4 Consolidation : The soling shall be watered and rammed with wooden rammers of approved weight. The brick soiling shall not be rammed with heavy Iron tammers as the bricks are likely to be crushed. Ramming shall continue till closely knit & compacted and surface conforming to the required levels is obtained. Earth on no account shall be used for making good or blinding purposes and if approved by Executive Engineer, sand shall be used for blinding purposes. Water shall be lightly sprinkled if required and directed.

5.5 Rates given in the schedule of quantities shall Include : Apart from other factors mentioned elsewhere in following:

(i) Preparing the subgrade.

(ii) Providing and laying the bricks on edge as described above.

(iii) Consolidating watering, ramming and blinding with approved sand as

directed.

(iv) All labour materials, and use of equipments and tools required for carryiflg out the works satisfactorily.

5.6 Mode of Measurement: The measurement for brick on edge soling shall be in square meter as provided.

6. CEMENT CONCRETE FLOORING AND CEMENT SKIRTING OR DADO

Plain Cement Concrete Flooring in Single Layer

6.1 Cement Concrete : Unless otherwise specified, the proportion of cement concrete shall be 1 :2.5:3.5 (Cement : fine aggregate : coarse stone aggregate of size 12mm and below by volume. Cement however, shall not be measured in volume but by weight. One bag of cement of 50kgs. shall be assumed to contain 35 litres of cement i.e. 1.20 cft). The coarse aggregate shall be from approved source, carefully selected, sufficiently . tough and hard stone pieces broken in a manner that will provide particles of approx. Cubical shapes affording good interlocking. Elongated or thin flake like fragments should be avoided. The maximum size of the coarse aggregate shall be 12 mm The fine aggregate shall be sand from approved source and consist of properly graded particles. The coarse and fine aggregates shall be conforming to relevant I.S. 383-1963 and shall be washed clean if necessary.

Unless otherwise mentioned in the item concrete in flooring shall be 4omm thick. The least amount of mixing water that will produce a workable mix and will allow finishing without excessive trwellings shall be used. Generally water cement ratio of 0.5 should sufficient.

6.2 Preparation of Sub-grade : Before placing the concrete flooring the subgrade shall be got approved by the Executive Engineer. The top surface of the subgrade shall be thoroughly cleared of the dirt, loose particles, cake mortar droppings and laitance if any, by scrubbing with coir or steel wire brush or by hacking if necessary.. The top surface of subgrade shall be elightly rough and shall have the required slope. The subgrade shall be moistened before laying the concrete flooring without forming any pools of water.

6.3 Laying : The concrete flooring shall be laid in alternate bays not exceeding 2x2 M. each. The edge of each panel into which the floor is devided should to supported by flat iron or wood duly oiled to prevent stickings. Their depth shall be same as that proposed for the concrete flooring as mentioned in the item. The flat iron should be removed before filling in the adjoining panels. At least 48. hours shall elapse before the concreting in the adjoining bays is commenced. Glass strips or approved separators shall be provided if specified in the item.

The concrete shall be laid immediately after mixing. While being placed, the

concrete shall be vigorously sliced and spaded with suitable tools to prevent formation of voids or honeycomb pockets. The concrete shall be brought to the specified levels 'by means of a heavy straight edge resting on the side forms and drawn ahead with a sawing motion in combination with a series of lifts and drops alternating with small lateral shifts. While concreting the adjacent hays, care shall be taken at ensure that edge of previously laid bays are not broken by careless or. hard tamping. Immediately after laying the concrete, the surface shall be inspected for high or low spots and any needed correction shall be done by adding or removing the concrete. After striking of the surface to the required grade it shall be compacted with wooden float. The blows shall be fairly heavy in the beginning but as consolidation takes place, light rapid strokes shall be given to complete the ramming. The floating shall be followed by steel trowelling after the surface has hardened sufficiently to present excess of fine material from working to the surface. The finish shall be brought to a smooth and even surface, free from defects and blamishes and tested with straight edges and manson's spirit level to detect any inequalities in the surface which, if any, shall be made good immediately. No dry cement or mixture of dry cement and said shall he sprinckled on the surface of concrete to absorb moisture or to stiffen the mix. The junctions of floor and walls shall be rounded off if so directed without extra payment.

No extra morter shall be laid over the concrete to make the floor in level. If broom finish is specifically. mentioned in the item, the surface shall be obtained rough with paralled broom marks before the concrete sets.

After the concrete in the bays has set, the joints of the panels shall be filled with cement paste as directed. The joints shall be straight both ways i.e. along the length and width. The vertical edge of the bays shall be neatly marked on the surface with a pointed trowel after filling the joints.

6.4 **Curing:** The surface shall be protected from direct sun when it is green. As soon as the surface has hardened sufficiently to prevent damage to it, it shall be kept continuously moist for at least 14 days by means of wet gunny bags 50 mm thick layer of damp sand spread over the surface or pooling water on the surface.

6.5 **Rates given in the schedule of quantities shall Include**: Apart from other factors mentioned elsewhere in the contract, the rates given in the schedule of quantity shall include for the following :-

(i) Cleaning and preparing the sub-grade.

(ii) Providing and laying concrete of the specified mix, and finishing the surface as described above.

(iii) Providing and fixing glass strips of approved separators to form panels when specified.

(iv) Curing.

(v) All labour, materials, tools and equipment for carring out the item as specified above.

6.6 Mode of Measurement : The measurements shall be in square metres of cast-in-situ of cement concrete flooring as provided.

6.7 Cement dado and Skirting

(a) Preparation of Surface: The walls to which skirting or dado is to be done shall have all the joints raked out to a depth of 10 mm If not already done. RCC surface shall be properly becked to got good key to mortar. All dust and oily matter, if any, shall be brushed and cleaned and the surface shall be kept wet for 6 hours before the dado or skirting work commences. The dado or skirting work shall not be commenced unless the preparatory work is passed by the Executive Engineer.

(b) Cement Mortar: Unless ,otherwise mentioned the proportion of mortar shall be 1:3 (1 cement : 3 sand), Sand in mortar shall be as per IS:1542-1960 as applicable to internal wall plastering and washed clean if necessary. The thickness of dado or skirting shall be 20mm thick unless otherwise specified.

(c) Application: The mortar shall be firmly applied with some what more than tile required thickness and well pressed, rubbed and levelled with a flat wooden rule to give required thickness. Long straight edges shall be freely used to ensure perfectly plain and even surface. No dry cement or mixture of dry cement and sand shall be sprinkled directly on the surface to absorb moisture or to stiffen the mix. The mortar shall adhere to the surface intimately when set and there should be no hollow sound when struck. All corners, angles and junctions shall be truely vertical and horizontal as the case may be, carefully and neatly finished. Care shall be taken to see that the top edge of the skirting straight in line and square and jointed with plaster above as required.

When neat cement finishing specified over the plaster surface. a coat of pure Porttland cement slurry 1.5 mm thick shall be applied and well rubbed to the plaster surface while the plaster surface is still fresh.

When no finish is specified the plastered surface shall be rubbed well to an even plane with a wooden float for external surface and finished smooth with a steel trowel for internal surface. If coloured dado or skirting is required approved coloured cement or cement mixed with the required shade of approved pigment shall be used.

(d) Curing: The dado or skirting shall be kept wet for 14 days.

6.8 Rates given in the schedule of quantities shall Include: Apart from other factors mentioned else where in this contract, the rate given in the schedule of quantities for the item of dado or skirting shall include for the following :

(i) Preparing the surface

(ii) Providing and applying segment mortar of specified mix, finishing the surface and finishing the edges with plaster as stated above.

(iii) Providing coloured cement and colouring pigment when coloured cement dado/skirting is specified.

(iv) Curing.

(v) All labour, materials, tools and equipment for carrying out the items as specified above.

6.9 Mode of Measurement :

(a) Dado shall be measured in square metres a provided.

(b) The height of skirting shall be specified in the item and shall be measured in R.M. (Skirting upto 30cm in height shall be measured in running metres).

7. CEREMIC TILES, IN FLOORING AND DADO FLOORING:

7.1 Tiles: glazed tiles including specials shall be of approved make and quality and shall conform to I.S. 777-1961 in all respects. Samples of tiles shall be got approved by the Chief Engineer, who will keep them in this office for verification as to whether the materials brought for use conform to the approved samples, glazed tiles shall be of the size 300x300x6.7mm

7.2 Mortar Bedding: Mortor bedding shall be as specified in the item given in the schedule of quantities.

7.3 Laying, Finishing, Curing and Cleaning : The tiles before laying shall be soaked in water for atleast 2 hours. Tiles which are fixed in the floor adjoining the wall shall be so arranged that the surface of the round edge tiles shall correspond to the skirting or dado. Neat cement grout of honey like consistency shall be spread over the bedding mortar just to cover so much area as can be tiled within half an hour. The edges if the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight lines. The joints between the tiles shall not be more than 1.2 mm wide. After fixing the tiles finally in an even place the flooring shall Improved with wet saw dust. The tile flooring shall be cured for 14 days. After the tiles have been laid in a room or the day's fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, the floor shall be carefully washed clean and dried. When dry, the floor shall be covered with oil. free dry saw dust which shall be removed only after completion of the constructions work and just before the floor is occupied.

7.4 Rates given in schedule of quantities shall Include : Apart from other factors mentioned elsewhere in this contract, the contractor's rate quoted shall Include for the following :-

(i) Cleaning the base and providing and laying bedding mortar and leveling.

(ii) Providing and fixing the tiles including all specials like round edge corner cups, angles etc. in neat cement float over the bedding mortar.

(iii) Filling the joints of tiles with neat white cement slurry.

(iv) Finishing, curing and cleaning.

(v) All labour, materials and use of tools for carrying out the item as specified above.

7.5 Mode of Measurement: Measurement. for flooring tiles shall be in square metres as provided.

7.6 Dado

(a) **Tiles:** Glazed tiles shall be same as described under glazed tiles flooring.

(b) **Mortar Backing:** All joints in the face work shall be raked out to a depth equal to not less than the width of the joints or as directed by the Executive Engineer. Concrete surfaces shall be property hacked. All dirt, soot, oil, or any other material that might interfere with' satisfactory bond shall be' removed. The surface shall be cleaned and scrubbed with fresh water and kept wet for 6 hours prior to applying backing mortar. The dado work shall not be commenced unless the preparatory work is passed by the Executive Engineer. The' proportion of mortar for backing shall be 1:3 cement mortar. Sand in mortar bedding shall be from approved source, and shall confirm to IS: 1542: 1960 as applicable to internal wall and ceiling plastering and external wall plastering. Tre thickness of mortar backing shall not be less than 12mm and not more than 20mm

(c) **Fixing Dado Tiles:** Dado work shall be done only after fixing tiles, on the floor. The plazed tiles shall be soaked in water for at least 2 hours before being used for dado work. Tiles shall be fixed when the ,cushioning, mortar is still plastic and before it gets very stiff. The back of tiles shall be covered with a thin layer of neat cement paste and the tite shall then be pressed in the mortar and gently tapped against the will with a wonden mallet. The fixing shall be done from bottom of wall upwards without any hollows in the bed or joints. Each tile shall be fixed as close as possible to the one' adjoining. The tiles shall be jointed with white cement slury. Any difference in the thickness of tiles shall be evened out in cushioning mortar so that all tiles faces are in one vertical place. The joints between the tiles shall not exceed 1.5 mm in width and they shall be uniform. After fixing the dado, they shall be kept continuously wet for 14 days. If doors, windows or other openings are located within the dado area, the tills, jambs, angles etc. shall be provided with ceramic tiles and appropriate special according to the foregoing specification and such tiled area shall be measured get alongwith the dado.

(d) Cleaning: After the tiles have been fixed the surplus cement grount that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the dado or skirting work shall be washed thoroughly clean.

7.7 Rates given in schedule of quantities shall Include : Apart .from other factors mentioned elsewhere in this contract, the rates given in schedule of quantities for the item of dado or skirting shall include the following:

(i) Backing mortar.

(ii) Providing and fixing tiles including all specials like round edges. angles, etc in, neat cement flat over : backing mortar.
(iii) Jointing of the tiles with white cement slurry,
(iv) Curing.
(v) Cleaning

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

7.8 Mode at Measurement: Dado shall be 'measured In square metres as provided.

8. POLISHED BARODA GREEN MARBLE STONE FLOORING / DADO FLORRING

8.1 Stone Slabs : The stone slabs all, be. hard, sound, durable. resistant to wear. Unless otherwise specified, stone slabs shall be square in shape.

The stone .slabs shall be without any soft venins, cracks or flaws and shall' have a uniform colour. A tolerance of ±3 mm in thickness at any point shall be permitted. The exposed surface of stone slabs shall be machine polished to a smooth even and true plane and the edges to be chiselled to half its depth. true and square to ensure uniform width of joint. The edges of stone' slabs shall be machine cut square to. the required shape, if necessary. The stone slabs shall be of approve colours and shades. A few approved samples of stone slabs to be used shall be deposited by the Contractor in the office of the Corporation's Engineer:

8.2 Mortar bedding : Mortor bedding shall be as specified in the item given in the Schedule of Quantities.

8.3 Laying, Cutting, Polishing, Finishing and Cleaning: Before laying, the stone slabs shall be thoroughly wetted with the clean water. Neat cement grout of honey like consistency shall be spread on the mortar bed over as much area as could be covered with the slabs within half an hour. The .stone :slabs shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slope in the mortar bed. The stone slabs

shall be laid in the approved pattern in single or two tone colour. Each stone slab shall be gently tapped with a wooden mallet till it is firmly and properly bedded. There shall be no hollows left. If there is a hollow sound on gentle tapping of the stone slabs, much stone slabs shall be removed and reset properly. The masson shall make the joint of uniform thickness and straight lines, The thickness of joints shall not exceed 1.5 mm The joint shall be grouted with neat 'cement slurry. No border stone slabs shall be less than 100mm in width. unless otherwise approved by the Executive Engineer, When the bedding and joints of the floating have been completely set, the surface shall be machine polished to give a smooth, even and true plane to the floor and thoroughly cleaned.

8.4 **Rates given in the schedule of quantities shall Include** : Apart from other factors mentioned elsewhere in this contract, the rate given in the schedule of quantities shall include for the following

(i) Cleaning the, base and providing and laying bedding mortar and levelling.

(ii) Providing and fixing the stone slabs in neat cement float on the bedding mortar.

(iii) Filling joints of stone slabs with neat cement slurry of required colour to match the colour of the stone slabs.

(iv) Chiselling, polishing, Finishing and cleaning.

(v) All labour, materials and use of tools for carrying out the item as specified above,

8.5 **Mode of Measurement :** Measurement for flooring, stone slabs shall be in square metre as provided.

8.6 **Dado/Lining and Skirting :**

(i) Door/window frames shall have cut rebates, Planted rebates shall

(a) The stone slabs shall be as specified above for flooring unless otherwise mentioned. The stone slabs shall be in approved length to match the flooring. The exposed edges of the stone slabs such as in dado/lining and skirting, jambs, soffits, sils ate. shall be machine cut and polished smooth.

(b) **Mortar Backing:** All joints in the face work shall be raked out to a depth equal to not less than the width of the joints or as directed by the Executive Engineer, Concrete surface shall be properly backed. All dirt, oil, or any other material that might interfere with satisfactory bond shall be removed. The surface shall be cleaned and scrubbed with fresh water and kept wet for 6 hours prior to applying backing motar. The dado lining as skirting work shall not be commenced unless the preparatory work is approved by the Executive Engineer. The

proportion of mortar for backing shall be 1: 3 cement : sand mortar. Sand in mortar bedding shall be from approved sources, and shall conform to I.S. : 1542-1960 as applicable to internal wall and ceiling plastering and external wall plastering. The thickness of mortar backing shall not be less then 12mm and not more than 20mm

(c) **Fixing Dado/Lining or Skirting Stone Slabs :** Dado/lining or skirting shall be done only after fixing stone slabes on the floor. The stone slabs shall be thoroughly wetted in water before being used for dado/lining or skirting work. The stone slabs shall be fixed when the backing mortar is still plastic and before it gets stiff. All the stone slabs shall be covered with an additional layer of neat cement paste and stones shall then be pressed in mortar and gently tapped against the wall with wooden mallet. The fixing shall be done from the bottom of wall up wards without any hollows in the beds or joint. The fixing shall be done from the fixed as close as possible, to the adjoining stone slab. The stone slabs shall be joined in neat' cement slurry to match the colour of the stones. The joints shall not ,exceed 1.5 mm in width and they shall be uniform. While fixing the stone in dado/lining or. in skirting work, care shall be taken to see that the adjoining flooring below, matches with the joints in the dado/lining or in skirting, as the case may be or shall be staggered as directed. When specified brass cramps and pins etc. of approved size shall also be used for fixing dado/lining.

(d) **Polishing :** When, stone slabs are completely set, polishing shall be done by hand with approved type of polishing stone. A smooth and even polished surface shall be obtained to match the finished surface of the flooring.

(e) **Curing:** The dado/lining of skirting shall be kept wet for 14 days.

8.7 **Rates given in the schedule of quantities shall Includes:** Apart from other factors mentioned elsewhere in this contract. the rate given in the schedule of quantities for the item of dado/lining or skirting shall include the following :

(i) Backing mortar.

(ii) Providing and fixing stone slab with exposed edges machine cut including all special tiles and finishing the edges with plaster.

(iii) Joints of the stone slabs filed with colored cement slurry to match the stone slabs.

(iv) Providing and fixing brass clamps and pins etc. for dado/lining where specified.

(v) Curing.

(vi) Chiseling polishing and cleaning the dado/lining and skirting.

8.8 Mode of Measurement :

(a) Dado/lining stall be measured in Square Metres as provided.

(b) The height of skirting shall be specified in the item and shall be measured in R. M. (Skirting upto 30cm. in height shall be measured in running metres).

9. MARBLE FLOORING/DADO

9.1 Marble Slabs: The marble shall be of approved shade and sources as mentioned in the Schedule of quantities and there size and tt e thickness shall be as shown on the drawings and as approved by the Executive Engineer. They shall be of selected quality, dense, uniform and homogenous in texture and free from cracks or other structural defects. It shall have even and crystalline grains. The surface shall be machine polished to an even and perfectly plain surface. and edges machine/cut the and square. The rear face shall he. rough enough to provide a key for the mortar. No slab shall be thinner the specified thickness at its thinnest part. The dimensions of the slabs shall be as specified. A few approved samples of finished slabs to be used shall be deposited by the Contractor in the office of the Corporation's Engineer. Unless other wise mentioned, the thickness of marble shall minimum 20mm

9.2 Concrete base & Mortar' Bedding : The base of cement or lime concrete shall be laid and completed to a reasonably true plain surface and to the required slopes and below the level of the finished floor to the extent of the thickness of the slabs and mortor bedding cement concrete or lime concrete base shall be paid under a separate item. Cement mortar for bedding may be mixed manually or by a mechanical mixer as directed. Lime mortar shall be prepared in a mortar mill. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and satisfactory bedding. Care shall be taken in preparing the mortar to ensure that there are no hard lumps that would interfere with the even bedding of the stones. Before spreading the mortar,. sub-floor or base shall be cleaned of all dirt, scum or laitance and of loose material and then well wetted without forming any pools of water on the surface. In case of RCC floors, the top shall be left a little rough. All points of level for the finished paving surface shall be marked out. The mortar shall then be evenly and smoothly spread over the base by the use of screed battens only over so much area as will be covered with slabs within half an hour. The thickness of the mortar bedding shall not be less than 12mm (about 1/2") and not more than 25mm (about 1"). Unless otherwise specified the proportion of mortar bedding shall be 1:2 lime motar or 1:4 cement mortar bedding shall be as per I.S. No. 2116-1965 as applicable to unreinforced masonry work.

9.3 **Laying Marble Slabs :** Before laying, the marble shall' be thoroughly wetted with clean water, Neat Cement grout of honey like consistency shall be spread on the mortar bed over as much area as could be covered with the slabs within half an hour. The specified type of marble slabs shall be laid to pattern as directed on the neat cement float and shall be evenly and firmly bedded to the required level and slope in the mortar bed. Each slab shall be gently tapped with a wooden mallet till it is firmly and properly bedded. There shall be no hollows left. If there is a hollow sound on gentle tapping on the slabs, such slabs shall be removed & reset properly. The joints shall be hair fine in width and in straight line grouted with neat coloured cement slurry to match the colour of the marble. The joints shall be struck smooth but there shall be no smearing over the) mortar of the slabs. The edges of the adjoining slabs shall be in one plane.

9.4 The flooring shall be kept undisturbed atleast for seven days and wet for fourteen days. Marble flooring shall be given a final cost of wax polish of approved make.

9.5 **Rates given in schedule of quantities shall include:** Apart from other factors mentioned elsewhere in this contract. the rate given in the schedule of quantities for item of marble flooring shall include the following:

(a) All labour, materials and equipment, cleaning the sub-base, laying mortar bed and cement coat and fixing marble slab as specified above and making up the joints and wax polishing.

(b) Any cutting and waste if required

(c) Curing

(d) Cleaning the floor from all stains etc.

9.6 **Mode of Measurement:** The measurement shall be in Sq. Metres for the actual marble flooring provided.

10. INTERNAL CEMENT PLASTER

10.1 Preparation of Surface: The walls to be plastered to have all joints raked out to the a depth of 10mm if not already done, RCC surface shall be properly hacked to get good key to the plaster. All dust and oily matter, if any, shall be brushed and cleanned and the surface to be plastered shall be kept wet for 6 hours before plastering is commenced.

10.2 Proportion of Mortar: Unless otherwise mentioned, the proportion of internal cement plaster for walls and ceiling shall be 1:4 (1 cement: 4 sand). Sand shall be from approved source free from foreign matter and shall be as per 18:1542-1960 as applicable to internal wall and ceiling plastering. No more cement mortar shall be propared than that can be used within an half an hour.

10.3 Application of Plaster: The mortar shall be applied evenly with force on the surface to be plastered. The mortar surface shall be finished at once by being rubbed over with a trowel till the cement appears on the surface. All corners, angles and junctions shall be truly vertical and horizontal as the case may be, carefully and neatly finished. Rounding of comers and junctions where required shall be done without extra charge. The mortar shall adhere to the surface intimately when set and thee should no hollow, sound when struck. The thickness of plaster shall be minimum 12 mm over the proudest part of th surface of brick wall and RCC surfaces and 20 mm over stone walls. Plaster for ceiling shall not be more than 12mm

10.4 Neeru finish: If the plaster surface is to be given neeru finish, the surface shall be combed slightly with wire brushes or nails before it is completely set to form key for neeru. The under coat shall be only damped but not soaked before the application of neeru. The lime of preparing neeru shall be fat lime and shall be of approved quality and source. Lime shall be slaked and mixed with sufficient water to form a thick paste. It shall be reduced to a fine paste by grinding. It shall then be passed through a fine sieve (3mm mesh) to remove all unstaked particles and foreign matter and alleged to mellow under water for at least 10 days in large slaking tanks. The surplus water on the top shall be allowed to run off. The slaked lime paste thus formed shall be used for preparing nerru. The neeru shall be prepared by mixing together 4 parts of this lime paste and 1 part approved fine sieved sand by volume, Jute fibres finely chopped shall be, adoed to the above mortar at the rate of 1 kg. of jute to every Cubic Metre of lime sand mixture. The mixture shall then be properly ground to a fine paste between two stones or a mill. The neeru thus prepared shall be kept moist until used and not more than what can be consumed in 15 days shall be prepared at a time.

Neeru shall be applied to the prepared and partially set but some what plastic surface with steel trowel to a thickness slightly exceeding 1.5 mm (about 1/6") and rubbed down to 1.5 mm (1/16") thickness and polished to a perfectly smooth and even finish, working from top to bottom. While trowelling is going on soap powder contained in thin muslin bags shall be dusted over the surface and worked in.

Moistening shall be commenced as soon as the plaster has hardened sufficiently and is not susceptble to injury. Soaking of wall shall be avoided and only as much water as can be readily abosorbed shall be used. The surface snail be kept sprinkled with water for 14 days.

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

10.6 When no finish is specified the plastered surface shall be rubbed well to an even plane with a wooden float for external surface and finished smooth with, a stool trowel for internal surface.

10.7 Rates given in schedule of quantities shall Include : Apart from other factors mentioned elsewhere in this Contract, rates given in schedule of quantities for the item of plaster shall include for the following :

(i) Erecting, dismantling and removing the scaffolding.

(ii) Preparing the surface to receive the plaster.

(iii) Providing cement plaster for the specified average thickness.

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

(v) Curing for 14 days.

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

(vii) Plaster work in hands, arises, rounded angles, fair edges, narrow returns quirks, 'V' joints, splays, drip mouldings, making good to metal frames, junctions with skirting or dados, narrow widths and small quantities, making good around pipes, conduits, timbers, sills, brakcets, railings etc, and making good after all the sub-contractors or nominated sub-contractors have done their work.

(viii) Neeru or cement finish when specified in the item.

10.8 Mode of Measurement : Plaster shall be measured in square metre.

(a) Walls: (i) The measurement of wall plastering shall be taken between the walls or partitions (the dimensions before plastering shall be taken) for the length and from the top of floor/skirting/dado (as the case may be) to the ceiling for the height.

(ii) **Deductions:** A, For jambs, soffits, stiils, etc. for openings not exceeding 0.5 M^2 each in area: ends of joists, beams, posts, girders, steps, etc. not exceeding 0.5 m2 each in area and openings not exceeding 3m^2 each, deductions and additions shall be made in the following manner :

(a) No deduction shall be made for ends of joists, beams posts; etc., and openings not exceeding 0.5 m^2 each, and no additon shall be made for reveals, jambs, soffits, sills etc., of these openings nor for lnishing the plaster around ends of joists, breams, posts, etc.

(b) Deductions for openings exceeding 0.5M^2 but not exceeding 31M^2 each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings :

(i) When both faces of wall are plastered with the same plaster deduction, shall be made for one face only.

(ii) When two faces of wall are plastered with different plaster or if one face is plastered and the other pointed, deduction shall made from the side of frames for doors, windows, etd. on which the width of reveals is less than that on the other side, but no deduction shall be made on the other side.

B. In case of openings of area 3 M^2 each, deductions shall be made for the openings but jambs, soffits and sills shall be measured.

(b) Ceilings : (i) Ceilings shall be measured between the walls or partItions and the dimensions before plastering shall be taken.

(ii) Ceiling with projected beam shall be measured over beams and the plastered sides of beams shall be measured and added to plastering on ceilings.

11. EXTERNAL CEMENT PLASTER WITH SAND FACED/COMBED/ROUGH CAST FINISHES

Sand Faced Finishes :

11.1 Preparation of Surface : The walls to be plastered to have all joints raked out to a depth of 10mm if not already done. RCC surface shall be properly hacked to get good key to the plaster. Any un evenness shall be levelled before the plastering is applied. All dust and oily matter. If any, shall be brushed and cleaned with a stiff bristle or wire brush, and the surface to be plastered shall be kept wet for 6 hours before plastering is commenced. If the surface becomes, dry in spots such areas shall be moistened again to rostore uniform suction.

11.2 Proportion of Mortar: Unless otherwise mentioned the proportion of external cement plaster for brick or concrete surfaces shall be 1:4 (1 cement : 4 sand), sand shall be from approved source free from foreign matter, washed clear if necessary and shall be as per IS: 1542-1960. No more cement mortar shall be prepared than that can be used within half an hour. The mortar may be hand mixed or machine mixed. In hand mixed mortar, cement and sand in the specified proportion shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 time or more till a homogeneous mixture of uniform colour is obtained. Fresh and clean water shall be added gradually through a rose and thoroughly mixed so that mix becomes homogenous and each particle of sand shall be completely covered with a film of we cement. Mixing platform shall be so arranged that no deterious extraneous material shall get mixed with mortar nor the mixing water of the mortar shall flow out.

11.3 Application of Plaster: The plastering shall be done in two coats namely under coat and finishing coat.

Under Coat: The under coat shall be of cement mortar 1:4 Water proofing compound of approved make shall be added according to manufacturer's specifications to make the mortar waterproof. Patches of plaster 15cm x 15cm shall be put on about 3m. apart as gauges to ensure even plastering in one place. The thickness of the under coat in any part shall not be less than 8mm

and more than 12 mm The mortar shall be firmly applied with somewhat more than the required thickness and well pressed into the joints on the surface and rubbed aria levelled with a flat wooden rule to give r required thickness. Long straight edges shall be freely used to ensure of perfectly plane and even surface. All corners must be finished to their true angles or rounded as directed. Plastering shall be done from top downward. Keys shall be-formed on the surface by thoroughly combining it with wavy horizontal lines about 12mm apart and 2mm deep when the mortar is still plastic. Under coat shall be cured for not less than 2 days before finishing coat is applied.

Finishing Coat : Cement mortar for finishing coat shall have washed approved sand with slightly larger proportion of coarse materials. The proportion of cement to sand shall be 1:4. The finishing coat shall be of such thickness to make the total average finish to thickness equal to the required plaster thickness as described. The finishing coat shall not be less than 4mm or more than 8mm thick. The finished surface shall be true and even and shall present uniform- texture throughout and all joining mark shall be eliminated. After application the surface should be finished with a wooden float laying with cork and tapped gently to retain coarse surface texture. A steel trowel shall not be used and overworking. shall be avoided. water shall not be applied to the surface of the finishing coat whilst working up. but patches showing signs of premature drying may be patted with a damp float. When the finishing coat had hardened, the surface shall be kept moist continuously for 14 days in any continuous face of wall. finishing coat should be carried out continuously and day to day breaks made to concide with architural breaks in order to avoid unsightly junction.

All mouldings shall be worked true to template and drawn neat dean and level. All exposed angles and junctions with door frames etc. shall be carefully finished as directed.

11.4 Curing : All plaster work shall be kept damp continuously for a period of 14 days. To prevent excessive evaporation on the sunny or windward side of the buildings in hot dry whether' matting or gunny bags may be hung over on the outside of the plaster in the beginning and kept moist.

11.5 Rates given in schedule of quantities shall Include: Apart from other factors mentioned elsewhere in this contract, rates given in the schedule of quantities for the item of plaster shall include for the following :-

(i) Erecting, dismantling and removing the scaffolding.

(ii) Preparing the surface to receive the plaster,

(ii) Providing cement plaster of the specified average thickness in two coats, including, water proofing compound.

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

(v) Curing for 14 days.

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

(vii) Plaster work in the bands, arises, rounded angles, fair edges, narrow returns, quirks, 'V' joints, plays drip mouldings: making good to metal frames junctions with skirting or dados, narrow width, and small quantities, making good round pipes, conduits, timber, sills, brakcets, railings, etc. and making good. after all the sub contractors or nominated sub contractors have done their work.

11.6 Measurement: All plastering work shall be measured in square metres. Dimensions shall be measured and quality worked out correct upto two places of decimals in metre and square metre respectively. If the average thickness of plaster provided by the contractor is more than what is specified on any account no extra payment will be made.

No deduction shall be made for ends of joists, beams, poosts etc. and openings not exceeding a.5M2 each. and no addition shall be made for reveals, jambs, soffits, sills. etc; of these openings nor for finishing the plaster around ends of joists, beams, posts etc.

Deductions for opening a.5M2 but not exceeding 3M2 each shall be made as follows and no addition shall be made for reveals jambs, soffits, sills, etc., of the following :

(i) When two faces of wall are plastered with the same plaster. deduction shall be made for one face only.

(ii) When two faces of wall are plastered with different plaster or if one face is plastered and the other pointed deduction shall be made from the plaster or points on the side of the frames for doors, windows, etc. on which reveals is less than that on the other side, but no deduction shall be made on the other side.

In case of openings of area above $3M^2$ each, deductions shall be made for the openings but jambs soffits and sills shall be measured.

11.7 Combed Finish: All the specifications given above for sand faced finish shall apply to this as well except that in the case of combed finish, the finishing coat will be treated to have combed texture of approved pattern.

11.8 Rough Cast Finish :

(a) All the specifications given above for sand faced finish shall apply to this as well except for the application of plaster which is described below :

(b) Application of Plaster: The plastering shall be done in two coats namely undercoat and finishing coat. The under coat shall be done same as in case of sand faced finish. The finishing coat shall contain a fairly coarse aggregate and shall be thrown on as a wet mix and shall be left in rough condition. The

mortar of the finishing coat shall consist of coarse aggregate of crushed stone or fine gravel of size generally 6 to 12mm as approved by Executive Engineer and specially graded mixture, mixed with approved sand cement. The proportion of cement to sand and aggregate/gravel shall be generally 1:1.1/2:3. The mortar shall be flung upon the under coat with large trowels to form an even protection coat. The finishing coat must be applied while the under coat is still soft and plastic. The thickness of the finishing coat shall be about 12mm unless otherwise specified.

12. WHITE WASHING, COLOUR WASHING AND DISTEMPERING

12.1 White Washing :

(a) **Material:** White wash shall be prepared from fresh burnt fat lime. The lime shall be dissolved in a tub with sufficient quantity of water (about 4/5 litres), kg. of lime) and the whole thoroughly mixed and stirred until it attains the consistency of thin cream. The wash shall be taken out in small quantities and strained through as clean coarse cloth. Clean gum dissolved in hot water shall then be added in suitable proportion of two grams of gum arrabic to a litre of lime to prevent the white wash coming off easily when rubbed. Rice size may also be used instead of gum.

(b) **Scaffolding :** This shall be double or single according to requirement and as directed, If ladders are used pieces of old gunny bags or cloth rags shall be tied on their lops to avoid damage or scratches to the plastered surfaces, etc. Proper stage scaffolding shall be erected when white washing the Ceiling,

(c) **Preparation for Surface :** The surface shall be prepared by removing all mortar droppings and foreign matter and thoroughly cleaned with hair or fibre brush or other means as may be ordered by the Corporation Engineers to produce an approved clean and an even .surface. All loose pieces and scales shall be scraped off and holes, cracks etc. filled with mortar to match with the surrounding finish.

In case where the surfaces have been previously white washed or colour washed, the old white or colour wash shall be entirely removed and surfaces broomed down before the new white wash is applied In case the old white wash cannot be removed by brooming, the surface shall be cleaned by scraping.

(d) **Application of white wash:** On the surface so prepared, the white wash shall be laid on with a brush. The first strike of the brush shall be from top down wards, another from 'bottom upward over the first stroke and similarly one stroke from the right and another from the left over the first brush before it dries. This will form one coat, Each coat must be allowed to dry and shall be subject to Inspection and approval before the next cost is applied. When dry, the surface shall show no signs of cracking. It shall

present a smooth and uniform finish free from brush marks and it should not come off easily when rubbed with a finger. Minimum 3 coats of white wash shall be applied.

No portions in the surface shall be left out initially to be patched up later on.

For old work, patches and repairs shall be white washed first. Thereafter, the whole surface shall be white washed with the required number of coats.

Doors, windows, floors and other articles of furnitures etc. shall be protected from being splashed upon. Splashing, droppings, if any. shall be removed and the surfaces cleaned.

(e) Rates given in the schedule of quantities to Include : Apart from other factors mentioned elsewhere in this contract, the rates given in the schedule of quantities for white wash shall include for the following :

(i) All labour, materials, equipment required for white washing.

(ii) Scaffolding including erection and removal,

(iii) Providing and preparing the white wash.

(iv) Preparing the surface for white wash including the scaffolding.

(v) Applying the white wash in three coats minimum, If a proper even surface is not obtained to the satisfaction of the Executive Engineer in 3 coats, Contractor shall carry out additional coats of white wash to approval at contractor's expense.

(f) **Mode of Measurement :** The measurement shall be in Sq. Metre. The mode of measurement shall be applicable to that for plaster.

12.2 Colour Wash

Material: This shall be prepared by adding approved colouring matter to the white wash (prepared as for white washing) according to tint required.

In all respects the same conditions and specifications as applicable to white wash shall also be applicable to colour wash.

12.3 Distempering :

Powdered/Dry Distemper

(a) Material: The powdered/dry distemper shall be of approved colour and shade manufactured by M/s. Blundel Eomite or other equivalent and approved.

(b) Scaffolding : This shall be double or single as required and directed.

(c) Preparing the Surface : The surface to be distempered shall be cleaned and all cracks, holes and surface defects shall be repaired with gypsum and allowed to set hard. All Irregularities shall be sand papered smooth and wiped clean. The surface so prepared must completely dry and free from dust before

distempering is commenced, In the case of walls newly plastered, Speciliation shall be taken to see that it is completely dry before any treatment is attempted.

For the old surface which had earlier been distempered, the surface shall be' cleaned of grease dust etc. The flackings of previous coatings, if any, shall be taken off. All cracks, holes and surface defects shall be repaired with gypsum and allowed to set 'hard and then sand papered smooth and wiped clean. But in case the surfaces are coloured or white washed the wash must be removed thoroughly first.

(d) **Priming Coat:** The priming coat shall be applied over the completely dry surface in the manner recommended by the makes in the case of patent distempers. When no priming coat is specified by the manufacturer a finely powdered chalk mixed with a thin solution of glue shall be applied to prepare a good, hard background, the coating when dry being sand papered as clean and smooth as possible.

(e) **Application of Distmper :** The instruction of the makers shall be followed regarding the preparation of the surface and application of priming and finishing coats. Distemper shall fiot be mixed in a larger quantity than is actually required for day's work. Hot water should be used to prepare the mixture, Distempers shall be applied in dry weather with a hard still brush in long parallel strokes. The treated surtace shall be allowed to dry and harden. Second or succeding coats shall not be applied until the preceeding coat has been passed by the Executive Engineer. Two more coats of distemper shall be given in exactly the same manner as the first one but that only after the earlier coat laid has thoroughly dried.

(f) **Rates given in the schedule of quantities shall include :** The rate shall include all labour, materials, equipment and tools for carrying out the following operations :

(i) Providing the primer and distemper and mixing the distemper.

(ii) Scaffolding.

(iii) Preparing the surface to receive the priming and finishing coats.

(iv) Applying the priming coat.

(V) Applying the distemper in 3 coat minimum. If a proper even surface is not obtained to the satisfaction of the Executive Engineer in 3 Coats. Contractor shall carry out additional coats of distemper to approval, at Contractor's expense.

(g) **Mode of Measurement** : Similar to that for white washing.

12.4 **Oil Bound Distempers :** The specification and conditions for this shall be the same as that applicable for dry disternper above except that oil bound

distemper of approved make, shade and colour shall be used after applying priming coat of petrifying liquid or other primer as may be recommended by that, manufacturers of distemper or as directed.

13. PLASTIC EMULSION PAINT

13.1 Materials: The emulsion paint and primers in general shall be of approved quality, colour and shade from the manufacturers / brands given in the list furnish with the tender document or other equal and approved.

13.2 Scaffolding: This shall be double or single as required and directed. If ladders are used pieces of old gunny bags or cloth rags shall be tied on their tops to avoid damage of scratches to the plastered surfaces, etc. Proper stage scaffolding shall be erected when painting the ceiling.

13.3 Preparation of the Surface :

New Surfaces : The surface to be painted shall be cleaned and all cracks, holes and surface defects shall be prepared with Plaster of Paris for spot filling and with filler prepared with whiting water and little quantity of paint for filling and levelling the wider areas.

Old Surfaces:

(i) The surfaces, which had been previously painted with emulsion paint, shall be lightly rubbed down and washed with clean water.

(ii) The surface, which had been painted with oil bounded distemper or oil paint shall be cleaned washed and sand papered.

(iii) The surface, finished with lime/colour wash, powder distemper shall be completely scraped off to the bare surface.

(iv) In case, after scrapping the surface any cracks, holes or other surface defects are noted, the same shall be rapaired before applying priming coat with Plaster of Paris for spot filling and with filler pro pared with whiting, water and little quantity of paint for filling and levelling the wider areas.

13.4 Priming Coat : The priming coat of approved shade shall be applied over the completely dry surface in the manner as recommended by the paint manufacturers. The emulsion paint, In the priming coat, may be thinned down with 20% water or as recommended by the paint manufacture. Turpentine or any other solvent shall not be used for thinning the paint

13.5 Application of Emulsion paint : The recommendation of approved paint manufacturers whose product is used, shall be followed regarding the preparation of the surface and the application of the priming and finishing coats. I he contractor shall arrange for technical assistance and supervision from the paint manufacturer, duing the execution of the painting work. After the priming coat has been applied and is perfectly dried, all holes, scratches, if any, shall be. repaired as mentioned in "preparation of surface-, and then

the second coat of approved shade and manufacture shall be evenly applied and allowed to dry. The third coat shall be carefully applied to achieve. smooth and even surface after the previous coat has dried up, Minimum 3 coat of paint shall be applied inclusive of priming coat. If a proper and even surface is not obtained to. the satisfaction of the Executive Engineer in 3 Coats contractor shall carry out additional coat of painting to approval at contractor's expense. Care shall be taken that dust or other foreign material do not settle or disfigure the various coats.

13.6 Rate given in schedule of quantities shall Include : Apart from other factors mentioned elsewhere in this contract, the rate given in schedule of quantities for the Item of plastic emulsion paint shall include for the following :

(i) All labours, material and equipment necessary to carry out the work.

(ii) Supplying the approval emulsion paint for priming and finishing coats.

(iii) Preparing the surface for receiving the primer and finishing coats.

(iv) Scaffolding including its, erection and dismantling.

(v) Application of the one primer coat and minimum two coats of finishing. If proper and even surface is not obtained to the satisfaction of the Executive Engineer in 3 Coats contractor shall carry out painting to approval at contractor's expense.

(vi) Protection to painted surface till dried and hand over.

(vii) Expense, if any, for supervision and technical assistance supplied by the approved paint manufacturer.

13.7 Mode of Measurement: The measurement shall be in square metre. The mode of measurement shall be as applicable to that for white washing.

14. PAINTING, FRENCH POLISHING, WAX POLISHING

14.1 Painting :

14.2 Material: Ready mixed oil paints and primers, In general, shall be approved quality, colour and of approved manufacture. These materials shall be in sealed tins and shall be opened in the presence of the Corporation's Engineer on site.

14.3 Preparation of Surface :

(a) **Iron and Steel Work:** Surface to be painted shall be thoroughly cleaned. sand papared and/or rubbed with Emery cloth, if necessary, to remove grease, mortar or any other foreign material, In case of rusted surface, it shall be first cleaned with wire brushes till the corroded rust is removed. The prepared surface shall be shiny and free from brush marks. patches, blister and other irregularities. The surface thus finished shall be got approved for painting.

(b) **Wood Work:** All surface to be painted shall be thoroughly cleared, sand papered and removed of all foreign materials. In case of surface having knot and nail holes, the same shall be filled with knotting and stopping materials. The knotting .material shall consist of pure shellac dissolved in methylated spirit. Stopping materials shall consist of putty. The surfaces thus treated shall be allowed to dry and then sand papered smooth.

14.4 Application : After preparing the surface a primer coat shall be applied.. The primer coat shall be ready mixed of approved make and manufacture. After the. primer coat is applied and perfectly dried, all holes, cracks, etc. if still remaining shall be filled in with putty and the surfaces sand papered smooth. Then a second coat, of paint of approved shade and manufacture shall be evenly applied and allowed to dry. The third coat shall be carefuly applied to achieve smooth and even surface after the previous coat has dried up. Minimum 3 coats of paint shall be applied inclusive of a primer coat If a proper and even surface is not obtained to the satisfaction of the Executive Engineer in 3 coats, Contractor shall carry out additional coats of painting to approval, at Contractor's expense. Care shall be taken that dust or other foreign material do not settle or other wise disfigure the various coats.

14.5 Rates given in schedule of quantities shall Include : Apart from other factors mentioned elsewhere in this contract, the rate for the item of painting shall include for the following :

(i) All labour, materials and equipment necessary to carry out the work.

(ii) Supplying the approved paint for priming and finishing coats.

(iii) Preparing the surface including knotting and stopping for receiving the primer and finishing coats.

(iv) Scaffolding including its erection and dismanting.

(v) Application of the one primer coat and two coats of finishing minimum. If a proper and even surface is not obtained to the satisfaction of the Executive Engineer in 3 coats, Contractor shall carry out additional coats of painting to approval at Contractors expense.

(vi) Protection to painted surface till dried and handed over.

Mode of Measurement : normally painting to woodwork and stel shall be included in the concerned items of work and shall not be measured separately. If painting is to be measured separately tile same will be as per I.S. 12001964.

14.6 French Polishing : French polish to be used shall comply with I.S. 3481952 in the requirements of quality and method of test.

Before French polish is applied, the surface of wood work shall be prepared in the same manner as for painting. The wood to be polished should be first painted with a filler composed of 1 part of whiting mixed with 0.53 part of

methylated spirit. After drying, it should be finely sandpapered. On the wordwork thus treated, a thin coat of french polish shall be applied and allowed to dry. After drying, the surface shall be lightly rubbed with a fine sand paper prior to the second and third coats. The shall show an even polished surface and be approved by the Executive Engineer.

14.7 Rates of Include : Similar to that of painting.

14.8 Mode of Measurement : Similar to that of painting.

14.9 Wax Polishing :

(a) The polish shall be of approved manufacture (e.g. Mansion Brand) or shall be prepared as under :

(b) A mixture of Bee's wax and turpentine in proportion of 2:1 by weight shall be used. The wax is melted and added to the turpentine, mixed well and allowed to cool.

(c) The surface of wood work shall be prepared as for oil painting before waxing. The wood work shall be smeared with the mixture and allowed to remain overnight so that the mixture may soak into the pores of the wood. In the morning the superfluous wax shall be wiped off and the surface rubbed up with a soft flannel to a fine polish.

14.10. Rates of Include : Similar to that of painting.

14.11 Mode of Measurement : Similar to the of painting.

15. CEMENT PAINTING

15.1 Material : External waterproof cement paint shall be of approved colour, manufacture Snowcem/Snowweem Plus' Durocem or other equiavalent and approved make.

15.2 Preparation of Surface : Before painting is commenced on surface, all dirt, oil grease, efflorescence and organic material shall be completely removed. The surfaces shall be wetted by sprinking of water with the fine spray. The surface shall be sprayed several times with a few minutes intervals between each spraying to allow the moisture to soak into the surface.

15.3 Application : Cement plaint solution shall be applied to the surface with hair brushes in a number of coats to get uniform finish. After the first coat of paint hardened, it shall be curred with water atleast for 24 hours, before the application of the second coat. Atleast 24 hours should elapse between the two coats. Similarly, 3rd coat shall be given to get uniform colour.

15.4 Curing : Cement paint work shall be kept damp atleast for 7 days.

15.5 Rates given in the schedule of quantities shall Include : Apart from other factors mentioned elsewhere in this contract the rate given in the schedule of quantities of providing cement paint shall include be the following :

(a) All labour, material and equipment to provide cement paint

(b) Scaffolding, including erecting and removing.

(c) Preparing the surface as stated above.

(d) Applying 3 coats of approved Snowcem or equal and approved paint. If a proper and even surface is not obtained to the satisfaction of the Executive Engineer in the 3 coats applied, the Contractor shall provide additional costs of painting to approval, at Contractor's expense.

(e) Curing as stated above.

15.6 Mode of measurement : Measurement shall be in Square Metre and as applicable to white wash. Nothing extra shall be allowed for painting on rough surface, for example, external sand-faced plaster rough cast plaster etc.

16 LIME CONCRETE (BRICK BAT COBA) WATER PROOFING OF THE ROOF

16.1 Coarse Aggregate: Coarse aggregate shall be broken from sound and thoroughly well burnt bricks. These shall be strong, durable, clean and free from Impurities and shall not contain any soft or powdery material. These aggregate shall be graded having a maximum size of 25mm generally conforming to I.S. 3068 and approved by the Executive Engineer. Burnt brick aggregate shall be soaked thoroughly in water for a period not less than 6 hours before use in the concrete mix.

16.2 Preparation of Base : The base shall be thoroughly rubbed, cleaned and slightly wetted and shall be got approved by the Executive Engineer before laying the concrete.

16.3 Preparation of Concrete : Lime and surkhi shall conform to the relevant I.S. "Specification. One part of slaked time and two parts of surkhi by volume shall be mixed on a water-tight platform. These shall be sprinkled with the required quantity of water and shall be well ground in a mill or using mechanical grinders. The lime concrete shall be obtained by thoroughly mixing, the aggregate and lime surkhit mortar in the proportion of 2 1/2 part by volume. Concrete shall be mixed on a level and impervious platform. The aggregate and mortar shall be thoroughly incorporated by being turned over and over, backwards and forwards not less than 3 times, until every particle of the coarse aggregate is fully coated with mortar. No more concrete shall be mixed than can be laid in place and rammed the same day. When it is necessary to give greater fluidity to concrete, this shall be affected by adding water to mortar and remixing mortar and not to the mixed concrete.

16.4 Laying : Unless otherwise specified, the average finished thickness of lime concrete shall not be less than 1ocm. thick, after compaction, and the minimum compacted thickness of the concrete layer shall no where be less than 7.5cm. The top of concrete surface shall be given necessary slope as

directed. After the lime concrete is laid, it shall be initially named with a manner not more than 2kg. and the finish brought to the required evenness and slope. The ramming shall be done rightly and rapidly to get the required compaction and to allow all the interstices to be filled with the mortar. Further consolidation, shall be done using wooden thapis, who will sit dose together and beat the surface lightly and in rhythm and move forward gradually. Special care shall be taken to properly consolidate Concrete at its junction with the parapet wall. The beating will normally have to be carried on for at least 7 days until the thapi makes no. impression on the surface and rebounds readily from it when struck. If the surface and rebounds readily from it when struck. If the surface during the process of compaction becomes so uneven that water lodges in pools, the surface shall be pricked up and fresh lime concrete spread and consolidated as is necessary, so as to ensure proper slopes and levels. While the beating is in progress the surface shall be sprinkled liberally with lime water and small preparation of sugar solution prepared by mixing about 3 kgs. of jaggery and 1-1/2 kg. 'Bael' limit to 100 litres of water. On completion of beating, the mortar that comes on the top shall be cleaned.

16.5 Curing: The lime concrete after compaction shall be curred for six days or until it hardens by covering with a thin layer of grass or straw which shall be kept wet continuously. Watering shall be done at frequent intervals from a watering can through a perforated rose, in moderate quantity so as to ensure through setting of the cleaned.

16.6 Rates given in the schedule of quantities shall Include : Apart from other factors mentioned elsewhere in this contract, the contractor's rate given in the schedule of quantities shall include for following:-

(i) Preparation of base.

(ii) Providing, laying and ramming lime concrete as directed above.

(iii) Compacting with lime, sugar and 'Bael' fruit solution as described above.

(iv) Curing.

(v) All labour material and used of tools and equipment necessary for satisfactory completion of work.

16.7 **Mode of Measurement:** Lime concrete shall be measured in square metre in as provided mentioning the average consolidated thickness.

17. CEMENT CONCRETE FLOORING IN TWO LAYERS

17.1 Plain Cement Concrete Flooring in two Layers : Unless otherwise mentioned in the item, concrete in flooring shall be 40 mm thick overall and shall be laid in two layers water added shall be minimum necessary to give sufficient plasticity for laying.

The concrete in under layer, unless otherwise specified, shall be in the proportion of 1:2:4 (Cement Fine aggregate: Coarse stone aggregate size of 12.5 and below) by volume and the proportion of the cement concrete for the top wearing layer shall be 1:2 (Cement: combined stone aggregate 4.75 mm and below) by volume. Cement, however, shall not be measured in volume but by weight. One bag of concrete of 50 kg, shall be assumed to contain 35 litres of cement i.e. 1.20 Cft: The coarse aggregate shall be from approved source, carefully selected, sufficiently tough and hard stone pieces broken in a manner that will provided particles of approx cubical shape affording good interlocking. Elongated or thin flace like fragments should be avoided. The fine aggregate shall be send from approved source and consist of property graded particles. The coarse and fine aggregates shall be conforming to relevant IS:383-1963 and shall be washed clean if necessary. The concrete shall be as stiff as possible and the amount of water added shall be minimum necessary to give sufficient plasticity for laying and compacting. For improving the workability of the mix, through mixing for a longer period rather than addition of more water shall be restored to Generally a water cement ratio of 0.5 (by weight) should suffix. Mix shall be used within half an hour of the addition of water for its preparation.

17.2 Preparation of Sub-Grade : Before placing the concrete flooring the sub grade shall be got approved from the Executive Engineer. The top surface of the sub-grade, shall be thoroughly cleaned of dirt, loose particles, cake mortar droppings and laitance if any by scrubbing with coir or steel wire brush or by hacking if necessary. The top surface of sub-grade shall be slightly rough and shall have the required slope. The sub-grade shall be moistered before laying the concrete flooring without forming any pools of water.

Before commencement of laying under layer of concrete on the prepared sub-grade, “screed” i.e. narrow strips of wood, bands of plaster or pieces of tiles laid on the sub-grade to act as guides for bringing the whole work to a true an even surface and imparting necessary slope to the under-layer with average thickness of 25 mm or specified in the item shall be provided.

The screeds shall be removed after laying the concrete for under layer of all the floor area for which they have been applied as guides and filled up with concrete mix of under layer. No extra payment shall be made for these “screeds”.

17.3 Laying : The concrete flooring shall be laid in alternate bays not exceeding 2 x 2 m each. The edge of each panel into which floor is divided should be supported by the flat-iron or wood duly oiled to prevent sticking. Their depth shall be same as the proposed for the concrete flooring as mentioned in the item. The flat iron should be removed before filling in the adjoining panels. At least 48 hours elapse before the concreting in the adjoining bays is commenced. A.C./glass/aluminium strips or other approved acparators (depth

to be same as the proposed for concrete flooring) shall be provided if specified in the item and shall be retained permanently in the concrete flooring. Care shall be taken to see that at no point the separators shall pretrude above the finished floor level.

Just before placing the concrete mix for under-layer, neat cement slurry shall be thoroughly brushed into the prepared sub-grade.

The concrete for underlayer shall be laid immediately after mixing. While being placed, the concrete shall be vigorously sliced and spaded with suitable tools to prevent formation of voids of honeycomb packers. The concrete shall be brought ahead with a sawing motion in combination with a series of lift and drops alternating with small lateral shifts. While concerting the adjacent bays, care shall be taken to ensure that the edges of previously laid bays are not broken by careless or hard tamping. Immediately after laying the concrete, the. surface shall be inspecred for high or low sports and any need correction shall be done by adding or removing the concrete. After striking of the surface to the required grade, it shall be compacted with wooden flont. The blows shall be fairly heavy in the beginning but as consolidation takes place, light rapid strokes shall be given to the complete the ramming.

The surface of the concrete is under-layer as laid above, shall not be finished smooth with a trowel but left rough after tamping it and levelling it with screed board.

The top wearing layer of mix 1:2 cement concrete of consistency stiffer than that of under-layer concrete shall when be immediately laid over the rough but green surface of under-layer and thoroughly tampled, struck off-level, and the surface floated with wooden boat. The surface shall then be tested with a straight edge and masons spirit level to detect any undulation in the surface which if any, should be made good immediately. The surface shall the be finished mooth as stated below.

17.4 Finishing the Surface : After the concrete has been fully compated it shall be finished by trowelling. Finishing operations shall start shortly after the compaction of concrete and shall be spread over the period of one to six hours depending upon the temperature at atmospheric conditions. The surface shall be trowelled 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 object of trowelling is to produce as hard and close knit a surface as possible. The time interval allowed between successive trowelling is very important. Immediately after laying top wearing layer, 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 work a layer rich in cement to the surface. Sometime after the first

trowelling, the duration depending upon the temperature, atmospheric conditions and the rate of set of cement used, the surface shall be retrewelled to close any pores in the surface, and to bring to surface and scrap off any excess water in concrete or liatance (it shall not be trowelled back into the topping). The final trewelling 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. The finished surface shall be smooth and even. Trewelling on a rich mix of dry cement and fine aggregate on to the surface shall not be permitted. The junctions of floor and walls shall be rounded off if so directed without extra payment.

Trowerl marks, wherever visible shall be immediately removed by lightly brushing with 100 mm wide painter's brush which is made just moist, so as to have the surface of uniform appearance. Over brushing shall be avoided.

After the concrete in the days has set, the joints (if permanent separators are not provided) of the panels shall be filled with cement pastes as directed. The joints shall be straight both ways i.e. along he length and width. The vertical edge of the bays shall be neatly marked on the surface with a pointed trowel after filling the joints. No extra mortar shall be laid over the concrete to make the floor in level.

If broom finish is specially mentioned in the item, the surface shall be obtained rough with parallel broom marks before the concrete the concrete sets.

17.5 If coloured cement concrete flooring is specified in the item, the top wearing layer shall consist of concrete mix coloured with the addition of coloured cement and approved mineral pigments shall be such as to produce required shade but in no case will it exceed one third part of cement. A few samples of coloured concrete flooring of required colour and shade (Light Shade Medium Shade or Dark Shade as specified in the item) shall be got approved from the Executive Engineer before commencement to flooring work.

17.6 **Curing** : Immediately after the flooring surface is finished, it shall be protected from rapid drying by erecting barriers against wind or draught and strong sunlight. As soon as the surface has hardened sufficiently to prevent damage to it, it shall be kept continuously moist for at least the days by means of wet gunny bags; 50 mm thick layer of damp sand spread over the surface or pooling water as the surface. During this period of flooring shall not be exposed to any traffic.

17.7 Harderinding and Polishing : Whenever specified in the item grinding shall be carried out as under, to make the surface smooter than trowel finish.

(a) First Grinding with Carborundum Stone of Coarse Grade : Grinding shall be commenced when the concrete, surfaces is 3-4 days old and sufficiently hardened and cured. The first grinding should be done with carborundum stone of coarse grade and fine and sprinkled over the surface using water freely.

After the first grinding, the surface shall be thoroughly washed to remove all grinding mud and covered with a grout of cement (including colouring pigment in case of coloured concrete flooring) in order to fill the pores and pin holes that appear after grinding.

(b) Second Grinding with Carborundum stone of Medium Grade : After the first grinding is over the surface shall be cured for 4 days and than the second grinding should be started with carborundum stone of medium grade, The flooring shall be washed and pores or holes, if any shall be filled in the same manner as described in (a) above.

(c) **Final Grinding wth Carborundum Stone of Fine Grade :** After ten days from the completion of the second grinding, the final grinding shall be carried out with carborundum stone of fine grade.

(d) **Cleaning and Polishing :** After the completion of the grinding as above the floor shall be throughly washed with warm water and soft soap and when it is completely dry, Oxalic acid powder shall be dusted over the surface sufficiently which must be sprinkled with water and rubbed hard with a piece of felt till the surface has acquired require gloss.

A hot mixture of terpentine and Bees Wax (4: 1 by weight) shall then be applied to the surface and thoroughly rubbed with clean cotton waste. The rubbeig must be continued until the flooring ceases to be stickly.

17.8 Rates given in schedule of quantities shall include : Apart from other factors mentioned elsewhere in the contact, the rates given in the schedule of quantities shall include for the following :-

(i) Cleaning and preparing the sub-grade.

(ii) Providing and laying concrete of the specified mixes and finishing the surface as described above.

(iii) Providing and fixing A.C./glass/aluminium srips or other approved separators to form panels when specified.

(iv) Curing.

(v) Providing coloured cement and approved mineral colouring pigment when coloured concrete flooring is specified.

(vi) Grinding and hand polishing when specified.

(vii) All labour, materials, tools and equipment for carrying out the item as specified above.

17.9 Mode of Measurement : The measurement shall be in square metres of cast-in-situ of cement concrete flooring as provided.

18. ALUMINIUM WORK :

18.1. All Aluminium work shall be free from defects, imparting strength, appearance shall be of the best available quality for the purpose specified. The Aluminium alloy used in the manufacturer of the extruded doors/windows/ventilators, partition sections shall correspond to I.S. designations HE 9-WP, I.S. : 253-1956. "Specifications for wrought Aluminium, Aluminium alloy bars, rods & sections (for general Engineering purposes)". Hollow Aluminium sections & coupling sections used shall conform to IS. designation HV 9-WP & Aluminium alloys extruded round tube & hollow sections (for general Engineering purpose only). Contractors shall commence manufacturing of doors, windows & ventilators only after the shop drawings showing construction, hardware etc. submitted by them are approved by the Employer.

Where Aluminium comes in contact with Concrete, brickwork, plaster or any other dissimilar metals, it shall be coated with a coat of Zinc Chromate conforming to IS : 104 - 1950. Contractor shall cover all the anodised finish work with a thick layer of clear fulfilment laquer base on methacrylates or cellulose butyarte to protect the surface from wet Cement during installations. The liquors coating shall be removed after the completion.

All the manufactured doors, windows, ventilators & partitions shall be stacked on site under cover. Damaged surfaces with defects like scratches etc., on finished work shall not be accepted. Fabricated materials shall be coated in an approved manner to protect the material against any damage during transportation. Loading & unloading shall be carried out with utmost care the doors, windows & ventilators on arrival at site shall be carefully examined to detect any damaged pieces. Arrangements shall be made for expeditious replacement of damaged pieces/parts. Materials found to be acceptable on inspection only shall be used.

All exposed surfaces of sections for Aluminium doors/windows / ventilators / partitions including beadings & other accessories shall be anodised / powder coated after fabrication, in a manner conforming to IS : 1868-1968 & to approved finish. Anodising shall be in matt finish natural colour & anodic coating shall be of a minimum thickness of 15 microns. Powder coating shall be of minimum thickness of 60 microns with approved Exposy / pure polyester paint powder all as per the specifications of Specialised Agencies.

18.2 Aluminium Doors, Windows, Ventilators & Partitions.

Aluminium doors, windows & ventilators shall be manufactured from study extruded sections of approved manufacture & shall be aluminium alloy from one of the manufacturer/s as given in the attached list of approved makes.

Contractor shall design & provide sturdy sections/members of doors, windows, ventilators & partitions including combination of joints so as to withstand wind load of high intensity.

The frame shall be square & flat & corners of the frames being fabricated to true right angles. Both the fixed & opening frame shall be of sections which have been cut to length, mitered & mechanically joined and/or electrically welded at corners as required for satisfactory performance. Sub-dividing bars shall be tenoned & riveted into the frame. All members shall be accurately machine milled & fitted to form hairline joints. The jointing accessories such as cleats, brackets etc. shall be of such material as not to cause any bi-metallic action.

Dimensions shown in the drawings are overall height & width to the outside of the frames of Aluminium doors, windows & ventilators. These dimensions are derived after allowing 12.5 mm clearance on all four sides for the purpose of fittings windows, doors & ventilators into the openings. Contractors are advised to verify the dimensions before fabricating & fixing the doors, windows, & ventilators in position.

18.3 METHOD OF FIXING

a. **Aluminium doors, windows, ventilators & partitions in brick work & concrete work :**

Aluminium doors, windows, ventilators & partitions shall be fixed to brick work by means of slotted steel adjustable lugs (natural finish), not less than 100mmx16mmx3mm with counter sunk galvanised machine screws & nuts 19x6 mm & to concrete work by means of 45mm x No. 10 galvanised wood screws & dash fasteners of suitable size & make.

b. **FIXING SCREWS AND LUGS.**

Outer frame shall be provided with fixing holes centrally in the web of the section at approved intervals. Any steel lug coming in contact with Aluminium should either galvanized or given a coat of bituminous paint. The members should be designed not only for its strength, stability, stiffness, against all odds, but also for easy operations, water tightness, easy replacement of glass & cleaning from inside. All screws used shall be of adequate size & shall be of cadmium plated brass.

18.4 GLASS AND GLAZING

Glass shall be of type of quality specified in the Schedule of quantities & manufactured by one of the manufacturer as per the list of approved makes. Before installation of "the glass the contractor shall ensure the following :

a. All galzing rebates shall be square, plumb true in plane, clear, dry & fee from dust

b. The glass edges shall be clear & cut to exact size, glass with chipped or damaged edges shall be rejected.

c. The glass shall be set in “glazing clips" & co-installed to achieve proper water tightness.

d. Suitable PVC or Neoprene gaskets shall be used for fixing glass so as to prevent rattling.

e. Beading shall be of anodised Aluminium section and shall be snap-on type having mired corners either triangular or rectangular as per Contractor's design & shall not be less than 0.13 Kg. per RM.

f. Any hollow portion between the frame & the brick/concrete surfaces & the component parts of the frame shall be filled up with suitable mastic 'cement & sand' filled as per IS specifications & rates quoted shall include for the same.

g. If required by the Chief Engineer, putty shall be applied to the face of the bead which is in contact with glass. Putty would also be filled, if necessary at the back. Putty used for glazing shall uniform to I.S. 420-1953.

On completion of the work, all glass shall be thoroughly cleaned & free from dirt, putty or other adhering material.

Wastage of cutting of glass shall be to Contractor's account. Frosted / ground glass shall be set with smooth surface outside.

The members proposed to be provided by the Contractors for Aluminium doors, windows, ventilators & partitions shall be of approved quality & sturdy to withstand the wind pressure of high intensity & day to day handling & shall be free from rattling, leakage etc. If required, contractor shall furnish the detailed design calculation to substantiate the sturdiness of each door, window, ventilator & partitions, the same shall be carried out by the Contractor & suitable adjustment shall be made on the basis of relevant tender items.

18.5 Aluminium doors, windows, ventilators & partitions shall be locally manufactured as per the design & drawing (which shall be approved by the Employer), from the extruded sections of one of the manufacturers as given in the attached list, including fittings & fixtures as shown on drawings.

18.6 The Chief Engineer reserves the right to delete any or all items of the trade & allot the work under this head to any Specified Agency/ Agencies. No claim what ever shall be entertained on this account.

18.7 MODE OF MEASUREMENT

Aluminium doors, windows, ventilators & partitions shall be measured by weight only. The weight shall be calculated as per theoretical weight/actual weight whichever is less. Any wastage of aluminium sections shall be on contractor's account. The weight of screws, lugs, nuts & bolts, butt hinges, hollow Z hinges, neoprene gaskets, hardware fittings & fixtures shall not

considered for payment. The rate shall include for fixing of fittings & fixtures shown on shop drawings approved by Engineer-in-Charge.

18.8 HARDWARE

All Aluminium hardware shall be supplied by L.I.C. of India, unless otherwise specified. The rate for Aluminium doors, windows, ventilators & partitions shall include for fixing hardware - fittings. The hinges shall be of heavy pattern with stainless pins & stainless steel washers. Contractor's rate shall include for necessary screws, bolts & other devices for a neat & secure, hardware arrangement. The bolts & screws etc., shall be of cadmium plated brass of required size to secure & permanently. In the hardware in place. No steel or iron screws shall be used. Samples of different items of hardware including screws shall be submitted alongwith the sample of doors / windows / ventilators partitions for approval.

Contractor shall be responsible for the proper working of all hardwares for a period of defect liability period from the completion date.

18.9 RATE GIVEN IN THE SCHEDULE OF QUANTITIES SHALL INCLUDE :

Apart from other factors mentioned elsewhere in this tender document, rates given in the schedule of quantities for the items of supplying & fixing Aluminium doors, windows, ventilators & partitions shall also include for the following, unless otherwise specified:-

a. All materials & labour required for supplying fixing in position approved andoised aluminium doors, windows, ventilators, & partitions & described in the' trade" at site of work.

b. After the shop drawings are approved, the contractor shall supply one sample each of window & ventilator with hardware etc. for approval as directed.

c. Supplying & fixing in position glass of specified thickness, type & quality along with putty, glazing clips & anodised Aluminium beading of required section.

d. All accessories for fixing doors, windows, ventilators & partitions to concrete/masonry surface as described in the trade.

e. Filling sealants as per details to ensure water tightness. all the sealants must be permanently resilient & non bleeding nature.

f. Protecting the surfaces & edges around doors, windows, ventilators & partitions from any damage while fixing the same.

g. Removing all protective coverings -& cleaning the door, window, ventilator & partition frames.

h. Neoprene /PVC weathering strips as required.

i. Drip strip to drain out water falling on the members of the frame.

j. Filling in cement mortar 1:4, the space between the concrete surface & the frame windows & ventilators.

a. PVC or rubber gasket for fixing glass.

b. Cadmium palted brass screws, wherever required.

c. Galvanised/Aluminium channels pieces, coach screws, rawl plug etc. of required size & number for fixing door, windows, ventilators & partitions in position.

d. Necessary scaffolding for erection of Aluminium doors, windows, ventilators & partitions in position.

e. Bellies for sliding windows & ventilators to include for adequate arrangements for arising out water collected in the channel of the outer frame.

f. All rates given in the schedule of quantities shall include for supplying and fixing.

g. Swing door shutters shall include for double action oil check floor springs of "Everite or Hardyn" or other equal & approved make & size including embedding the floor springs in the flooring & making good the same.

h. For all windows & ventilators openings, contractor shall prepare M.S. retrievable template frame with necessary tolerance for obtaining the correct dimensions of opening in concrete/brick masonary works.

II. WATERSUPPLY, INTERNAL SANITARY INSTALLATIONS AND DRAINAGE WORK

GENERAL SPECIFICATIONS

1. GENERAL

1.1 All water supply, internal sanitary installations and drainage work shall be carried out by skilled and licensed plumbers in a manner complying in all respects with the requirements of the relevant bye-laws of the municipal or of local bodies in whose jurisdiction the work is to be executed.

1.2 All fittings are to be accurately placed in the positions as directed by Executive Engineer, to be securely plugged to walls with hard wood or any other approved plugs or breeze blocks built into Bricks/Stone, R.C.C. work or set in cement as required and are to be left in a clean, sound and perfect conditions.

1.3 All sizes and lengths to be verified at site.

1.4. The whole of the work is to be tested at contractor's expenses at such items and in such a manner as Executive Engineer shall direct and to the entire satisfaction.

The contractor shall also make arrangement for the disinfection of all mains and tanks intended for potable water to the satisfaction of the Executive Engineer and rates given in the schedule of quantities shall include for same. The mains and tanks should be thoroughly flushed with clean water after disinfection.

1.5 All damage done to floors, walls etc, during the process of fixing of water supply, internal sanitary installations and drainage work shall be restored to original condition, to the satisfaction of the Executive Engineer at the Contractor's expenses.

1.6 All the materials shall be in accordance with the specifications and shall be approved by the Executive Engineer before bulk suppliers are brought to site. The contractor shall furnish well in time before work commences, at his own cost, any samples of materials of workmanship that may be called for by the Executive Engineer for his approval or rejection and any further samples in case of rejection until such samples are approved. Such samples when approved shall be the minimum standard for the work to which they apply. Where materials are specified to comply with an Indian Standard specification, the contractor shall, if required, furnish the manufacture's certificate that the materials satisfy the requirements of Indian Standard Specifications. For plumbing works, typical samples prototypes shall be erected in position for approval before undertaking work. Rates given in the schedule of quantities shall cover for each preliminary work. Materials rejected shall be removed forthwith by the contractor off the premises.

1.7 Sewer and drains shall be laid in proper alignment and gradient in accordance with the rules and regulations of statutory bodies whose approval are necessary. On completion.

2 WATER SUPPLY

Cast iron pressure pipes and specials:

2.1 Pipes and Specials : All pipes and specials shall be of cast or spun iron, straight with spigot and socket ends with flanged ends as specified and shall confirm to the latest edition of the Indian Standard Specifications for class 'A' pipes. Class A pipes may be used when the test water pressure exceeds 120 meter of head. The pipes and specials shall be suitable for joining with lead unless otherwise specified. As far as possible only standard specials shall be used.

2.1.1 All pipes shall be coated inside and outside while hot with an approved anticorrosive paints having a tar or other suitable base.

2.2 Excavation of trenches for C.I. Pipes and specials.

2.2.1.1 Excavation : The trenches for the pipes shall be excavated to lines and levels as directed. The bed of the trenches shall have to be truly and evenly dressed throughout from one change of grade to the next.

2.2.1.2 The gradient is to be set out by means of boring rods and should the required depth be exceeded at any point, the trench shall be refilled as directed by the Executive Engineer at the Contractor's Expense.

2.2.1.3 The bed of the trench, if in soft or made up earth, shall be well-watered and rammed before laying the pipes and depressions thus formed shall be filled with sand or other soft materials as the Executive Engineer may direct.

2.2.1.4 If rock is met with, it shall be removed to 15 cm below the level of the pipe

valves and fittings and the trench shall be refilled with sand or other suitable materials.

2.2.1.5 The excavated materials shall not be placed within 1 metre or half the depth of the trench, whichever is greater from the edge of the trench.

2.2.1.6 The trench shall be kept free from water. Shoring and timbering shall be provided wherever required.

2.2.1.7 The Width of trench at bottom between faces of sheeting shall be such as to provide not less than 20 cms. clearance on other side of pipe, Trenches shall be of such extra width when required as will permit the convenient placing of timber supports, strutting and planning and handling of specials.

2.2.2 Internal Road Crossing : All road crossing within the site, if any, will be excavated half at a time the second half being commenced, after the pipes have been laid in the first half and the trench refilled. The trench at existing road crossings shall be filled with mud concrete for the full depth except for the top 15 cm layer, which will be filled with cement concrete 1:2:4. The rates quoted shall also cover the cost of breaking road surfaces of all types wherever met with, including their foundation.

2.2.3 Protection of Existing Services : All pipes, water mains, cables etc. met within the course of excavation shall be carefully protected and supported by the contractors at their own cost to the satisfaction of the Executive Engineer. Such mains will be hung from timbers placed across the trench. Care shall be taken not to disturb the electrical and communication cables, removal of which, if necessary shall be arranged by the Executive Engineer.

2.2.4 Lighting and Watch: The 'open trenches' shall be provided with fencing and watchmen to guard against accidents. Red flags during day and Red lights during night shall be provided at the ends and at intervals along the sides of the trenches.

2.2.4.1 Sign boards with necessary wording such as "SLOW", "ROAD CLOSED" etc. shall be provided at least 30 metres ahead of road crossings where the work is in progress. The precaution will be continued till the surface is restored. The contractor shall be held responsible for compensation as a result of accident or injury to any person or property due to improper fencing or inadequate lighting arrangements.

2.2.4.2 Temporary bridges of planks shall be provided over the trenches for keeping open the access to private or public property.

2.3 Lay of Pipes & Specials:

2.3.1 Stacking: The pipes and specials shall be lined up on one side of alignment of the trench socket facing up hill or in the direction of flow of water.

2.3.2 Laying: Before being laid the pipes shall be examined to see that there are no cracks or defects. Subjects to the approval of the Executive Engineer, the damaged portion of the cracked pipe may be cut at a point not less than 15 cm beyond the visible extremity of the crack with diamond pointed chisel. Before lowering the pipe in the trench, the pipes shall be thoroughly cleaned

of all dust and dirt. Special care shall be taken to clean the inside of the sockets and the outside of the spigots. Holes to receive the sockets shall be excavated in the trench bed so as to firmly bed the full length of the pipe.

2.3.2.1 The pipes shall be lowered into the trench by means of suitable pulley blocks shear-legs, chain ropes etc. In no case the pipes shall be rolled and dropped into the trench. After lowering the pipes the spigot of one pipe shall be carefully centered into the socket of the next pipe and driven to the full distance that it can go and the pipe line laid to levels required, being kept in position by earth filling well watered and rammed at two or more places in its length.

2.3.2.2 Specials shall also be laid in their proper position as stated above.

2.3.2.3 The pipes laid on level ground, will be laid with socket facing the direction of flow of water in all other cases, the sockets will be laid facing uphill.

2.3.2.4 Any deviation either in plain or elevation of less than 11-¼^0 shall usually be effected by laying the straight pipes round a flat curve, of such radius that minimum thickness of lead at the face of the socket shall not be reduced below 12 mm or the opening between spigot, and socket increased beyond 12 mm at any joint. A deviation of about 2-½^0 can be effected at each joint in this way.

2.3.2.5 At the end of each day's work , the last pipe to be laid shall have its open end securely closed with a wooden plug to prevent access to dirt and animals.

2.4 Thrust Blocks and Anchorages : Portland cement concrete thrust blocks of suitable design shall be provided at all bends of the pipes so as to withstand dynamic and static forces likely to be developed due to water running through the pipes. The thrust blocks shall be made after the joints have been caulked with lead and these shall be paid for separately, unless otherwise specified.

2.5 Lead caulked joints:

2.5.1 Lead for joints : It shall be bluish grey in colour, very soft and malleable of uniform quality, readily melted, free from foreign material and shall conform to I.S. 782.

2.5.2 Spun yarn for joints : This shall be of best quality preferably white. It shall be free from oil, tar, greasy substances and shall be soaked in hot coal tar or bitumen and dried before use.

2.5.3 Jointing : The yarning material shall be placed around the spigot of the pipe and shall be of proper dimensions to centre the spigot in the socket. When spigot is shoved home, the yearning material shall be driven tightly against the inside base or hub of the socket with suitable yarning tools. When a single strand of yarning material is used, it shall have an overlap at the top of not more than 5 cm. When more than a single strand is required for a joint, each strand shall be cut to sufficient length so that the ends will meet on opposite

sides of the pipe and not on the top or at the bottom. Successive strands of yarning material shall be driven home separately. The leading of the pipes etc., shall be done by means of ropes covered with clay or by using special leading rings. The lead shall be rendered thoroughly fluid and each joint shall be filled in one pouring.

2.5.4 Quantity of lead and yarn: Approximate weight of lead and yarn required for joint for various sizes of C.I. Pipes and specials shall be as per I.S. 3114 as under :-

Dia of pipe	Lead/Joint	Spun Yarn/Joint
80 mm	1.8 Kg.	0.10 Kg.
100 mm	2.2 Kg.	0.18 Kg.
125 mm	2.6 Kg.	0.20 Kg.
150 mm	3.4 Kg.	0.20 Kg.
200 mm	5.0 Kg.	0.30 Kg.
250 mm	6.1 Kg.	0.35 Kg.
300 mm	7.2 Kg.	0.48 Kg.
350 mm	8.4 Kg.	0.60 Kg.
400 mm	9.5 Kg.	0.75 Kg.

NOTE : The quantities of lead and spun yam given in this table are provisional and a variation of 20 per cent is permissible.

2.5.5 Caulking : After the joints have been run they must be thoroughly caulked until they are perfectly watertight. Caulking of joints will be done after a convenient length of pipe has been laid and leaded. The leading ring shall first be removed and any lead, outside the socket shall be removed with a flat chisel and then the joint caulked round three times with caulking tools of increasing thickness and a hammer of 2 to 3 kg. weight. Lead joints shall not be covered till the pipe line has been tested under pressure but the rest of the pipe line may be covered up to prevent expansion and contraction due to variation in temperature.

2.5.6 Lead Wool Joint : When it is impractical or dangerous to use molten lead for joints they may be made with lead wool inserted in strings not less than 6 mm thick and thoroughly caulked.

2.6 Flanged Joint : C.I. Pipes may also be jointed by means of flanges cast on where specified. The jointing material between flanges of pipes shall be compressed fiber board or rubber of thickness between 1.5 mm to 3 mm The fiber board shall be impregnated with chemically neutral mineral oil and shall have a smooth and hard surface. Its weight per sq. metre shall be not less than 112 gm/mm thickness.

2.6.1 Each bolt shall be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The practice of fully tightening the bolts one after another is highly undesirable.

2.7 Testing : Before testing the trench shall be partially backfilled except at the joints. Completed pipe line shall be subjected to the following two tests.

(a) Pressure test at a pressure of at least double the maximum working pressure pipe and joints shall be absolutely watertight under the test

(b) Leakage test (to be conducted after the satisfactory completion of the pressure test) for a duration of two hours.

2.7.1 Where any Section of a main is provided with concrete thrust block or anchorage, the pressure test shall not be made until at least five days have elapsed after the concrete was cast.

2.7.2 Pressure Test Procedure : Each valve section of the pipe shall be slowly filled with water and all air shall be expelled from the pipe through hydrant and blow off. If these are not available at high places, necessary tapping may be made at points of highest elevation before the test is made and plugs inserted after the tests have been completed.

2.7.2.1 The specified pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Executive Engineer. The duration of the test shall not be less than 5 minutes.

2.7.2.2 All exposed fittings, valves, hydrants and joints should be carefully examined during the test. When the joints are made with lead, all such joints showing visible leaks shall be recaulked until tight. Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced by sound material and the test shall be repeated at Contractor's own expense until satisfactory results are obtained.

2.7.3 Leakage Test Procedure : Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valve section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

2.7.3.1 Should any test of pipe laid disclose leakage greater than that permitted by

IS Code of Practice 3114, defective joints shall be repaired at Contractor's own expense until the leakage is within the specified allowance.

2.8 Refilling : Refilling in trenches for pipes shall be commenced as soon as the joints have been tested and passed. The refilling on top and round the pipes, shall be done with great care and in such a manner so as to obtain the greatest amount of compactness and solidity possible. For this purpose the earth filling shall be done in regular layers of 15 cm (watered and rammed at each layer). All surplus earth shall be disposed off as directed by the Executive Engineer.

3. G.I.Pipes and Fittings :

3.1 Pipes and Fittings : The pipes shall be of galvanised steel, welded and seamless, screwed and socketed and shall conform to the latest Indian Standard Specifications for "Medium" pipes, unless otherwise specified.

3.1.1 The details of screwed and socketed M.S. pipes regarding nominal bore thickness and weight shall be as per IS 1239 (part-I) as under :

Nominal bore	Weight of pipe in kg/m.		
	Light	Medium	Heavy
15 mm	0.96	1.23	1.46
20mm	1.42	1.59	1.91
25 mm	2.03	2.46	2.99
32 rnm	2.61	3.17	3.87
40mm	3.29	3.65	4.47
50mm	4.18	5.17	6.24
65mm	5.92	6.63	8.02
80mm	6.98	8.65	10.30
100 mm	10.20	12.40	14.70

The above weights are for black pipes and theoretical weights of G.I. pipes are about 6 % higher.

3.1.2 The pipes shall be tested to withstand a pressure of 50 kg/sq.cm. without showing defects of any kind. These shall be supplied screwed with taper threads and the sockets with parallel threads.

3.2 **Laying in trenches for External Work:** G.I. Pipes and fittings shall be laid in trenches. The width of the trench shall be the minimum width required for the working. The pipes laid underground shall not be less than 60 cm. from the ground level. They shall be surrounded on all sides by approved quality material. The work of excavation and refilling shall be done as specified earlier for Cast Iron Pressure Pipes. All pipes and fittings laid below ground shall be painted with anti-corrosive bitumastic paint and wrapped with hessian and again coated with anti corrosive bitumastic paint of approved quality. The cost of the above shall be included in Contractor's rates.

3.2.1 Pipes embedded in masonry/concrete shall be treated similarly as described above.

3.3 **Fixing of Pipes for Internal Work :** G.I. Pipes and fittings on the walls shall be fixed by means of standard pattern holder-bat clamps, keeping the pipe 12 mm clear of the plastered surface of wall everywhere, or concealed (inside chase) as directed. Where pipes are to be concealed in walls and floors by cutting chases, the pipes and fittings shall be coated with bitumen wrapped with hessian & again painted with one coat of anti-corrosive bitumen of approved quality and rates quoted shall include for same. Cutting long length of horizontal chases on the walls for concealing pipes shall be avoided.

3.3.1 All exposed G.I. pipes and fittings shall be painted with two coats of oil paint of approved quality, manufacture, colour and shade, over a coat of red-oxide or other approved primer after cleaning thoroughly the surface of the pipes and fittings and allowed to dry. The cost of such painting shall be included in the rates quoted by the contractor.

3.3.2 All pipes and fittings shall be fixed truly vertical and horizontal or as directed by the Executive Engineer. Care shall be taken to ensure that concealed G.I. Pipes (used for external or internal works) are not laid in lime mortar or lime concrete surroundings.

3.3.3 **Jointing :** Where pipes have to be cut or re-threaded, ends shall be carefully filed out so that no obstruction to bore is offered.

3.4 In jointing the pipes, the inside of the socket and the screwed end of the pipe shall be rubbed over with white lead and few turns of hemp yam wrapped round the screwed end of the pipe which shall then be screwed home in the socket with a pipe wrench. Care must be taken that all pipe and fittings are kept at all times free from dust and dirt during fixing.

3.5 **All G.I. pipes and fittings may be tested to a pressure of 7 kg. per sq.cm. to ensure that pipes have proper threads and that proper materials (such as white lead and hemp) have been used in jointing. All leaky joints must be made leak proof by tightening or redoing at Contractor's expense.**

4. Plastic Pressure Pipes

4.1 Types of Plastic Pipes: **Plastic Pipes and fittings conforming to Indian Standard Specifications are of three types as under:**

(a) Low Density Polyethylene (LDPE) Conforming to IS:3076

(b) High Density Polyethylene (HDPE)' Conforming to IS:4984

(c) Unplasticised Polyvinyl Chloride (UPVC) Conforming to IS:4985

4.1.1 The pipes used in water works shall be of the specified type and shall conform to Indian Standard Specifications with pressure ratings indicated below, unless otherwise specified.

Outside dia of Pipe	**Pressure rating**
Upto 32mm	10.0 Kgf/cm^2
40 mm to 50 mm	6.0 Kgf/cm^2
Above 50 mm	4.0 Kgf/cm^2

4.1.2 Plastic pipes shall not be used for hot water installations.

4.2 Polyethylene Pipes' (Low Density & High Density) : Long lengths of un-branched underground water supply lines, flexible water supply connectors in place of lead connectors in houses and laboratories and as waste pipes for wash basins and sinks are some of the applications of these pipes. The recommended temperature range for these pipes is from - 18°C to 38^{0}C. The pipes shall neither be used in soils liable for contamination by coal gas nor may be installed exposed to sunlight.

4.2.1 Jointing : Pipes to be jointed shall be cut to required length with knife or hand-saw, if required a mandrel may be inserted into the bore of the pipe for ease of operation. Excessive pressure shall be avoided at the time of cutting so that the circular shape of the open end is not distorted.

4.2.1.1 The pipe end to be jointed shall be heated in boiling water by dipping 10 cm of the end of the pipe for 2 to 4 minutes to make it soft and pliable. (A large diameter pipe which has heavier wall thickness will naturally take a little more time to soften). The pipe end should not touch the bottom surface of the container which is in direct contact with the flame.

4.2.1.2 The spigot (or insert type) fitting shall be inserted through the softened end by slow and steady direct push. Twisting motion shall be avoided. Where the fitting cannot be pushed in fully in the first instance, the pipe along with the partly inserted fitting shall be reheated in boiling water for another minute or two and the fitting pushed in straight. The fitting is not to be pulled out. After inserting the fitting the pipe should be allowed to cool by itself (and not by dipping in cold water). All joints shall be made leakproof.

4.2.1.3 If indicated, hose clips shall be fixed and tightened over the portion of the fittings, as reinforcement

4.2.1.4 If polythene pipe is to be jointed with G.I. pipe, an adaptor will be used.

4.2.1.5 For bends, Polythene Pipes may be bent cold to a radius of not less than eight times the outside diameter of the pipe. Bends of small radius down to three times the outside diameter may be made by hot bending.

4.2.1.6 For internal use in cold bending a wall clip should be fitted at the point where the bend is to start. The pipe should be flexed by hand and a second clip

fixed at the end of the bend to prevent the pipe springing back. When the pipe is buried, no clips are necessary.

4.2.1.7 In hot bending the pipe should be heated by immersion in boiling water or by the careful application of a blow lamp flame. The flame should be used with care, taking about three minutes to heat the pipe. The flame should be applied only between the limits of the bend. When sufficiently soft, the pipe should be bent to the desired radius using a bending spring inside the bore.

4.2.1.8 The work, where so directed, shall be carried out in accordance with the manufacturer's instructions and as illustrated in their catalogues.

4.2.2 Fixing: For internal work continuous support shall be given in the following manner:

Horizontal runs	12 times outer dia of pipe of 25 mm and under 8 times outer dia of pipe of over 25mm
Vertical runs	24 times outer dia of pipe.

4.2.2.1 For external work, the Polythene pipes shall be unrolled and laid in trenches. The width of the trench shall be the minimum width required for working. The pipe shall be laid underground at 30 to 60 cm. depth. The pipes shall be laid with a slight horizontal undulation ("Snaking") so that it can follow any movement of soil.

4.3 Unplasticised Polyvinyl Chloride Pipes and Fittings (UPVC) : The pipes may be used as substitute for G.I. pipes in water supply where specified. The recommended temperature range for these pipes is from -1^0C to 49^0C. These pipes shall not be used for transporting bleaching powder solutions for disinfection of water.

4.3.1 Jointing : Unless otherwise specified, the pipes and fittings shall be jointed by solvent welded joints as per manufacturer's specifications by the non-heat application method. This technique is used with spigot and socket type joints. The sockets shall be in the form of injected moulded fittings. The solvent cement shall consist of a solution of vinyl-Polymer or copolymer dissolved in a suitable volatile mixture of organic solvents and shall be of the slow drying variety. The pipe ends must be bevelled with a bevelling tool at an angle of 30° on the outer periphery. The total length of the socket of the fittings shall be marked on pipe ends and checked how far the pipe ends could be inserted into the fitting. Usually the free insertion (without force) should go upto 1/3 to 2/3 of length. The cement solvent shall be applied on the pipe ends to the full length of the socket and on the inside surface of the socket after cleaning the surfaces. The pipe ends should be pushed tight

into the socket fitting and held for about 30 seconds. The surplus cement solvent should be wiped out. The pipe finally inserted shall in no case be less than 2/3 of the marked length of the pipe end.

4.3.2 Service Connections : UPVC saddles shall be used for the offtake of the service connections from larger bore pipes. Ferrules shall not be screwed directly into the UPVC pipes.

4.3.3 Fixing : The UPVC pipes can be bent cold or hot in the similar manner as stated earlier for polythelene pipes, with the difference that only very gradual curves (radius of curvature not less than 3 times the nominal diameter of pipes of size upto 50 mm) can be negotiated. The spacings for supports in above ground indoor installations shall vary from 600mm to 1200mm for pipes of nominal bore 12mm to 50mm respectively.

4.4 Testing of Plastic Pipes : All pipe work, fittings and appliances shall be inspected and tested hydraulically after the completion of installation of contractor's own cost. All control valves shall be positioned 'open' for the duration of the test and open ends temporarily closed with watertight fittings,the testing pressure normally shall not be one and half times, nor greater than twice the maximum working pressure at the weakest point of the system. The test pressure shall be maintained for at least one hour. Pressure shall be applied by either manually operated hand pump or a power driven pump. Air vents should be kept open at all high points so that air may be expelled from the system during filling. When the system has been fully all air displays from the line, air bends shall be closed & the line initially inspected for seepage charged with water and at the joints and the firmness of support under load. Pressure then may be applied until the required level is obtained. The system shall be slowly and carefully filled with water during pressurisation, to avoid surge pressure of water hammer.

4.4.1 With the test pump stopped, the required pressure should be maintained without significant loss for a period of one hour. Any defects revealed by such tests should be made good at Contractor's cost and the tests repeated until a satisfactory result is obtained.

4.4.2 Underground lines shall be tested before 'backfilling. Where pipe lines contain couplings which permit the pipe to slip, consideration must be given to the restraint of the line before pressure is applied. Partial backfilling leaving the joints exposed for inspection may be adopted.

5. Water Meters, Sluice Valves and other Appurtenances

5.1 Water Meters (Domestic type): Water Metres upto 50 mm nominal size shall conform to IS Specifications for Water Metres (Domestic types) IS:779

of Type A unless otherwise specified. The meter body shall be of bronze gun-metal or brass and marked to read in litres complete with registration box, cap and lid. The water meters shall be provided with strainers. Strainers shall be of a 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 a way as not to permit disturbing the registration box or tampering with it. Meters provided with internal strainer involving opening of the registration box for cleaning, shall be fitted with an additional strainer on the inlet side and rates quoted by contractor shall include such additional strainers cost of testing and scaling by local Municipal authorities complete.

5.1.1 Connections: The meter casing shall be fitted in the pipe line by two conical or cylindrical nipples or tail pipes with connecting nuts which shall be provided with each meter. The nipples of water meters shall be made of the same materials as specified for body.

5.1.2 Markings: Each Meter shall be marked with the following information :

(a) Nominal size :
(b) Direction of flow :
(c) ISI Certification Mark .
(d) Manufacturer's name and trade mark:

5.2 Water meters (Bulk type) : These shall conform to IS:2373 and shall be of size 50 mm and above. They shall be of (impeller) vane wheel type or helical type. The body of the meter shall be made from cast iron. The meter casting shall be fitted into the pipe line by means of a double flange, the internal diameter of which shall be equal to nominal size of meter. The meter shall be provided with registration box and cap of brass or cast iron. Provision shall be made to lock the lid to registration box. Meters shall be supplied and fitted with an External Strainer (Dirt Box) of suitable material not susceptible to electrolytic corrosion and rates quoted by contractor shall include for the same. Meters shall be provided with markings as described in Clause 5.1.2 above.

5.3 Ferrules: Brass Ferrules shall conform to IS 2692. Necessary saddle pieces of approved type shall be used for off take of the service connections and rates quoted shall include for the same.

5.4 Sluice Valves: Sluice Valves shall conform to IS : 780 and shall be of Class I Type unless otherwise specified with double flange and hand wheel for operation. The body, dome, cover, stuffing box, thrust plate, wedge, gland and cap may be of cast iron but the spindle shall be of brass or Aluminium,

bronze. Valves shall be fixed to spigot and socket cast iron and steel pipes by means of suitable flanged spigots or flanged socketted tail piece as directed and rates quoted by contractor shall include for the same. Before the valves are actually fixed, they shall be cleaned and greased and it should be seen that all parts are in perfect working condition.

5.4.1 Surface boxes for sluice valves: These shall conform to IS : 3950 with a cast iron frame and a mild steel hinge pin. The upper surface of cover shall have non-slip surface. The surface boxes shall be coated with a composition having bitumen or tar base. The minimum weight of surface box shall be 33 kg. The internal size of surface box shall be 230 mm x 150 mm x 150 mm

5.5 Air Valves : These are placed at every summit, in the line to permit the escape of air when the main is filled and afterwards, if any air is carried into the main. Fixing of Air Valves may be done by means of fixing saddle piece on pipes and drilling the same where necessary. Rates quoted shall include for the same.

5.6 Brick Masonry Chambers for Housing Meters, Valves and Appurtenances: These shall be constructed as per size as indicated. These shall be measured and paid for separately. The bricks used shall be of first quality best locally available and from approved source and shall be laid in cement mortar 1:3. The walls shall be plastered both inside and outside with 15 mm thick cement plaster 1:3. The foundation concrete shall be of PCC 1:4:8 and 75 mm thick. The top slab shall be of 100mm thick RCC 1:2:4 unless otherwise specified.

III. INTERNAL SANITARY APPLIANCE

6. Squatting Pattern W.C. Pan:

6.1 W.C.Pan : 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 front unless, it is possible to accommodate cistern to suit this design. The pan shall be approved quality conforming to I.S. Specifications IS : 2556 (Part III). It shall have 100 mm C.I. or porcelain trap 'P' or 'S' type, with effective seal 50 mm and 50 mm vent arm.

6.1.1 Fixing: The W.C. pan shall be sunk in floor sloped towards the pan in a workmanlike manner, care being taken not to damage the pan the process of fixing. If damaged in any way, 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 run of pan to receive

the specified thickness of the floor finishing. A pair of foot rests for long pattern pans shall be fixed at a convenient angle where specified.

6.1.2 The joint between the pan and the trap shall be made with (a) lead or (b) cement mortar 1:1 and hamp yarn as specified in the Schedule of Quantities.

6.2 Flushing Cistem : The flushing of the W.C. pan shall be done by "pull and let go" flushing cistem of the valveless siphonic type conforming to IS: 774 unless otherwise specified. The cistern shall be of best cast iron, mosquito proof of 12.5 litres capacity or other specified together with cover lever, G.I. chain and pull of specified quality, ball valve with copper or plastic float as specified and necessary unions etc. for connection with inlet and outlet pipes and overflow.

6.2.1 Brackets : The cistern shall be fixed on cast iron or rolled steel cantilever brackets which shall be firmly embedded in the wall in CM 1:3 or fixed by using plugs and screws, to the satisfaction of the Executive Engineer.

6.2.2 Overflow : The cistern shall be provided with 20 mm G.I. overflow pipe with fittings which shall terminate into mosquito proof coupling secured in a manner which will permit it to be readily cleansed or renewed when necessary. The length of the overflow shall be as per Municipal requirements.

6.2.3 Flush Pipe : The outlet or flush pipe from the high level cistern shall be of 32 mm galvanized wrought iron pipe not less than 1.00 mm thick of light quality G.I. Pipe or lead pipe of minimum thickness 2.6 mm as specified, which shall be connected to the WC Pan by means of an approved type of joint. The flush pipe shall .be fixed to wall by using holder bat clamps or embedded as required. Where lead pipe pieces are required to be used in conjunction with G.I. Flush pipes for ensuring 'proper connection, the contractor shall do so at his own cost and rates quoted shall include for the same.

6.2.3.1 If the connection between the cistern and the W.C. pan is made with G.I. pipe the bends and offsets shall be made cold, and connection to the pan may be made by means of an approved type of joint or white lead mixed with chopped hemp.

6.2.4 Painting : Inside of cistern and fittings shall be painted with approved bitumastic paint and outside of the cistern, brackets, overflow and flush pipe etc., shall be painted with a priming coat of red oxide, and finishing two or more coats of white zinc or any other colour and shade to match with the painting of surrounding walls. The cost of such painting shall be included in the rate quoted for the flushing cistern.

7. Pedestal Wash Down Water Closet

7.1 W.C. Pan : The W.C. Pan shall be of white vitreous china of one piece construction of Wash down type with integral 'P' or 'S' trap as required. It shall be approved quality and pattern conforming to IS:2556 (Part II).

7.2 Seat & Cover : The seat with lid shall be of well seasoned teakwood varnished or Mahogany polished or plastic seat as specified with rubber buffers and shall be fixed in position by using Chromium plated (C.P.) brass hinges and screws. The seat shall be non absorptive and free from cracks and crevices in the material. The plastic seat and cover where specified shall conform to I.S. Specifications and shall be of black colour unless otherwise specified.

7.3 Flushing Cistern : The flushing of the W.C. Pan shall be done by high level or 'low level' valve less siphonic flushing cistern of approved quality, as specified. In the former case the specifications will be same as those for flushing cisterns of squatting pattern W.C. pans. In the latter case there shall be white glazed vitreous china or porcelain enameled or plastic as specified of 12.5 litre or of other capacity cistern as specified with all internal fittings, bracket and C.P. brass flushing handle, which shall be fixed at low level and connected to the W.C. pan by means of 40 mm diameter white enameled porcelain bend and rubber or 'Light' quality G.I. pipe or 2.6 mm thick lead pipe connection or as other specified.

7.3.1 Overflow : There shall be 20 mm overflow with mosquito proof coupling of approved design which shall conform to the specification as stated under squatting pattern W.C. Pan.

8. Bowl Urinal

8.1 Bowl Urinal : The urinal shall be flat back or angular pattern lipped from basin of required dimensions of white vitreous china and one piece construction with integral 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 screws of proper size. Each urinal shall be connected to a 40 mm diameter wastes lead pipe unless otherwise specified which shall discharge into a channel or a floor trap as specified. The connection between the urinal and flush or waste pipe shall be made by means of white lead mixed with chopped hemp. The flush pipe and waste pipe shall be concealed where directed.

8.2 Flushing : The flushing of the urinals shall be done by automatic flushing cisterns conforming to I.S. Specifications. The cistern shall be cast iron not less than 5 mm body thickness or other specified having valveless siphon

automatic flushing arrangements of specified capacity. It shall be supported on a pair of R.S. or C.I. cantilever brackets which shall be embedded or fixed to wall by means of wooden plugs and screws. The cistern shall be connected to the urinal basin by means of a G.I. Medium Quality or a lead or specified type of flush pipe with fittings. The pipe shall be fixed by using proper holder bat clamps or concealed by embedding as directed. The body thickness shall be not less than 6 mm in the case of vitreous sanitary cistern and 1.60 mm before coating in the case of pressed steel cistern. The latter should be porcelain enamelled against corrosion.

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

Number of Urinals in a range	Capacity of flushing cistern	Main	size of pipe distribution
1	5 litrs.	---	15 mm
2	10 litrs	20 mm	15 mm
3	12.5 litres	25 mm	15 mm
4	12.5 litres	25 mm	15 mm

8.2.2 The joint between the urinal basin and flush and waste pipe shall be made by means of putty or white lead mixed with chopped hemp, or as specified in case of lead pipes.

8.2.3 Painting : The inside and the outside of cast irron cistern, the fittings and brackets shall be painted as given under flushing cistern for squatting pattern W.C. Pan.

9. Urinal Stalls

9.1 Urinal Stalls : The urinal stall and its screens shall be of white vitreous china of approved quality and manufacture. The stall shall be 1140 mm high and 460 mm wide and 400 mm deep. The stall shall be provided with 840 mm x 360 mm division plates. In case of range of two or more urinals. there shall be further division plates similar to end screens. The range shall have 150 mm deep tread plates of fire clay unless otherwise specified.

9.2 Flushing : The stalls shall be provided with white glazed vitreous china automatic flushing cistern of proper capacity with 6 mm minimum body 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 clamps unless otherwise specified. Capacity of flushing cistern and relevant sizes of flush pipe for stall urinals shall be the same as specified for bowl urinals.

9.2.1 Outlet : Each range of stalls shall be provided with C.I. urinal trap with vent arm having C.P. brass outlet grating of size 50 mm for one or two stalls and 75 mm for more stalls or as specified.

10. Squatting plates

10.1 Squatting Plates : The urinal plates shall be of white glazed vitreous china with integral flushing rim of size 600 mm x 350 mm as specified. There shall be white vitreous channel with stop and outlet pieces in front. The plate and channel shall be of approved quality and conform to IS : 2556 (Part VI).

10.2 Flushing : Each set of plates shall be provided with automatic C.I. cistern complete with G.I. flush pipe with fittings and spreader arrangements fixed with holder-bat clamps or embedded as specified. There shall not be more than four plates in a range fed by a single cistern.

10.2.1 Capacity : The capacity of the flushing cistern and the size of the flush pipe for the number of squatting; plate urinals in a range will be as follows:

Number of Urinals in a range	Capacity of flushing cistern	Main	Size of flush pipe distribution
1	5 litres	--	20 mm
2	10 litres	25 mm	20 mm
3	12.51 litres	32 mm	20 mm
4	12.51 litres	32 mm	20 mm

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

10.2.3 **The joint between the urinal plate and the flush pipe shall be made with putty or white lead mixed with chopped hemp.**

10.2.4 Painting : The inside and outside of the cistern, the fittings and brackets shall be painted as described for flushing cistern for squatting pattern W.C. pan.

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

10.4 Walling : The squatting plate shall have 1220 mm high wall in front and one on either side. These shall be lined as specified.

11. Wash Basins

11.1 Basins : The wash basins shall be of white vitreous china of approved quality, make and pattern conforming to I.S. Specifications. It shall be of one piece construction with an Integral combined overflow. The size of the basin shall be specified.

11.2 Fittings : Each wash shall be provided with 15 mm C.P. brass pillar taps as specified, 32 mm C.P. waste with C.P. brass bottle trap or G.I. trap and plug as specified, G.I. chain and rubber plug unions, joints etc., complete in all respects of approved quality.

11.3 Fixing : The basin shall be supported on a pair of R.S. or C.I. cantilever brackets embedded or fixed in position by means of wooden cleats and screws. These brackets shall be painted to the required shade as given under flushing cistern for squatting pattern W.C. The wall plaster shall be cut to rest over the top edge of the basin. After fixing the basin, plaster shall be made good and surface finished to match with the existing one.

11.4 Waste connection : The waste pipe shall discharge into a floor trap leading to a gully trap, on ground floor and on upper floors, it may be connected to a waste pipe stack. The C.P. brass bottle trap and union shall be connected to 32 mm G.I. light class waste pipe or lead pipe as specified which shall be suitably bent towards the wall and/or concealed in the wall as directed.

12.0 Sinks

12.1 Sinks : The Sink shall be of white glazed fire clay with weir type overflow conforming to I.S. Specification unless otherwise specified. The size of the sink shall be as specified. The sink shall be of an approved quality and manufacture.

12.2 Fittings : Each sink shall be provided with 40 mm C. P. brass waste coupling union of standard pattern. C.P. brass chain and 40 mm rubber plug may be provided where specified.

12.3 Fixing : The sink shall be supported on C.I. cantilever brackets embedded, fixed into position. These brackets shall be painted to the required shade as given under flushing cistern for W.C. The wall plaster on the rear shall be cut to overhang the top edge of the sink.

12.4 Waste connection : The waste pipe shall discharge into a floor trap leading to a gully trap on ground floor and may be connected to a waste pipe stack on upper floors. C.P. brass coupling and union shall be connected to 40 mm G.I. light quality waste pipe provided with suitable tee and plug for cleaning purposes.

13.0 Toilet Requisites :

13.1 Mirror : The mirror shall be of approved make glass with bevelled edges. The size and shape of the mirror shall be as specified. It shall be mounted on an asbestos sheet and shall be fixed in position by means of 4 C.P. brass screws and washers over rubber washers and wooden plugs firmly embedded in the wall. C.P. brass clamps with C.P. screws may be an alternative method for fixing.

13.2 Glass Shelf : The shelf shall be of glass of approved quality with edges rounded off. The size of the shelf shall be as specified. The shelf shall have C. P. brass guard rail with rubber washers on positions resting on glass plate and C.P. brass brackets which shall be fixed with C.P. brass screws to wooden plugs firmly embedded in the wall.

13.3 Towel Rail : Towel rail shall be of C.P. brass with two C.P. brass brackets. The size of the rail shall be as specified. The bracket shall be fixed by means of C.P. brass screws to wooden cleats firmly embedded in the wall.

13.4 Toilet Paper Holder : The paper holder shall be wooden or of C.P. brass or vitreous china as specified. The wooden paper holder shall be made of well seasoned teakwood finished with beeswax. These shall be fixed in position by means of C. P. brass screws and wooden cleats embedded in wall.

13.5 Liquid Soap Holder : This shall be of glass or C.P. brass as specified. It shall be fixed in position by means of C.P. brass screws and wooden cleats embedded in the wall. The liquid soap holder shall be of approved size, and make.

13.6 Shower Rose : The shower rose shall be of C.P. brass swivelling type of approved size, make and design. Where specified the same shall be provided with a C.P. brass shower arm with necessary C.P. brass wall flange and fitting.

13.7 Water Connectors : Water connection to flushing cistern, wash basins etc. shall be by means of lead pipe or white polythene pipe connection pieces as specified with C.P. brass connectors on either ends and a stop cock. The size of the lead pipe or polythene pipe connection and stop cock will depend upon to the size of water connection and shall be as specified. The length of the connecting pieces shall be at least 375 mm

14. Cast Iron, Soil, Waste Vent and Rainwater Pipes and Fittings.

14.1 Cast Iron, Pipe and Fittings : Cast Iron soil, waste, vent and Rainwater pipes and fittings where specified shall conform to the latest Indian Standard Specifications for these pipes. The pipes shall have spigot and socket ends and shall be with or without ears as directed by the Executive Engineer.

14.2 Weights : The Standard Weights and thickness of pipes are given below and a tolerance upto minusa 10% may however be allowed against these standard weights.

Soil, Waste and Vent Pipes					RAIN WATER PIPES	
	SANDCAST		SPUN IRON			
Nominal dia of pipe	Minimum thickness	Nominal Wt. for 2 M long pipes exclusive of ears	Minimum thickness	Nominal Wt. for 2 M long pipe	Minimum thickness	Nominal Wt. for 1.8 M long pipe exclusive of ears
Mm	Mm	kg.	mm	kg.	mm	kg.
50	5	12.65	3.5	9.2	3	7.5
75	5	18.37	3.5	13.8	3	11.0
100	5	24.15	4.0	21.0	3	14.0
150	5	35.66	5.0	38.5	4	26.0

14.2.1 These shall be free from cracks and other flaws. The interior of pipes and fittings shall be clean and smooth. These pipes shall be coated internally and externally with suitable coating material having a tar or other approved base, in accordance with relevant I.S. Specification for these pipes.

14.2.2 The access door fittings shall be of proper design so as not to form any cavities in which this may accumulate. Doors shall be provided with 3 mm rubber

insertion packing and when closed and bolted they shall be watertight and airtight.

14.3 Fixing : The pipes and fittings shall be fixed to walls atleast 50 mm clear of the finished surface of walls by using proper holder-bat clamps. The pipes shall be fixed perfectly vertical or in a line as directed. The spigot ends shall abut the shoulder of the socket and leave no annular space in between. The pipes shall be strongly supported at the foot by a bed of cement concrete 1:3:6, 150 mm thick and rates quoted shall include for provision of the same.

All soil pipes shall be carried up above the roof and shall have a suitable cowl. The beds in the bottommost sailor waste stack shall necessarily be of long radius and perfectly made of two 135º C.I. bends.

14.3.1 Connection between main pipe and the branch pipes shall be made by using proper branches and bends invariably with access doors for cleaning.

14.4 Cement Mortar Joints : Where specified, the pipes jointed with cement mortar joints shall be as under :

Closely twisted spun yarn gasket of such diameter as required to support the spigot of pipe at the proper grade and make truly concentric joints and in one piece of sufficient length to pass around the pipe and lap at the top, shall be thoroughly saturated in cement paste. This gasket shall be laid in the socket for the lower third of the circumference of the joints and covered with cement mortar 1: 1. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted and carefully driven home after which a small amount of mortar shall be inserted in the annual space around the entire circumference of the pipe an solidly rammed into the joints with a caulking tool. The mortar previously placed being driven ahead of the gasket. The remainder of the joint shall then be completely filled with cement mortar 1:1 and beveled off at an angle of 45 degree with the outside of the pipe.

14.4.1 Where any water closet pan or earthenware pan connected to such pan is to be Jointed with C.I. soil pipe, the joints between the pan/trap and the socket of the C.I. Pipe shall always be of a flexible nature and such joint shall be made with a mixture of bitumen and chopped asbestos fiber (not dust).

14.5 Lead Caulked Joints: Where the pipes are to be jointed with lead caulked joints, the same shall be done as follows:

The annular space between the socket and spigot will be first well packed in with spun yarn leaving 25 mm from the lip of the socket for lead. The joints may be leaded by using proper leading rings or if they are not available by wrapping a ring of hemp rope covered with clay round the pipe at the end of

the socket, leaving a hole through which lead shall be poured in (for pipes with sockets facing upwards 12 mm high clay bund on the socket edge may be used).

14.5.1 The lead shall be rendered thoroughly fluid and each joints filled in one pouring. Before caulking, the projecting lead shall be removed by flat chisels and then the joints caulked round with proper caulking tools and a hammer of 1 to 1-1/2 kg. in weight in such a manner as to make the joint quite sound. After being well set up the joint is to be left flush, neat and even with the socket.

14.6 Testing : All cast iron pipes and fittings including joints will be tested for gas tightness by a smoke test and hydraulic performance by a water test and left in working order after completion.

14.6.1 Smoke Test: Smoke shall be pumped into the drains at the lowest and from a smoke machine which consists of a blow and burner. The materials usually burnt are greasy cotton waste which form clear pungent smoke which is easily detectable by sight as well as by smell if leaking at any point of the drain.

14.6.2 Water Test : The water test may be applied before the appliances are connected and may be carried out in sections so as to limit the static head to 4.5 metres.

14.6.3 The contractor will have to rectify all defects traced in such tests at his own expense to the satisfaction of the Executive Engineer.

14.7 Painting : All the exposed C.I. pipes and fittings shall be painted with two coats of oil paint of approved quality, manufacture, colour and shade to match the surroundings. The cost of such painting should be included in the contractor's rates.

14.7.1 The surface of the pipes and fittings to be painted shall be cleaned throughly. Red oxide or other approved primer shall be painted and allowed to dry. The finishing shall be done by painting 2 or more coats with paint in an approved colour and shade.

14.7.2 On no account shall lime mortar or lime concrete come in direct contact with C.I. pipes.

15. Asbestos Cement Rainwater, Soil, Waste and Vent Pipes and Fittings :

15.1 Pipes and Fittings : Asbestos cement Rainwater, soil waste and vent pipes and fittings shall conform to the latest Indian Standard Specifications for these types of pipes. The pipes shall have spigot and socket ends. The access door fittings shall be of proper design so as not to form any cavity in

which filth may accumulate. Doors shall be provided with 3 mm rubber insertion packing and when closed and bolted they shall be watertight and air tight.

15.2 Thickness and Sizes : The standard thickness and sizes with permissible tolerance of the dimension for pipe and fittings shall be as given below.

Nominal diameter of pipe of Fitting	Thickness of pipe or fitting	Permissible Variation in thickness	Permissible Variation in External Diameter
mm	mm	mm	mm
50	6.5	±1.0	± 1.5
60	6.5	± 1.0	± 1.5
80	8.0 .	± 1.0	± 1.5
90	8.0	± 1.0	± 1.5
100	8.0	± 1.0	± 1.5
125	9.5	± 1.5	±2.5
150	9.5	± 1.5	±2.5

15.3 Fixing : The pipes and fittings shall be fixed to walls at least 50 mm clear by using proper holder bats weighing 1 to 1-1/2 Kgs. each. The spigot end shall about the shoulder of the socket and leave no annular space in between. All soil pipes shall be carried up above the roof and shall have an AC. Cowl. The bends in the bottom most soil or waste stack shall necessary be of C.I. long radius and preferably made of two 135º C.I. bends.

15.3.1 Connection between main pipe and the branch pipes shall be made by using proper branches and bends invariably with access doors for cleaning.

15.4 Jointing : AC. pipes shall be jointed with Cement Mortar joints 1:1 as described for Cast Iron Pipes.

15.5 Testing : The joints of pipes shall be tested by smoke test and water test as described for cast iron pipes.

15.6 Painting : A.C. Pipes shall be painted to match the surrounding and rates quoted shall be included to cover the same.

16. Lead Pipes :

16.1 Lead Pipes : All lead pipes shall be hydraulic drawn and of equal substance throughout and shall conform to the relevant I.S. Specifications. When not supported on bearers, all lead pipes shall be supported by strong lead tacks at least 40 mm; wide soldered on to the pipes at suitable intervals. The size and weights of these pipes for flushing and soil, waste and ventilating pipes shall be as given in table below.

Nominal Internal diameter mm	Wall Thickness mm	Weight Per Metre . Kg.
20	2.60	2.09
25	2.60	2.56
32	2.60	3.28
40	2.60	3.95
50	2.70	5.07
75	2.70	7.48
100	2.70	9.88
150	3.00	16.36

16.2 Wiped Solder Joints: All joints of lead pipes shall be wiped solder joints as described below: The pipe ends to be jointed shall be cleaned with a wire brush and freed from oxide if any, Chalk shall then be rubbed to kill the Greasy nature of the lead. After this, plumbers black shall be applied. The length of the joint as given below shall then be marked on the Pipe. A fine shaving of lead shall be removed from this length with a shave hook. Tallow shall then be smeared over the prepared surface. The molten solder, an alloy composed of 3 parts of tin and 7 parts of lead, shall be poured in a thin stream from a laddle moved in an elliptical direction over the joint position including a portion of the soiled pipe at each end beyond the mark. When sufficient solder has been poured the joint shall be wiped with a pad of wiping cloth with long continuous movements in one direction only so as to

leave a neatly formed elliptical shaped joint. Surplus solder remaining on the joint shall be removed with a tool called "draw off"

16.2.1 The minimum and maximum length of the wiped solder joint shall be 80 mm & 90 mm respectively.

16.2.2 The joints shall be watertight, airtight and shall be free from tears, burrs, strings, ribands or droppings.

16.3 Cleaning access : Brass screw cleaning access shall be provided on lead pipe wherever necessary and directed. Rates quoted shall include for the above.

16.4 Lead Pipe Connection : The joints between lead pipe and C.I. or stone ware pipe shall be made as under :

Where any stoneware or C.I. pipe or trap is connected with a lead soil, waste or vent pipe or trap, this shall be inserted between the two, a 4.5 mm thick brass ferrule or thimble 150 mm long which shall be slipped into or over the lead pipe and jointed to it by means of a wiped solder joint. The other end of the ferrule shall then be inserted into the socket of the cast iron or stoneware pipe. In the case of former, the joint shall be made with molten lead (lead caulked) and in case of the latter with cement mortar 1: 1 as in stoneware pipe drains.

16.4.1 The joints between outgo of a W.C. pan and a lead pipe shall be made as under:

The lead pipe shall be slipped into a brass thimble or socket and jointed to it by a wiped solder joint. The outgo of a W.C. pan shall then be inserted into the socket and jointed by using cement mortar as in stoneware pipe drains.

16.5 Painting : All exposed lead pipes shall be painted as in cast iron pipes and fittings. The cost of such painting should be covered in the contractor's rates.

17. Plumbers Brass work, water and Waste Fitting.

17.1 General : Generally, the whole of plumbers brass work or gunmetal fittings shall be of heavy quality and approved manufacturer and pattern. They shall in all respects comply with the latest Indian Standard Specifications. Brass castings for valves, unions, thimbles, ferrules, taps, waste etc., shall be in all respects sound and good, free from laps, blow holes and fittings, plugs, burns stops or patches. The fittings shall be fixed in the pipe line in a workmanlike manner. Care shall be taken to see that joints between fittings and pipes are made leakproof. The fittings and joints shall be tested to a pressure of 20 kg. per sq. cm. unless otherwise specified. The defective fittings and the joints shall be repaired, redone or replaced. Brass work requiring connection to lead

pipes shall have tinned ends.

17.2 Screw down bib and stop taps : These shall be of cast brass or bronze of 'polished bright' or 'chromium plated' finished and of size as specified and shall conform to I.S. 781.

17.2.1 Unless otherwise indicated the minimum finished weights of bib taps and stop taps shall be as given below.

Size in mm	Minimum finished weight in Kg.	
	Bib taps	Stop taps
15	0.40	0.40
20	0.75	0.75
25	1.25	1.30
32	--	1.80
40	--	2.25
50	--	3.85

17.2.2 Washers for cold water taps shall be of selected leather, rubber asbestos composition or of plastic as directed. Washers for hot water taps shall be good quality fibre or rubber asbestos composition as directed.

17.3 Pillar Taps : Pillar taps shall be of cast brass of chromium plated finish and of size as indicated and shall conform to I.S. 1795. Washers shall be of materials as for bib taps and stop taps.

17.3.1 Unless otherwise indicated the minimum finished weights of pillar taps shall be as given below :

Size in mm	Minimum finished weight in kg.
15	0.60
20	1.00
25	1.50

17.4 Ball Valves : Ball Valve shall be of high pressure type, made of (excluding the float or ball) brass of size indicated shall conform to IS:1703. The float shall be of copper sheet or polythene as indicated. Unless otherwise indicated the minimum finished weights of ball valves (exclusive of the float), and those of copper float shall be as below:

Nominal Size in mm	**Weight in Kg.**		**Diameter** of float in mm
	Ball .valve exclusive of float	Copper float	
15	0.30	0.22	127
20	0.47	0.32	152
25	0.87	0.68	203
32	1.20	0.92	229
40	1.65	1.05	254
50	1.92	1.53	305

17.4.1 The minimum thickness of the copper sheet used for making float shall be 0.55 mm

17.5 Syphon traps (Galvanised malleable Iron or Brass) : Traps for lavatory basins, sinks and baths shall be of C.P. brass unless otherwise specified or G.I. of approved manufacturers. Traps for lavatory basins and sinks shall have one inspection eye, fitted with screw plug and washer, while for baths the traps shall have 2 branches screwed externally, one of which shall be fitted with washed cap and other with a vent tail pipe and union nut for overflow connection. A loose coupling nut shall be fitted to the inlet for coupling to the waste and the outlet shall be either plain tails for lead pipe or screwed with pipe thread and provided with union tail and pipe.

17.6 Waste Fitting : Waste fittings shall be brass chromium plated conforming to I.S. 2963. Sink waste shall be of 40 mm bore and wash basin waste shall be 32 mm bore, unless otherwise specified.

17.7 Waste plug and accessories : Waste plug shall be of hard rubber or other equally suitable material and shall conform to IS : 3311. The depth and thickness of the plug shall be such as to provide the required rigidity and water tightness. Each waste plug shall have a loose shackle. The shackle and other metal components shall be of corrosion resistant material.

17.7.1 Plug chains shall be made of brass or bronze wire, of diameter not less than 1.80 mm, brazed oval links approximately 13 mm in length.

17.7.2 Chain stays shall be of brass or bronze and shall be of bolt or screw type as indicated.

17.8 Lead traps : These shall be of size and pattern as indicated. The weights of lead sheets used in manufacturers of traps shall be not less than 30kg/Sq.M.

17.8.1 The traps shall be supplied with brass screw saps, the screw of which shall be lead burnt or soldered to the trap with a well reinforced joint. Neither the screwed end of the cap, when screwed home nor the sleeve shall protrude beyond the inner surface of the trap. A washer to render the cap water-tight shall be supplied with every cap.

17.9 Gate Valve : The valves used for cold water services shall be of gunmetal and conform to Class-I type of IS 778. For hot water installations Class - II valves shall be used. The gate valves shall be of the full way opening type with a metalic hand wheel fixed on the head of the spindle. The valves shall have screwed or flanged the ends as approved by the Executive Engineer.

17.10 Globe Valves (Screw down stop valves) : These shall be of gunmetal Class-I type for cold water services conforming to J.S. 778 unless otherwise specified. The valves shall have screwed or flanged ends as directed. The valves shall be provided with metalic hand wheel fixed on the head of the spindle.

17.11 Check (Non return) Valves : These shall be of gunmetal Class-I type for cold water services conforming to I.S. : 778 unless otherwise specified. The valves shall have screwed or flanged ends as directed. They shall be suitable for horizontal or vertical use as directed.

17.12 Foot Valves : Foot valves shall be of sewing or lift type and provided with brass strainer and conform to the requirements of I.S. 4038. The ends shall be screwed or flanged as directed.

17.13 Nahani traps : The traps shall be of Cast Iron and self cleaning design. The traps shall be of specified size and fitted with a hinged C.P. brass or Cast Iron grating as specified.

17.13.1 The grating shall be fixed flush with the floor while the trap shall rest on 1:6 cement mortar bed.

17.13.2 Where one pipe or single system of plumbing is employed it shall be essential to provide deep seal Cast Iron floor traps of effective water seal 50mm complying with the requirements of Indian Standard specifications.

18. Water Tanks

18.1 Water Tanks : Hoisting of ready made mild steel, galvanised iron, RCC or Asbestos cement water tanks into position shall be carried out with proper tackle, care being taken that no part of the tank or the structure is damaged with operation. The tanks shall be installed truly level. Steel tanks of capacity up to 1800 litres (mild steel or Galvanised Iron as specified) shall be of 3.2 mm thick sheet rivetted to 32 mm x 32 mm x 6mm angle iron frame complete with MS

cover and frame weighing 15 Kg. with locking arrangement including proving pads of size as required for inlet and outlet pipes G.I. overflow pipe piece with mosquito proof couplings and scour pipe with backing nut of required sizes shall also be provided. Supports for tanks shall be provided as specified and shall be measured and paid for separately.

18.2 Pipe inserts : G.I. Pipe inserts to be kept in position for outlets, washouts and inter connection of tanks while casting, RCC water tanks shall be of the specified size and diameter and shall be threaded throughout its length. A 150 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.

18.3 Overflow pipes : Overflow pipe inserts for tanks shall be of the specified size and diameter with an approved mosquito proof coupling and rates quoted shall include for same.

IV DRAINAGE

19. Salt Glazed Stoneware Pipe Drainage

19. 1 Pipes : All pipes and fittings must be new and perfectly sound, free from fire cracks and imperfections of glazing, cylindrical and of standard nominal diameter, length and depth of socket. They shall be made of hard burnt stone ware of dark grey colour and thoroughly salt glazed inside and outside. These pipes and. fittings shall conform to grade 'A' of the relevant latest I.S. specifications for these pipes and fittings, unless otherwise specified.

19.2 Excavation of trenches for salt glazed stoneware pipes: Excavation of trenches and connected works such as road crossing, protection of existing services, lighting and watch etc. shall generally be carried out in accordance with the procedure described earlier in respect to Cast Iron pressure Pipes and fittings. Trenches for drainage work shall be carried out to the required levels. Use of sight rail and banning rods shall be adopted during the whole process of excavation and laying of pipes. Any excess excavation more than required shall be made good in 1:3:6 PCC at contractor's cost.

19.3 Concrete Support or Protection : Where it is desired to support or surround pipe sewers or drain, it shall be done in concrete 1:4:8 by adopting one of the following methods as specified.

19.3.1 Bedding : Bedding shall be rectangular in section and shall extend latelly at least 150 mm beyond on both sides of the projection of the barrel of the pipe. The thickness of the concrete, below the barrel of the pipes shall be not less than 100 mm for the pipes under 150 mm in diameter and be not less than 150 mm for pipe 150 mm and over in diameter. Where bedding is used alone, the concrete shall be brought up at least to the invert level of the pipe to form a cradle and to avoid line contact between the pipe and the bed.

19.3.2 Hunching : Concrete hunching shall consists of a concrete bed as described for bedding with the full width of the bed carried upto the level of the horizontal diameter of the pipe & splays from this level carried up on both sides of the pipe from the full width of the bed to meet the pipe barrel tangentially.

19.3.3 Surround or encasing : The surround or encasing shall be similar to hunching upto the horizontal diameter of the pipe and the top portion over this shall be finished in a semi-circular form to give a uniform encasing for the top half of the pipe. Encasement may be provided when the maximum subsoil water-table level is likely to rise above the top of barrel or where there is insufficient earth cover over the top of the barrel.

19.4 Laying of Pipes : Pipes shall be carefully laid to the levels and gradients shown on the plans. Great care shall be taken to prevent sand etc; from entering the pipes. The pipes between the manholes shall be laid truly in straight line without vertical or horizontal undulations. The pipes shall be laid with the socket leading uphill. The body of the pipe shall for its entire length rest on an even bed of concrete and places shall be excavated in the concrete to receive the socket of the pipe.

19.5 Jointing : In each joint, tarred gaskin or spun yam soaked in neat cement slurry shall be passed round .the joint and inserted in it by means of a caulking tool. More skins of yam shall be added and well rammed home.

19.5.1 The object of the yarn is to centre the spigot of one pipe within the socket of the other and to prevent the cement mortar of the joint penetrating in to the pipes.

19.5.2 Cement mortar 1: 1 shall be slightly moistened and must on no account be soft or sloppy and shall be carefully inserted by hand into the joint. The mortar shall then be punched and caulked into the joint and more cement mortar added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall then be finished off neatly outside the socket at an angle of 45°.

19.5.3 Any surplus mortar projecting inside the joint shall be removed and to guard against any such projections, sack or gunny bag shall be drawn past each after completion:

19.6 Curing: The cement mortar joints shall be cured at least for seven days, before testing.

19.7 Quantity of Cement and Spun Yarn : The approximate quantity of cement and spun yarn required for each joint, for certain common size of pipes are given below for guidance.

Nominal Dia of Pipe	Cement	Spun Yarn
mm	Kg.	Kg.
100	1	0.25
150	1.5	0.35
200	2	0.70
250	2.5	0.80
300	3.25	1.10
350	4.5	1.25
400	5.5	1.50

19.8 Jointing S.W. Pipes with C.I. Pipes : Where any C.I. Soil, Waste or Ventilating pipe or trap is connected with a stoneware pipe communicating with a sewer, the beaded spigot end of such C.I. pipe or trap shall be inserted into a socket of such S. W. Pipe drain and the joint made with cement mortar 1:1.

19.9 Testing : All joints shall be tested to a head of 600 mm of water above the top of the highest pipe between two manholes.

19.9.1 The lowest end of the pipe shall be plugged watertight. Water shall then be filled in manhole at the upper end of the line. The depth of water in the manhole shall be 600 mm plus the diameter of the pipe. The joints shall then be examined. Any joint found leaking or sweating shall be remade and embedded into 150 mm layer of cement concrete 1:2:4, 300 mm in length and the section retested, at the Contractor's expense untill satisfactory results are obtained.

19.10 Refilling : Refilling in trenches for pipes shall be commenced as soon as the joints and concrete have been passed. The refilling on the top and around the drain shall be done with great care and in a manner as will obtain the greatest amount of compactness and solidity possible. For this purpose the earth shall be laid in regular layers of 150 mm watered and rammed at each layer. All surplus earth shall be disposed off as directed by the Executive Engineer

20. Stoneware Storm Water Drains :

20.1 Storm Water Drains : When S. W. pipes are used for storm water drainage, no concreting will be necessary. The cement mortar for jointing will be 1:3 or as specified. To avoid elogging of drains, both ends shall be kept plugged until the construction of manholes is completed in every respect. On completion care shall be taken that each plug is removed and the face of the drain made smooth.

21. Stoneware Gully Traps :

21.1 Gully Trap : This must be new, perfectly sound, free from fire cracks and other imperfections of glazing, of standard nominal diameter and other dimensions. It shall be made of hard burnt stoneware of dark grey colour and thoroughly salt glazed inside and outside.

21.1.1 Each gully trap shall have one C.I. granting 150x150 mm and one watertight C.I. cover with frame 300x300 mm (inside dimensions) with machined seating faces.

21.2 Excavation : The excavation for gully traps shall be done true to dimensions and levels as indicated on plan or as directed by the Executive Engineer.

21.3 Fixing : The gully trap shall be fixed on cement concrete foundation 700 mm square and not less than .100 mm thick. The mix for the concrete will be 1:4:8 (1 cement, 4 sand and 8 stone ballast 40 mm). The jointing of gully outlet to the branch drain shall be done similar to jointing of S. W pipes.

21.4 Masonary Chamber : After fixing and testing the gully and branch drain, a brick masonary chamber 300x300 mm (inside) in first class brick in cement mortar 1:4 shall be built with 110 mm thick wall round the gully trap from the top of the bed concrete upto ground level. The space between the chamber walls and the trap being filled in which cement concrete of the specification of bed concrete. The chamber shall be plastered internally and externally with cement mortar 1:3 (1 cement: 3 sand) finished with a floating coat of neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating.

21.5 C.I. Cover : C.!. Cover with frame 300x300 mm (inside) or as specified with rnachined seating faces shall then be fixed on the top of the brick masonry with cement concrete 1:2:4 and rendered smooth. The finished top of cover shall be left 50 mm above the adjoining ground level so as to exclude the surface water from entering the gully trap.

22. Reinforced Cement Concrete Pipe Drainage :

22.1 RCC Pipe : All pipes and fittings must be new and perfectly sound free from cracks, cylindrical straight and of standard nominal diameter and length. They shall be made of reinforced cement concrete, manufactured by centrifugal or spun process and shall have an even texture. Each pipe shall have one collar with it. The Pipes shall conform to latest Indian Standard Specifications and shall be of "NP2" class unless otherwise specified.

22.2 Excavation of Trenches : Excavation of trenches and connected works such as road crossings, protection of existing service, lighting and watch etc. shall generally be carried out in accordance with procedure described earlier of Cast Iron pressure Pipes and stoneware pipes.

22.3 Concrete Support: Chairs made of cement concrete shall be used unless otherwise specified for supporting pipes. These shall be provided in suitable intervals which shall not exceed the length of pipe. In cases where the soil is made up or is very soft. other forms of concrete supports may be resorted to form the bed of the trench below the pipe as directed by the Executive Engineer.

22.4 Laying : The pipes shall be carefully laid to levels and gradients shown in the plans and sections. Great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in straight lines without vertical or horizontal undulations.

22.4.1 The body of the pipe shall for its entire length rest on an even bed in the trench and places shall be excavated to receive the collar for the purpose of jointing.

22.5 Jointing : A few skins of spun yarn soaked in neat cement wash shall be inserted in the groove at the end of the pipe and the two adjoining pipes butted against each other. The collar shall then be slipped over the joint, covering equally both the pipes. Spun yarn soaked in neat cement wash shall be passed round the pipes and inserted in the joint by means of caulking tools from both ends of the collar. More skins of yarn shall be added and well rammed home.

22.5.1 The object of the yarn is to centre the two ends of the pipes within the collar, and to prevent the cement mortar of the joint penetrating into the pipes.

22.5.2 Cement mortar 1: 1 (1 cement : 1 sand) shall be slightly moistened, and must on no account to soft or sloppy and shall be carefully inserted by hand into the joint. The mortar shall then be punched and caulked into the joint and more cement mortar 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°.

22.5.3 Any surplus mortar projecting inside the joint is to be removed and to guard against any such projections sack or gunny bag shall be drawn past each joint after completion.

22.6 Curing: The cement mortar joints shall be cured at least for ten days.

22.7 Testing and Refilling : This shall be the same as described for S.W. Pipe drains except that in the case of testing, the head of water for testing shall be 3000 mm above the top of the highest pipe between two manholes.

23. Cement Concrete Storm Water Drain :

23.1 Storm Water Drains : When concrete pipes are used for storm water drainage, the cement mortar for the jointing shall be 1:3 (1 cement: 3 sand), or as specified. To avoid clogging of drains, both ends shall be kept plugged until the construction of manholes is completed in every respect. On completion care shall be taken that each plug is removed and the face of the drain made smooth.

24. Cast Iron Pipe Drainage :

24.1 Application : C.I. pipe drainage may be adopted in the cases mentioned below where specified :

(a) In bad or unstable ground where Soil movement is expected.

(b) In made-up or tipped ground.

(c) To provide for increased strength where a sewer is laid at insufficient depth, where it is exposed or where it has to be carried on piers or

above ground and

(d) Under buildings and where pipes are suspended in basements and like situations.

24.2 Pipes : The pipes used shall conform to the latest Indian Standard specification IS : 6163 or C.I. Spigot and socket pipes unless otherwise specified.

24.2.1 All pipes shall be coated inside and outside while hot with an approved anticorrosive paint having a tar or other suitable base.

24.2.2 The nominal weights of the pipes shall be as per details below :

Nominal dia of Pipe	**Nominal weight of pipes including socket length for pipes for overall length 3.66 M.**
mm	**Kg.**
80	44
100	52
150	85
200	135

24.3 Excavation in Trenches, laying and jointing, refilling etc. : Specifications for trenches and connected works for laying and jointing, refilling cast iron pressure pipes & stoneware pipes shall apply in this case.

24.4 Concrete Supports : In normal ground, no concrete support or protection to C.I. pipes need be provided. Where supporting piers are specified, these shall not be less than 300 mm in length (parallel to the axis of pipe) and at least equal in section to that described for hunching under concrete supports for S.W. pipes. Piers shall be built just behind the pipe sockets, intermediate piers being provided where necessary.

25 Brick Masonry open Surface :

25.1 Surface Drains: The top of the drain shall always be kept 50 to 75 mm above adjoining ground level so as not to admit storm water from surrounding area into it. The over all depths of the various size of drains shall be as follows :

Drain .Size		Depth
10 cm		15 cm
15 cm	.	23 cm
23 cm		30 cm

25.1.1 The earth excavation shall be done true to levels and lines. The drains shall be built in first class brick in cement mortar 1:5 over a 100 mm bed of cement concrete 1:5:10. The inside bottom corners of the drain shall be rounded off by means of fine cement concrete 1:2:4. Inside of the drain, top and sides of the brick work shall be plastered with 12 mm cement mortar 1:3 finished with a floating coat of neat cement. The drain may be given as far as possible a uniform slope from the starting point to the discharging point.

25.2 Brick Masonry Drains with Stoneware Glazed Channels: The work shall be carried out as per specifications of open surface drains except that the cement plaster of the inside of the drain shall be omitted and stoneware glazed channel of proper size shall be fixed in drain with cement mortar 1:1.

26. Manholes and Inspection Chambers :

26.1 Chambers : At every change of alignment, gradient or diameter of a drain, there shall be a manhole of inspection chamber. The maximum distance between manholes shall not exceed 30 meters.

26.2 Size : The. size of the manhole or inspection chambers specified shall be the internal size of the manhole (between brick faces). The work shall be done strictly as per drawings and specifications.

26.3 Excavation : The manhole shall be excavated true to dimensions and levels, shown on the plan as directed by the Executive Engineer.

26.4 Brick Work : The brick shall be of first quality. best locally available and from approved source. The brick work shall be laid in cement mortar 1:3. The joints shall be made thoroughly leakproof.

26.5 Plaster : The walls shall be plastered both inside and outside with 20 mm thick cement plaster 1 :3. Where subsoil water condition exists, the outside surface of the wall shall be plastered with the addition of approved waterproof compound.

26.6 Foundation Concrete : The manhole/inspection chambers shall be built on a base of cement concrete of mix 1:4:8 of thickness of atleast 15 cms for chambers upto 1 M depth, at/east 20 cms for chamber from 1 M to 1.5 M depth and atleast 30 cms for inspection chamber of greater depth.

26.7 Pointing : Pointing shall be done with cement mortar 1:2 wherever required.

26.8 Channels and Benching : The channels and benching shall be done in cement concrete 1:2:4 and rendered smooth to the grade with cement mortar 1:2. The channel shall be semicircular in the bottom half and of diameter equal to the sewer.. Above the horizontal diameter, the sides shall be extended vertically to the same level as the crown of the outgoing pipe and

the top edge shall be suitably rounded off.

26.9 R.C.C. Cover Slab : Cover slab shall of RCC 1:2:4 of 100 mm thickness or other specified with steel reinforcement as per details.

26.10 Foot Rests : Foot rests shall be provided in all inspection chambers and manhole over 0.8 m in depth and shall be of C.I. square flats 25 mm weighing atleast 4.50 Kg. or as specified and shall be painted with coal tar. These shall be embedded in masonry in cement mortar atleast 25 cms., while the brickwork is in progress. This shall be set staggered into two vertical runs which may be 38 cms apart horizontally, and 30.5 cms apart vertically. The top foot rest shall be 45 cms below the manhole cover and the lowest not more than 30 cms above the benching.

26.11 Level of invert : Sewers of unequal sectional area should not join with level inverts in a manhole, but the crown of the screwers shall be kept at the same level and necessary slope given in the invert of the manhole in the direction of main flow and the junction must be made with care so that flow in the main is not impeded.

26.12 House Connections : No drain from house fittings i.e. gully trap or soil pipe etc., to manhole shall exceed a length of 6 meters unless it is unavoidable.

26.13 Measurements: The depth of the manhole shall be reckoned from the invert level of the channel to the top of the C.I. cover. The depth shall be measured correct to nearest cm.

26.14 Manhole upto 1000 mm depth : This shall be of 800x800 mm size unless otherwise specified and is generally constructed within compounds for house drainage only. The thickness of brick walls shall not be less than 230 mm

26.15 Manholes of depths between 1000 mm and 1500 mm : This shall be of 1200 x 900 mm unless otherwise specified. The thickness of brick walls shall not be less than 230 mm

26.16 Manhole of depths more than 1500 mm : Circular chambers with minimum diameter of 1400 mm or rectangular chambers with minimum internal dimensions of 1200 x 900 mm shall normally be provided unless otherwise specified. The brick work for the portion, exceeding 1500 mm and upto 2200 mm shall normally be 345 mm thickness, unless otherwise specified.

26.17 Drop Manholes : Where it is impractical to arrange the connection of tree branch pipe sewer within 600 mm of the invert of the outgoing sewer in the manhole, a drop connection shall be provided. If the difference in level between the incoming drain and the sewer does not exceed 600 mm, the connecting pipe may be directly brought through the chamber wall and the fall

accommodated by constructing a ramp in the benching of chamber.

26.17.1 The connection shall be made by constructing a vertical shaft outside the manhole chamber as shown in drawings or directed by the Executive Engineer. The rates quoted shall include for providing the requisite length of SW or RCC pipe embedded, in the masonry or PCC at the upper and lower ends of the drop arrangement, providing and fixing SW or RCC right angled bend and double tee junction of .the requisite size including cutting ends if required and jointing, providing 110 mm thick brick masonry in 1:2 cement mortar or PCC encasement alround including finishing with cement plaster 1: 1, 20 mm thick and excavation and plugging the open mouths of the double tee junctions and house connection pipes wherever directed.

27. C.I. Covers

27.1 Covers : The C.I. manhole covers and frame shall be cleanly cast and shall be free from air and sand holes, cold shuts and warping which are likely to impair utility of castings. They shall be tough homogenous cast iron, of Heavy, Medium, or Light Duty type as specified. The sizes specified are the clear internal dimensions. The minimum weights of the various types of manhole covers with frames and their internal size will be as given below :

Sr. No.	Description	Clear opening	Minimum Weight of cover	Minimum Weight of frame	Total Weight
		mm	Kg.	Kg.	Kg.
1.	Heavy Duty Circular	500 Dia	118	111	229
2.	Medium Duty Rectangular	455 x 610	80	64	144
3.	Medium Duty Circular	500 Dia.	58	58	116
4.	Light Duty Rectangular Double Seal	455 x 610	29	23	52

27.2 Manhole covers with double seal shall be used near buildings and within compounds. When the Inspection Chamber is built in domestic premises

where they are not subjected to wheeled traffic load, light duty C.I. cover may be used. When it is built within the metalled width of the road under heavy vehicular traffic, it shall be provided with heavy duty C.I. cover. Medium duty covers shall be used in light traffic condition such as internal approach road and cycle tracks.

27.2.1 The covers used in manholes on sewer lines shall invariably bear the word "SEWER" on the top and those used for storm water drains shall bear word 'S.W.D.'. These markings shall be done during casting of the covers

27.2.2 The frame of manhole cover shall be embedded firmly in the RCC slab or plain concrete as the case may be on the top of the masonry.

27.2.3 After the completion of the work manhole covers shall be sealed by means of thick motor grease. All exposed surfaces of the frames and covers shall be painted with coal tar. The cost of such work should be included in the Contractor's rates.

TECHNICAL DETAILS FOR ELECTRICAL INSTALLATION WORK

T. D. 1:

All items of works are to be carried out strictly as per I.E. Rules 1956. IS: 732, IS: 3943-1966, CPWD General Specifications for Electrical Works-Part-I (Internal)-2013 or their latest version. In case the tenderer observes any deviations in the provision made in Schedule of works vis-a-vis provision of the above given publications, he is advised to bring it out clearly while making his offer.

T. D. 2:

(a) INSTALLATION: Rates quoted by the tenderer should include for the following work unless stated otherwise.

(i) Installation of switches on slotted angle iron frame work of adequate section. The main panel board is to be installed on the floor with adequate supports from wall at the back to make the entire arrangement adequate sturdy.

(ii) Connecting the main branch switch meter, bus bar, distribution board with adequate length and section of PVC insulated leads in PVC Conduit as per requirement of site.

(iii) Labeling of the switches to indicate clearly the area or the load being controlled by them.

(iv) Connecting the earth wire run along with mains, cables etc., to the earth line by providing a suitable socket etc.

(b) BUS BAR:

(i) All bus bars are to be made of Tinned copper strips of the given section.

(ii) All bus bars are to be covered with PVC sleeves or red, yellow, blue and black colours to indicate various phases and neutral bar clearly. Alternatively, PVC insulation tape of the aforementioned colours is to be used for identification of phases and neutral as indicated above.

(c) All locally fabricated elements of the Main panel board (such as slotted angle Iron frame works, bus bar chamber, distribution board etc.) should be provided with the final coat of battle - ship grey paint (synthetic enamel) after erection and before commissioning and all switches, bus bars distribution boards provided to main panel boards are to be labeled.

T.D. 3:

a) Drawing showing details of installation indicating very clearly the sections of slotted /M.S. angle iron proposed to be used, the depth to which members are to be grouted inside the wall, mode of their support at the floor level including grouting inside the floor should be got approved by the Contractor before actual execution of work.

b) The drawing showing the arrangement of the main distribution boards, floor distribution boards showing the actual dimensions of switchgears, bus chambers, distribution board etc., should be got approved by the Contractor before fabrication.

c) After execution of the work, the Contractor has to submit completion reports with drawings of the entire installation showing the manner in which the work has been actually carried out in triplicate to L.I.C. of India. This is in addition to the drawings which the Contractor is required to submit with the completion reports/tests reports he has to submit as per the requirement of local electric supply company.

d) It is the responsibility of the Contractor to attend to the inspection of the installation if carried out by the Inspecting authority of the State Government/Electric supply Authority. As mentioned in T.D.1 since the works are to be carried out strictly as per I.E. Rules and relevant Indian Standard specifications, the defects indicated by the above given inspecting authorities will have to be rectified by the Contractor at no extra cost to LIC of India.

T.D. 4:

a) Insulated cables are to be on the walls, beams ceiling etc., by providing plugs of well seasoned wood, cemented into the walls to within 6.5 mm. of the surface, within the electrical shaft, the cables are to be run on M.S. Clamps made out of angle, channel or flat section of required thickness grouted in the wall securely. The cable trenches in the Meter room in which the cables have been laid are to be filled up with sand.

b) All cable terminations inside switches, bus bar, distribution and switch boards should be made in a workmanlike manner by providing sockets of suitable amperage, compression glands of suitable dia as required. Rates quoted should be inclusive of all these accessories and nothing extra will be considered on these counts.

c) Measurements for Mains and Cables will be taken as per IS: 5903-1973 or latest version of it.

T. D. 5:

a) The work of providing earth electrodes is to be done strictly according to IS:3043 – 1966 or its latest version.

b) The earth electrodes are to be installed minimum 4.5 meters away from the premises.

SPECIFICATION FOR ELECTRICAL INSTALLATION WORKS IN LICI BLDGS.SUBJECT TO THE GENERAL CONDITION OF CONTRACT IN FORCE

(A) GENERAL

1. The installations shall generally be carried out in conformity with the Code of Practice for electrical wiring installation (system voltage not exceeding 650 V. vis I.S. 730. 1963 or the latest revision thereof.
2. **DEFINITION:** As given in I.S. Code of Practice shall apply.
3. **PRESSURE AND FREQUENCY OF SUPPLY :** All current consuming devices shall be suitable for 433 V, 3phase, 50 Hz A.C. supply.
4. **SYSTEM OF WIRING :** The wiring shall be carried out as per schedule. Power wiring shall be kept separate and distinct from lighting wiring. All wiring must be done on the distribution system with main and branch distribution board at convenient centres. All conductors shall run as far as possible along the walls and ceilings so as to be easily accessible and capable of being thoroughly inspected. The contractor shall arrange beforehand the balancing of circuits in consultation with Electrical Engineer of L.I.C.I.
5. **CONDUCTOR :** The conductors shall be of copper or otherwise stated in tender and shall be either PVC insulated or PVC insulated PVC sheathed. The minimum sections of conductors used for wring of light and plug points shall be 1.5 sq mm. single core wires shall only be used.
6. **CABLES:**
   i) All cables including flexible cables used shall be ISI approved and confirming the ISI specifications.
   ii) Twin flexible cable shall be of minimum section area of 14/0.0076 and PVC insulated.
7. **TEST:** The installation with fittings complete shall before current is switched ON, satisfactorily pass the following tests. The whole of the lamps and appliance having been connected to the conductors and all switches and fuses being 'ON', a pressure not less than twice the intended working pressure subject to a limit of 500 volts shall be applied and the insulation resistance of the whole or any part

of the installation to earth must not be less in Mega ohms than 25 divided by the number of points as defined above. With all lamps and appliance removed from the circuits a similar test between poles may be demanded, provided that during the rainy season half the above test value will be accepted. Where any appliance referred to is a motor larger than one-half B.H.P. the insulation resistance of that particular circuit must be greater than one Mega ohm.

8. **JOINTS AND LOOPING BACK:** No joints shall be allowed in conductors. Neutral shall be looped from point to point whereas the live wires shall be looped in the switch board only from switch to switch.

9. **FANS AND REGULATORS**

(a) All ceiling fans shall be suspended from a hook or shackle and insulated from the same. All joints in the suspension rod shall be screwed and all joints or bolts in connection therewith shall be additionally secured by means of split pins.

(b) The canopy and wood block at the top of the suspension rod shall effectually hide the suspension.

(c) All fans shall be hung nine and half feet above the floor or as directed by the supervising officer.

(d) Each fan shall have a speed regulator which shall have a cover and an 'OFF' and shall be so designed as to be capable of reducing the normal speed of the fan by not less than 60 percent with all resistance in circuit. The regulator shall be capable of continuous use on any contact without burning or overheating.

SPECIAL CONDITIONS AND TECHNICAL SPECIFICATIONS

FOR ELECTRICAL WORKS

1. **SCOPE OF WORK:** In general the work to be carried out under this contract shall be as specified in the specifications detailed in the schedule of quantities shown in the drawing and generally shall comprise of supply and installations of the following:
    i) Wiring for lights, fan points, power outlets, special power wiring etc.
    ii) DB's Main boards, floor boards.
    iii) Mains, sub mains and power cables.
    iv) Earthing
    v) Lighting protection
    vi) Supply of fittings and fans
    vii) Erection of fittings and fans.

2. **SPECIFICATION AND STANDARDS:** Specifications applicable to this work shall be as per India Standard Specifications and Specifications laid in National Electrical Code unless otherwise specified in the description of items, given in the schedule of quantities or in the special conditions and/or Technical Specifications. Requirements or these specifications shall be fulfilled by the contractor within the tendered rates.

3. In the interpretations of specifications or items where descriptions are conflicting or incomplete or otherwise subject to dispute the following order of decreasing importance shall prevail.
    a) Description of item in the schedule of quantities.
    b) Specifications attached to the tender.
    c) Indian Standard specifications, I.E. Rules & CPWD General Specifications for Electrical Works-Part-I (Internal)-2013 or their latest version.

4. **ALTERATIONS:** If any minor alterations are found necessary the contractor will carry out the same with the prior approval of the Chief Engineer, without any extra charges.

5. **WORKMAN SHIP:** The work will be carried out in the best workman like manner and any defect in the work or changes in the design etc. if pointed out shall be carried out by the contractor within the tendered rates, without any extra charges.

6. **EMPLOYEMTN OF SUPERVISORS/WORKERS:** The contractor shall employ adequate skilled and unskilled workmen to complete the work within the stipulated time and make his own arrangement for storage of materials etc. A whole time Electrical Engineer/Supervisor shall be deputed by the contractor who shall remain at site of work to receive orders or any other instructions from the Architect/Engineer-in-charge.

7. **MATERIAL SUPPLIED BY THE OWNER:** Any material supplied by the employers to contractor for erection, if damaged in any way during cartage or execution of work or otherwise, shall be made good by the contractor at his own cost.

8. **CONTRACTOR'S RESPONSIBILITY:** During the progress of work, completed portions of the building may be occupied and put to use by the owner but contractor will remain full responsible for maintenance of the electrical installation till the entire work covered by this contract is satisfactorily completed by him and taken over by the owner.

9. **CONTRACTOR TO OBTAIN INFORMATION HIMSELF:** The contractor shall obtain for himself, on his own responsibility and at his own expenses all the information which may be necessary for the purpose of tendering and for entering into a contract and must examine and study the specifications, inspect the site, the building and electrical plans etc. The contractor shall also not withstand any information given to him make local and independent enquiries.

10. **TENDER RATES:** All rates tendered will include for the cost of material, connections, labour, supervision, tools, plants, transport, contingencies, breakage, wastage, sundries scaffolding and they should be for an item complete in all respects.

11. **APPROVALS:** The contractor, while executing the work, shall conform to the provision on any Government Act relating to the work and to the regulations and Bye Laws of the local authorities, and of the company to whose system of supply the installation is proposed to be connected. The contractor shall give all notices required by the acts, regulations or certificates and drawings as required and will make necessary arrangements to procure electricity supply without any extra charges. The contractor shall also obtain all approvals from appropriate authorities for the items of work done under this contract. All inspection fees or submission fees paid by the contractor will be reimbursed by the owner against valid official receipts. Contractor shall possess or shall employ a sub-contractor

who possesses a valid Electrical Contractor's License issued by the inspectorate of the local government. The contractor shall file applications and follow up with electricity supply company for the sanction of power supply and commissioning of the electrical installations preparation of drawings in consultation with the Architects (if any) Approval of drawings and installation etc. shall be arranged by the contractor. All incidental charges/expenses associated with the above work shall be borne by the contractor.

12. **SAMPLES AND FABRICATION DRAWINGS:** Samples of materials and fabrication drawings will be submitted by the contractor according to the schedule/specifications. Any deviation from the schedule/specification will have the written consent of the competent authority of LICI. However, approval given to any samples of drawings submitted by the contractor shall in no way exonerate the contractor from his liability to carry out the work in accordance with the terms of the contract.
13. **COMPLETION DRAWINGS:** The contractor shall submit one complete set of Original Tracing and further two copies of layout drawings to the Executive Engineer after completion of the work. These complete drawings shall give the following information.
    a) Layout of Lighting and Power Wiring.
    b) Location of DB's MCB's sub mains cables and earthing.
    c) Junction boxes draw boxes and dummy conduits for telephones, fire alarm and other systems.
    d) Schematic diagram and shall indicate all systems that are covered in the scope of this work. No completion Certificate will be issued until the drawings in the above mentioned form are submitted. The drawings will be prepared and submitted by the contractor without extra charge.
14. **PROGRESS AND TIME COMPLETION:** The work will commence immediately after the contractor receives instructions to proceed and will ensure that the work is completed within the stipulated period. Electrical work shall be carried out simultaneously with other works. The contractor will work in co-operation with the building contractor and other contractors and shall arrange to place the conduits in the masonry and concrete work as the building or other work proceeds. Any hold up in the building or other works because of delay in laying of conduits or otherwise, shall be the responsibility of the Electrical contractor and will make him liable for damages, if any, by the Employers. The contractor shall in consultation with the Executive Engineer Elect. Draw up a time schedule before commencement of the work. This time schedule will be strictly adhered to.

15. **DEFECT LIABILITY PERIOD:** The completed installation shall not be finally taken over and acceptance certificate issued to the contractor until the expiry of defect liability period of one year. The contractor shall be liable for :
    a) The replacement of any defective parts that may develop in goods of his own manufacture or supplied by him.
    b) The rectification of all the defects arising out of defective workmanship of the contractor.
    c) Bringing to the notice of Engineer-in-Charge any defect arising in materials supplied by the LIC of India. The owner shall provide replacement of such material.

    Until the installation is finally taken over, the contractor shall have right of entry to the premises at his own risk and expenses for maintaining of the installation in proper order.

16. **PAINTING AND MARKING:** All exposed steel work will be painted with one coat of primer and two coats of synthetic enamel paint in shades approved by the Engineer-in-Charge. This work will be done by the contractor without extra charge. All DB's Main Boards, Meter Boards, etc. shall be marked/number to indicate the area they control.
17. **CONDUITS FOR VARIOUS SYSTEMS:** Separate and independent conduits will be laid for each systems such as lighting, power normal and essential DG set supply telephones, TV etc. conduit less than 20mm in diameter shall not be used.
18. **INSPECTION:** During production and prior to dispatch of equipment, contractor shall provide and secure every reasonable access and facility of inspection for Dy. Chief Engineer and his representative if so desired.
19. **SYSTEM OF WIRING:** In any system of wiring no joints shall be made at intermediate points in the through run of cables unless the run of final circuit sub mains, mains etc. exceed the length of standard coil as manufactured by the manufacturer of the cables.
20. **POINT WIRING:** In case of recessed conduit system the point shall be completed with conduit including accessories and cables, necessary junctions outlets and switches boxes connector, wherever required necessary earthing, connections and ceiling rose.

    a) The point shall commence from the distribution board each having independent neutral wires and shall end up to the outlet through control switch.

    b) Installation shall be carried out in conformity with the ISI codes practice India Electricity Rules and CPWD General Specifications for Electrical Works-Part-I (Internal)-2013 or their latest version.

c) The convenience outlet socket points shall be completed with 2/3 pin socket enclosed in a sheet steel box with the controlling switch as required and third pin shall be earthed.

21. **JUNCTION AND PULL BOXES:** Junction and Pull boxes of required sizes and ways shall be of sheet steel boxes.
22. **QUANTITIES:** Quantities indicated in the schedule are approximate and subject to wide variations.
23. **APPROVED MATERIALS:** List of approved makes and manufacture of Electrical materials is attached. Only such materials as are on this list shall be allowed to use. If contractor wishes to use any other materials not on the list he must obtain permission of the Engineer-in-Charge in writing. He must furnish samples/literatures of items to Engineering –in-charge in advance for approval. Materials to be used for particular item of work shall be of one brand throughout project and shall be ISI marked. Those materials for which ISI certificates are not issued, these shall have approval of Chief Engineer.

TECHINICAL SPECIFICATIONS

1. **INTRODUCTION:** The electrical installation shall be carried out in accordance with the specifications with the specifications given here under and shall be in conformity with Indian Electricity Act 1901 as amended. Indian Electricity Rules 1986 as amended up to date relevant Indian Standard Code of Practice for electrical installations in Buildings, supplementary regulations of State Electricity Departments and electricity, undertakings/ Boards concerned. Local Electric supply undertaking. Local Municipal Authority (Municipal Corpn.) and any other concerned Authority, where those specifications call for higher standards, these specifications shall be followed. The general safety precautions as specified, in the Is code No. 5216/1969 "Code for safety procedures and practice in Electrical Works" and CPWD General Specifications for Electrical Works-Part-I (Internal)-2013 or their latest version shall be followed.

2. **DEFINITIONS AND CONVENTIONAL SYMBOLS:** The definitions of terms shall be in accordance with Indian Standard Code of practice for electrical wiring installation IS732/1963. The signs and symbols specified in IS Code 732/1963 shall be followed unless indicated otherwise in the drawings.

3. **POINT WIRING:** Point wiring shall include all works necessary to complete the point from distribution board up to outlet excluding circuit wire unless mentioned otherwise in the schedule of quantities and shall include, conduit, outlet boxes, switch/push button, cover plate, wires, earth wire connectors etc.

4. **SUB MAIN WIRING:** Sub Main wiring shall mean length of wiring from one main/distribution switch gear to another main/distribution switch gear measured along the run of wiring. Such wiring shall be measured on linear basis and will include conduit pipe with accessories, junction/draw/pull boxes with covers, wires etc as detailed in the item. Measurements will be from end to end of conduit, exclusive of interconnections in the switch board etc.

5. **SYSTEM OF WIRING:** Wiring shall be carried out in such a system as specified in the tender, schedule or otherwise in specifications. Power and heating wiring shall be kept separate and distinct from lighting and fan wiring. All conductors shall run as far as possible along the wall and ceiling so as to be easily accessible and capable of being thoroughly inspected. In no case open wiring shall be run above false ceiling. Due consideration shall be given for neatness, good appearance and safety.

6. **CABLES:** All cables shall conform to relevant Indian Standards. Conductors of all cables shall be Copper/Aluminum as indicated in the schedule. Smallest conductor to be used shall have nominal cross sectional area of not less than 1.5 sq.mm for light points and 4 sq.mm for power points or as specified Standard conductor cables shall be used if so specified in the schedule of quantities.

7. **JOINTS AND LOOPING BACK:** Wiring shall be done in the looping system. Phase or live conductors shall be looped at the switch box and neutral conductor can be looped outlet to outlet.

8. **MARKING OF APPRATUS:** Switchgears shall be marked such as to indicate section of installation thus controls. All distribution boxes shall be marked lighting and power as the case may be and also marked with pressure and number of phase of supply. Each shall be provided with a circuit list giving details of circuit it controls.

9. **COMPLETION TESTS:** On completion of installation the following test shall be carried out.
    a. Insulation resistance test
    b. Polarity test of switch
    c. Earth continuity test

a. **INSULATION RESISTANCE TEST:** The insulation resistance shall be measured by applying between earth and the whole, system of conductors or any section thereof with all fuses in place and all switches closed, and except in earthed concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it need not exceed 500 volts for medium voltage circuits. Where the supply is derived from the three wires DC or a Polyphase AC system, the neutral pole of which is connected to earth either direct or through added resistance the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The

insulation resistance shall also be measured between all metallic (if used) conduits connected to one pole or phase conductor of the supply and all conductors connected to the Neutral or to the other pole or phase conductors of the supply with all lamps in position and switches in "OFF" position and its values shall be not less than that specified below. The insulation resistance is mega ohms measured as above shall not be less than 50 mega ohms divided by number of outlets. A preliminary and similar test may be made before lamps etc. are installed in this even the insulation resistance to earth should not be less than 100 mega ohms divided by the number of outlets or when PVC insulated cables are used for wiring 25mega ohms divided by the number outlets.

b. POLARITY TEST OF A SWITCH

i). In a two wire installation a test shall be made to verify that all switches in every circuit have been fitted in the same conductor throughout and such conductor shall be labeled or marked for connection to the non earthed conductor of the supply.

ii). In a three wire or four wire installation a test shall be made to verify that every non linked single pole switch is fitted in a conductor which is labeled or marked for connection to one of the phase conductor of the supply.

iii). The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a lamp, one lead of which connected to earth glowing of test lamp to its full brilliance, when the switch is in "ON" position irrespective of appliance in position or not shall indicate that the switch is connected to the right polarity.

c. **EARTH CONTINUITY TEST:** The earth continuity conductor including metal conduits and metallic envelops of cables in all cases shall be tested for electric continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm. The contractor shall notify in writing to the Engineer-in-Charge about the completion of the work. With in 30 days from the date of this notification, Engineer-in-Charge may send their representative to remain present at the time of carrying out of the tests by the contractor if so desired. Should the above tests not comply with the limits and requirements as above, the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. These tests shall be carried out by contractor without any extra charges.

10. **JUNCTION BOXES:** The junction box shall be made of metal on all sides, except on the front and shall be MS/GI/SS or a specified in the tender. In case of welded mild steel sheet boxes the wall thickness shall not be less than 1.6mm for boxes. Except where otherwise stated 3mm thick phenolic laminated sheets shall be fixed on the front with brass screws. Clear depth of the box shall not be less than 60mm and this shall be increased suitable as required. All fittings shall be fitted in flush pattern.

11. **TYPE AND SIZE OF CONDUIT:** The maximum number of PVC insulated Aluminum /Copper conductor cables of 650/1100 V grade confirming to IS: 694-1990 that can be drawn in one conduit of various sizes is tabulated below:

Nominal cross sectional area of conductor in Sq.mm	**20 mm**		**25 mm**		**32 mm**	
	S	**B**	**S**	**B**	**S**	**B**
1.5	**5**	**4**	**10**	**8**	**18**	**20**
2.5	**5**	**3**	**8**	**6**	**12**	**10**
4.0	**3**	**2**	**6**	**5**	**10**	**8**
6.0	**2**	**-**	**5**	**4**	**8**	**7**
10.0	**2**	**-**	**4**	**3**	**6**	**5**

12. **ERECTION OF CONDUIT:** The erection of conduit of each circuit or section shall be completed before conductors are drawn in.

13. **LAYING CONDUITS IN SLAB/FALSE CEILING:** Conduit shall be laid in the slab before casting and shall be adequately secured to the reinforcement to avoid displacement conduits when laid above false ceilings shall be properly fixed/secured with saddles. Wherever conduits are laid in the floor, these shall be properly embedded and covered with 1:8 cement and mortar.
14. **MAKING OF CHASE:** The chase in the wall shall be neatly made and of ample dimensions and be 50mm deep to permit the conduit to be fixed in the manner desired. In the case of bldg. under construction, conduits shall be buried in the wall before plastering and shall be finished neatly after erection of conduit. In

case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with building work.

15. **FIXING OF CONDUIT IN CHASE:** The conduit pipe shall be fixed by means of staples or by means of saddles not more than 60cm apart or by any other approved means of fixing. Fixing of standard bends shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors. At either side of bend, saddles/staples shall be fixed at a distance of 15cm on either side from the centre of the bend.
16. **INSPECTION /DRAW/ PULL BOXES:** Suitable PVC inspection/junction boxes to be barest minimum requirements shall be provided to permit periodical inspection and to facilitate replacement of wires, if necessary. These shall be mounted flush with the wall/ceiling and covered with 3mm thick egg. White hylam cover plates, Suitable ventilating holes shall be provided in the inspection box covers if so directed.
17. **LAYING OF CONDUITS IN FLOOR/FILLING:** Conduits laid in floor/filling shall be covered with 1:3 cement mortar to prevent damage/displacement.
18. **TYPES OF ACCESSORIES TO BE USED:** All outlets such as switches, wall sockets etc. will be flush mounting type as specified in the specifications.
19. **CONDUIT JOINTS:**
    a) All joints shall be sealed/ cemented with approved cement. Damaged conduit pipes/fittings shall not be used in the work. Cut ends of conduit pipes shall have neither sharp edges nor any burrs left to avoid damage to the insulation of conductors while pulling them through such pipes.
    b) The Engineer-in-charge, with a view to ensuring that the above provision has been carried out, may require that the separate lengths of conduit etc. after they have been prepared shall be submitted for inspection before being fixed.

20. SWITCH BOARDS (SHEET STEEL CUBICLE PATTERN):

i**) CONSTRUCTION:** Switch boards shall be sheet cubicle, indoor, floor wall mounting, free standing type. The design shall be totally enclosed, completely dust tight and vermin proof. The sheet steel used shall be 2mm thick gauge. Gaskets shall be used between adjacent units and beneath all covers to render the joints effectively dust proof.

A base channel of 50mm x 25mm fabricated out of 3mm thick rolled sheet steel, painted black shall be provided to prevent corrosion of the sheet steel cubicle and to facilitate cleaning of floors.

The switch boards be easily extensible, the arrangements shall be logical, compact and neat.

The switch board shall have uniform height through its length. Barriers shall be provided between the modules to accommodate equipment associated with outgoing circuits. All modules shall have a covering at the bottom so that entry of rats and vermin is not possible.

ii) FEEDER ARRANGEMENTS: The switch boards shall be of single front construction and equipment shall be mounted on the front only. Switch boards shall be of dead front type. All switches, push buttons etc shall be operated from the front. The rating of switches fuses, contactors etc. shall be as specified. Out going feeders shall be neatly arranged in different compartments. Normally equipment for individual feeders shall be accommodated in separate modules.

The framework shall house the switches, switch fuse units, starters and contactors. MCBs and MCCBs etc in multi tier formation. The equipment shall be mounted independent of the back plate and not on the rear surface of the housing. Each module shall be held securely against sponge rubber gaskets to make the equipment dust tight.

The compartment doors shall be so inter locked that it shall not be possible to open the door when the switch is in closed position.

iii) BUS BAR: Three phase (and neutral) copper/aluminum bus bars shall be of the incoming switch current rating and shall be housed in separate bus bar chambers. Bus bars shall be supported on unbreakable non hygroscopic hylam supports rigidly held to the frame work of the chamber. Bus bar chamber shall have colour coding to identify the various phase of the bus bars.

iv) CABLE COMPARTMENT: A cable compartment running along with vertical module shall be provided for easy termination of all incoming and outgoing cable entering either from top or bottom.

Adequate supports shall be provided for the cables where necessary. The cable compartment shall have its own screwed removable cover for easy access during cabling.

v) CONTROL WIRING: All control wiring shall be carried out through the common vertical compartment. In case wires are required to cross the bus bar chamber such crossing shall be carried out in neat bunches. Control wiring shall be done by PVC insulated wires of minimum size 1.5 sq.mm copper conductors. All control wiring

shall be fitted with identification ferrules at each end. Not more than two connections shall be made at any terminal. The wires shall be arranged and supported in such a manner that there shall be no strain on terminations. The terminations shall be of adequate current rating and size to suit individual feeder arrangements. Power terminal shall be pressure clamp type suitable for copper/aluminum wires. For connections above 63A/35 Sq.mm cable lugs shall be used. These cable lugs shall be mounted in such a manner as to facilitate cable connections.

vi) CABLE ENTRY: Cubicles shall be designed to facilitate aluminum conductor PVC cable entry from top / or bottom as the case may be. Removable sheet plates shall be fitted at the top and bottom to drill holes for cable entry at site.

vii) PAINTING: All steel works shall be painted in approved shade as required.

21. ERECTION OF ELECTRICAL PANEL & BOARDS:

a) **STORING:** The panels shall be stored in well ventilated, dry places, suitable polythene covers shall be provided for necessary protection against moisture.

b) **ERECTION:** Switch boards shall be installed on suitable foundation. Foundation shall be as per the dimensions supplied by the panel manufacturers. The foundation shall be flat and level. Suitable grouting holes shall be provided in the foundation. Suitable MS base channel shall be embedded in foundation on which the panel can be directly installed. The switch boards shall be properly sighed and bolted to the foundation.

c) **PRE COMMISSION TESTS:** Panels shall be commissioned only after the successful completion of the followings test. The tests shall be carried out in the presence of Engineer-in-Charge.

i) All main and auxiliary bus bar connections shall be checked and tightened.
ii) All wiring terminations and bus bar joints shall be checked and tightened.
iii) Wiring shall be checked to ensure that it alt according to the drawing.
iv) All wiring shall be tested for insulation resistance by a 1000volt megger.

22. EARTHING: Earthing shall conform to the following specifications for other detail not covered in these specifications IS: 3043-1966 shall be refereed to (Code of Practice for earthing).

a) PLATE EARTH ELECTRODE: For plate electrodes minimum dimensions of the electrodes shall be 600 mm x 600 mm x 3mm thick. The electrode shall be buried in ground with its faces verticals and top not less than 3m below ground level.

b) **METHOD OF INSTALLING WATERING ARRANGEMENTS:** In case of plate electrode, a watering pipe of 20mm dia of medium class GI pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided on the top this pipe for watering the earth. The watering funnel attachment shall be housed in masonry enclosure of not less than 30cm x 30cm x 30cm.

c) **LOCATION OF EARTH ELECTRODE:** Normally on earth electrode shall be situated not less than 1.5m from any building. Care shall be taken that the excavations for earth electrode may not affect the column footings or foundations of the building in such cases electrodes may be further away from the building. The location of the earth electrode will be such where the soil has reasonable chance of remaining most, as far as possible entrances, pavements and roadways are definitely avoided for locating the earth electrode.

d) **METHOD OF CONNECTING EARTHING LEAD TO EARTH ELECTRODE:** 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. All materials used for connecting the earth lead with electrode shall be tinned brass in cases of copper plated electrode. The earthing lead shall be securely connected at the other end of the main board. Loop earthing shall be provided for all mounting of main board and other metal switches and distribution fuse boards with not less than 14 SWG copper wire. The earthing lead from electrode shall be suitable protected from mechanical injury by 15mm dia GI pipe in case of wire and 40mm dia medium GI pipe in case of strip, portions of this protection pipe within ground shall be buried at least 30cm deep (to be increased to 60 cm in case of road crossing and pavement). The portion within the building shall be recessed in walls and floors to adequate depth. In all cases the relevant provisions of Rule 33, 61 and 67 of Indian Electricity Rules 1956 as amended shall be complied with. Metallic covers or supports of all medium pressure or HT apparatus or conductors shall in all cases be connected to earth by not less than two separate and distinct earth electrodes. No earth electrode shall have greater resistance than one ohm as measurers by an approved earth testing apparatus.

23. **CABLE WORK, STORAGE AND HANDLING:** Cable drums shall be stored on a well drained, hard surface preferably of concrete, so that the drums do not sink in the ground causing rot and damage to the cable drums. During storage periodical rolling drums once in 3 months through 90 degree shall be done especially in the case of paper insulated cables Rolling shall be done in the directions of the arrow market on the drum. It should be ensured that both ends of the cable are

properly sealed to prevent ingress/absorption of moisture by the insulation. Protection from rain and sun is preferable. Sufficient ventilation between cables drums should ensured during storage. The drums shall always be rested on flanges and not on flat sides. While removing cables the drums shall be properly mounted on jacks or on a cable wheel or any other suitable means making sure the spindle, back etc. is strong enough to take the weight of drum. The cables shall not be bent to a sharp/to a small radius. The minimum safe bending radius for all types of PVC cables shall be taken as 12 times the overall diameter of the cable. Wherever practicable, larger radius should be adopted. At joints and terminations, the bending radius of individual cores of multi core cable shall not be less than 15 times the diameter. Cable with links and straight ended links or with similar apparent defects like defective armoring etc. shall not be installed.

24. **INSTALATION:** The cable installation including, necessary joints shall be carried out in accordance with the specifications given herein. For details not covered in the specifications, IS: 1255-1967 shall be followed.
Before the cable laying is undertaken, the route of the cable shall be decided by the Engineer-in-Charge. While shortest practicable route should be preferred, cable runs shall generally follow fixed developments such as roads, foot paths, etc with proper offsets so that future maintenance, identification etc. are rendered easy. Cables of different voltages and also power and control cables should be kept in different trenches with adequate separation, where available space is restricted. LV/MV cables shall be laid above HV cables. Where cables one another, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.

LAYING DIRECT IN GROUND: Width of trench shall first be determined on the following basis:

i) The minimum width of trench for laying single cable shall be 35 cm.
ii). Where more than one cable is to be laid in the same trench in horizontal formation the width shall be increased such that the inter axial spacing between the cables except where other specified shall be at least 20cm.
iii). There shall be a clearance of at least 15cm between axis or the cables and sides of trench.

DEPTH OF TRENCH: The depth of trench shall be determined on the following basis:

i). Where cables are laid in single tier formation the total depth of trench shall not be less than 75cm for cables up to 1.1 KV and 1.2m for cables above 1.1KV.

ii). When more than one tier of cables is unavoidable and vertical formation of laying is adopted depth of trench in b(i) above shall be increased by 30cm for each additional tier to be formed.

EXCAVATION OF TRENCHES: The trenches be excavated in reasonable straight lines, wherever there is a change in direction suitable curvature shall be provided which shall be gradual. Excavation should be done by any suitable means manual or mechanical. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.
Existing properly exposed during trenching shall be temporarily supported or propped adequately as directed by the Engineer-in-Charge. The trenching in each cases shall be done in short length necessary pipes laid for passing cables therein and the trench refilled.
If there is any danger of trench collapsing or endangering adjacent structure, the sides shall be well shore dup with timbering and/or sheeting as excavation proceeds. Where necessary, these may even be left in places when back filling the trench. The bottom of the trench shall be in level and free from stone, brickbats etc. The trench shall then be provided with a layer of lean, dry sand cushion of not less than 8cm in depth.

LAYING OF CABLE IN TRENCH: The cable drum shall be properly mounted on jacks or on a cable heel at a suitable location, making sure that the spindle is horizontal in the bearing so as to prevent the drum creeping to one side while rotating.

The cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains. The entire cable length shall as far as possible be paved off in one stretch. However, where this is not possible the remainder of the cable may be removed by 'Flanking' i.e. by making one long loop in the reverse direction.

For short runs and sizes up to 50 sq.mm of cables up to 1.1 KV grade, any other suitable method of direct handling and laying can be adopted with the prior approval of the 'Engineer-in-Charge. When the cable has been properly straightened, the cores are tested for continuity resistance and the cable is less then measured. The ends of all lead sheathed cables shall be sealed with solder immediately. In case of PVC cables, suitable moisture seal tape shall be used for this purpose.

Cable laid in trenches in a singly tier formation shall have a covering of clean and dry sand of not less than 17 cm above the base cushion of sand before protective cover is laid.

In case of vertical multi-tier formation after the first cable has been laid a sand cushion of 30 cm shall be provided over the initial bed before the second tier is laid. If additional tiers are formed each of the subsequent tiers also shall have a sand cushion of 30 cm as stated above. The top most cable shall have final sand covering not less than 17 cm before the protective cover is laid. At the time of original installation, approximately 3m of surplus on each side of underground joints (Straight through/Tee/Termination and at entire and places as may be decided by the Engineer-in-Charge. The surplus cable shall be left in the form of loop. Where there are long runs of cable length, loose cable may be left at suitable intervals as specified by the Engineer-in-Charge. Unless otherwise specified, the cables shall be protected by second class bricks of not less than 20cm x 10cm x 10cm(nominal size4) as per CPWD Building specification for protection covers placed on top of the sand (bricks to be laid widthwise for the full length of the cable to satisfaction of the Engineer-in-Charge. Where more than one cable is to be laid in the same trench this protective covering shall cover all the cables and project at least 5cm over the side of the end cables.

BACK FILLING: The trenches then shall be backfilled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered if necessary, in successive layers not exceeding 30cm unless other wise specified. Crown earth not less than 50mm in the centre and tapering towards the side of the trench shall be left to allow for subsidence. The crown of earth however should not exceed 10 cm so as not to be hazard to vehicular traffic.

The temporary reinstatement of roadways should be inspected at regular intervals, particularly during the wet weather and any settlement should be made good by further fillings as may be required. After the subsidence has ceased, trenches cut through road ways or other paved areas shall be restored to the same density and materials the surrounding area and repaved in accordance with the relevant CPWD building specifications to the satisfaction of the Engineer-in-Chief.

Where road beams or lawns have been cut out or kerb stone displaced, the same shall be repaired and made good to the satisfaction of Engineer-in-Charge and all surplus earth rack removed to places as specified.

ROUTE MARKERS AND INDENTIFICATION TAGS: Route markets shall be provided along straight runs of the cables at locations approved by the Engineer-in-Charge and generally at interval not exceeding 100 m. Markets shall also be provided to identify the change in the direction of the cable route and also for locations of every underground joint. Wherever more than one cable is laid/run side by side marker tags as approved inscribes with cable identification details shall be permanently attached to all the cables in the manhole put pits/entry points in buildings/open ducts/Trays etc these shall also be attached to various cables laid direct in ground at suitable intervals as decided by Engineer-in-Charge before the trenches are filled-up.

LAYING IN PIPES/CLOSED DUCTS: In location such as road crossing entry to buildings, on poles, in paved areas etc. cables shall be laid in pipes or closed ducts. Stoneware pipes, GI, CI or spun reinforced concrete pipes shall be used for such purposes.

Pipes shall be continuous and clear of debris or concrete before cable is drawn. Sharp edges at ends shall be smoothened to prevent an injury to cable insulation or sheathing.

Pipes for cable entries to the building shall slope downwards from the building and suitable sealed to prevent entry of the water in the building. Further the mouth of the pipes at the building end shall be suitable sealed to avoid entry of water. Cable grips/draw wires and winches etc. may be employed for drawings cables through pipes/closed ducts etc.

LAYING OF SURFACE: The cables may be laid in through trays or bracket at regular intervals or directly cleated to walls/ceiling when laid over bracket supports the cables shall be clamped to prevent undue sag Cable clamps shall be made from material such as mild steel, porcelain, wood, aluminum etc. In case of single core cable the clamps shall be non magnetic material. A suitable non-corrosive packing shall be used for clamping unarmored cables to prevent damage to the cable sheath.

JOINTING TERMINATION: Jointing work shall be carried out only by a licensed/experienced cable jointer. Sufficient surplus ventilation shall be provided during jointing operation in order to disperse fumes given out by fluxing. Jointing materials and accessories like conductor ferrules solder flux and protective tapes filling compound, jointing boxes etc. of right quality and correct sizes, conforming to relevant Indian Standards, wherever they exist shall be used. The design of the joint box and the composition of the filling compound shall be

such as to provide an effective scaling against entry of moisture in addition to affording proper electrical characteristic to joints.

Where special type of splicing connector kits or epoxy resin spliced joints is specified, materials approved for such application shall be used and instructions of the manufacturer/supplier of such materials shall be strictly followed.

Insulation resistance of cables to be jointed shall be measure with 500 V megger up to 1.1 KV grade and with 2500-5000 V megger for cables of higher voltage. Unless the insulation resistance values are satisfactory, jointing shall not be done. Whenever aluminum conductor is exposed to outside atmosphere a highly tenacious oxide film is formed which makes soldering of aluminum conductor difficult. The oxide film should be removed using appropriate tape of flux.

CABLE TRAYS: Cable trays shall be made of CRC sheet 1.8mm thick and of the sizes as specified in the schedule of quantities and marked on the drawings. Final routes shall be marked and ascertained at site in consultation with the Engineer-in-Charge. Installation of cable trays shall include all hard wares including suspension rods of 10mm MS rods. Each run of cable tray shall be rigid and be completed before cables are laid. Installation of cables trays shall be also include fixing by means of dash fasteners or by exposing of MS rods in the ceiling to support the tray in a rigid and perfect manner. Cutting of RCC/brick work, welding of suspension rods, repairing including supply of suspension rods etc. shall be deemed to have been included in the erection rates.

CERTIFIED:

1. **That the rates are quoted after actually visiting site of work and acquainting with worked condition and.**
2. **That we have carefully studied the conditions of contract and specifications for material and workmanship and will adhere to the same.**

SIGNATURE OF CONTRACTOR