TENDER DOCUMENT
FOR
CONSTRUCTION OF MULTI STOREYED OFFICE BUILDING
AT

VIBHUTI KHAND, GOMTI NAGAR,
LUCKNOW, U.P
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1. INSTRUCTION TO BIDDERS
PART-A

PROJECT DESCRIPTION/ SITE INFORMATION

Hindustan Petroleum Corporation Limited (hereinafter referred to as "HPCL"), proposes to construct new office building with maximum possible GRIHA rating (min 3 star) for its North Central Retail Zone at Lucknow (Uttar Pradesh).

The site addresses is as below:

Hindustan Petroleum Corporation Limited
13TC V/V Vibhuti Khand
Gomti Nagar,
Lucknow-226010, Uttar Pradesh

1 SCOPE OF WORK

The brief scope of work comprises of, but not limited to, the following

A. Construction of a RCC building with (Basement + Stilt+7) storied and other associated works with the Building like External Development, Boundary Wall, Transformer/DG Foundation, Service Rooms, other ancillary civil works, etc.

B. External cladding /finishing works

C. Public health engineering works which includes piping and allied works for drainage, sewerage, wash rooms/toilets, pumping system etc. for the entire facility.

D. Fire Safety Provisions including fire water sprinklers, pumps, etc.

E. Compliance to Green Building norms as per assigned GRIHA criteria.

F. Passenger Lifts, Car lifts and stacked car parking.

G. Miscellaneous works including site office and other common items as per Schedule of Quantities.

Bidders are requested to submit their most competitive offer for carrying out the work set out, in the prescribed format and time frame specified elsewhere in the tender.
Bidder should submit a detailed work plan incorporating work schedule for different jobs in manner so that work can be completed as per time schedule mentioned.

All the safety precautions should be taken while executing jobs at site such as excavation, work at height etc., All necessary Personal Protective Equipment such as helmets, shoes shall be arrange by the Contractors for their laborers as per the directions of Engineer and the quoted rates shall include cost towards all the above.

SITE CONDITION:

Before quoting for the said job the contractor is required to visit the site and make himself acquainted with the scope of the job and quote accordingly.

The tenderers are required to go through the tender document thoroughly and carefully and offer their most competitive rates for the job.

In case of any clarifications contractor may contact Shri. Ganesh Gaikwad, Chief Manager-E&P, Engg & Projects Deptt, Gresham Assurance House, 2ND Floor, A-1595 (3), 1-A, Sir P M Road, 132, Shahid Bhagat Singh Road, Fort, Mumbai- 400 001 on 022-22608533 regarding any queries.

Scope also includes shifting of any scrap materials/excess earth lying at the constructional area to the designated place inside premises at no extra cost. Job also includes site clearing from any debris, vegetation, bushes and trees, etc and make the site free for construction with in the parameters prescribed by the green norms of GRIHA & local statutory bodies

2.0 SITE VISIT

2.1 The bidder is advised to visit and examine the site of works at all locations and their surrounding and obtain for himself on his own responsibility all information that may be necessary for preparing of the bid and entering into the contract. The cost of visiting the sites shall be at bidder’s own expenses. No extra claim on account of non-familiarity of site conditions shall be entertained during execution of works.

2.2 The bidder and any of his personnel or agents will be granted permission by the Owner to enter upon his premises and lands for the purpose of such inspection, but only upon the explicit condition that the bidder, his personnel or agents will release and indemnify the Owner and his personnel and agents from and against all liability in respect thereof and will be responsible for personnel injury (whether fatal or otherwise), loss of or damage and expenses incurred as a result hereof.

The bidder is advised to visit and examine the site of works and their surrounding and obtain for himself and on his own responsibility all information that may be necessary for preparing of the bid and entering into the contract. The cost of visiting the sites shall be at bidder’s own expenses.
No extra claim on account of non-familiarity of site conditions shall be entertained during execution of works.

The prospective bidders are requested to thoroughly read and comprehend the various sections of this tender document and visit the sites before quoting for the tender and offer their most competitive rates for the job. **It may be noted storage constraints for building materials are envisaged during the construction of basement & other civil works as site area is very small. It is recommended that the vendor shall identify alternate storage space near to the site so that all works at site can be done smoothly without large shifting & re-shifting of construction materials. The vendors may note the above constraints while quoting for the job as HPCL will not entertain any claim including on delivery period during the construction on account of the above.**

**3.0 SPLIT-UP OF WORK**

Total work shall be awarded to single agency and the scope of work shall not be split.

**4.0 SUBMISSION AND OPENING OF BID**

4.1 This is only a Price Enquiry (Invitation to Offer) and not an Order.

4.2 The bidder shall take utmost care of the following:

4.3 The Bid shall be submitted in two parts namely, UNPRICED and PRICED Part, respectively.

4.8 Technical and Un-priced Part of the Offer will be opened by HPCL as per the due date and time mentioned in the tender notice online. The Priced part of the Offer will be subsequently opened on line of techno- commercially qualified bidders after appropriate intimation.

4.9 For details, bidders are advised to study the E-Tender terms and conditions attached separately along with tender.

4.10 The bidding document shall be read in conjunction with any amendment issued subsequently.

**5.0 VALIDITY OF EMD**

5.1 Earnest Money Deposit shall be in the form of Original Bank Guarantee for the amount given in the tender notice and issued by any Scheduled bank (Other than Co-Operative Bank). Performa of BG for EMD is given in this tender document. No adjustment shall be made with EMD submitted earlier with other tenders of HPCL or any outstanding amount with HPCL. Earnest Money Deposit furnished by the Bidder shall be valid for a period of 06 (SIX) MONTHS from the date of submission of the bid.
5.2 EMD of the unsuccessful bidders shall be returned as promptly as possible upon award of contract.

5.3 EMD of successful bidder will be returned upon the bidder’s accepting the contract, and furnishing the requisite Security Deposit.

5.4 EMD may be forfeited for:

i. If a bidder withdraws its bid during the validity period of the bid.

ii. If a bidder does not accept the relevant clause no 14.0 of Instruction to bidders

iii. If the successful bidder fails within the specified period to furnish the requisite Security Deposit.

5.5 Any bid not in accordance with above clauses will be rejected as non-responsive.

6.0 VALIDITY OF OFFER

6.1 Bid submitted by Bidder shall remain valid for a minimum period of 04 (Four) MONTHS from the due date/extended due date for submission of Bids. Bidders shall not be entitled during the said period of six months, without the consent in writing of the Owner, to revoke or cancel their Bid or to vary the Bid given or any term thereof. In case of Bidders revoking or cancelling their Bid or varying any of the terms in regard thereof without the consent of Owner in writing, Owner shall reject such Offers and forfeit Earnest Money paid by them along with their offers.

6.2 Bidders are advised to refrain from contacting by any means HPCL and/or their employees / representatives on their own, on matters related to Bids under consideration. HPCL, if necessary, will obtain clarification on the Bid by requesting for such information/clarifications from any or all Bidders, either in writing or through personnel contact. Bidders will not be permitted to change the substance of Bids after opening of Bids.

6.3 Notwithstanding sub-clauses 6.1 and 6.2 above, HPCL may solicit the bidder’s consent to an extension of the period of validity of offer. The request and the response shall be made in writing. If the bidders agree to the extension request, the validity of Bank Guarantee towards Earnest money shall also be suitably extended. Bidders may refuse the request without forfeiting his EMD. However, bidders agreeing to the request for extension of validity of offer will neither be permitted to revise the price nor to modify the offer.

7.0 BID CLARIFICATIONS/AMENDMENTS BY HPCL
7.1 HPCL may issue clarifications/amendments in the form of addendum/corrigendum during the bidding period and may also issue amendments subsequent to receiving the bids. For the addendum/corrigendum issued during the bidding period, bidders shall confirm the inclusion of addendum/corrigendum in their bid. Bidder shall follow the instructions issued along with addendum/corrigendum.

7.2 Bidders shall examine the Bidding Document thoroughly and submit to HPCL any apparent conflict, discrepancy or error. HPCL shall issue appropriate clarifications or amendments, if required. Any failure by Bidder to comply with the aforesaid shall not excuse the Bidder from performing the Services in accordance with the contract if subsequently awarded.

8.0 CONFIDENTIALITY OF DOCUMENTS

Bidder shall treat the Bidding Document and contents therein as private and confidential and shall not use the Bidding Document for any other purposes.

9.0 APPLICABLE LANGUAGE

The bid prepared by the bidder, all correspondences and documents related to this bid shall be written in English language only. For document submitted in any other language, an English translation shall also be submitted, in which case, for the purpose of interpretation of the bid, the English translation shall govern.

10.0 CAUTION AND DISCLAIMER

Transfer of Bid document by the bidder is not permitted.

Bidder shall make his own interpretation of any and all information provided in the Bidding Document. HPCL shall not be responsible for the accuracy or completeness of such information and/or interpretation. Although certain information’s are provided in the Bidding Document, however, bidder shall be responsible for obtaining and verifying all necessary data and information as required by him. HPCL reserves the right to accept or reject any/all tender in whole or in part without assigning any reason whatsoever. HPCL shall not be bound to accept the lowest tender and reserves the right to accept any or more tenders in part. Decision of HPCL in this regard shall be final.

11.0 EVALUATION OF TECHNO COMMERCIAL BIDS

Prior to detailed evaluation of bids the owner shall determine whether each bid is
(i) Accompanied by EMD as specified in the Tender notice

(a) Bids without EMD as specified in the Tender Notice or with EMD not as per prescribed proforma as per Bidding Document shall be rejected.

(b) Public Sector Enterprise/Undertaking (Self Declaration required along with Unpriced Bid) and SSIs registered with NSIC (Copy of valid registration Certificate should be submitted along with the Unpriced Bid) are exempted from submitting EMD.

(c) Prospective bidders who are SSI registered with NSIC shall provide a declaration in writing along with their unpriced bid whether they have succeeded in securing orders for same items, in competition (i.e. without price preference) with large scale units during the preceding 12 months.

(ii) Totally complying with the requirement of the tender document.

12.0 RECEIPT OF BID

Bids received late online i.e. after due date and time, due to any reason (s) whatsoever shall be rejected.

13.0 DEVIATIONS TO TENDER REQUIREMENTS

13.1 The bidders are required to submit offers strictly as per the terms and conditions/specifications given in the Bidding Document and not to stipulate any deviations. The offer of bidders stipulating deviations to any of the following terms/conditions of the Bidding Document shall not be considered for price bid opening.

i. Security Deposit [Clause No. 4 (b) of GCC]
ii. Defect Liability period (Clause No. 5.n of GCC)
iii. Suspension & Termination (Clause No.5e & 12 of GCC)
iv. Increase in Time Schedule of Completion
v. Liquidated Damages (Clause No. 10 of GCC)
vi. Force Majeure (Clause No. 13 of GCC)
vii. Scope of work
viii. Validity of offer
ix. Retention Money (Clause No. 7.c of GCC)
x. Deviation in payment terms
xi. Firm Price (Clause 3.3 & 3.4 of SCC)

13.2 In case Bidders wish to stipulate any deviation to Bidding Document requirements other than those stated above, they shall indicate the same as per the proforma enclosed in the Bidding Document. Bidder shall note that
clarification/queries/deviations mentioned elsewhere in the offer shall not be given any cognizance. However HPCL reserves their right to reject bids containing deviations to any of the Bidding Document stipulations.

13.3 UNSOLICITED POST BID MODIFICATION

Bidders are advised to quote strictly as per terms and conditions of the Bidding Document and after submission of offer not to stipulate any deviation / exceptions. Once quoted the bidders shall not make any subsequent price changes, whether resulting or arising out of any technical / commercial clarifications sought/allowed on any deviations or exceptions mentioned in the bid unless discussed and agreed by HPCL in writing.

Note: The bidders are advised to quote the correct tax rates/structure during bidding as HPCL will not allow any revision in rates on account of taxes during the technical evaluation on account of any clarification/deviations provided in the deviation sheet in the tender. Clarification if any shall be obtained during pre-bid meeting /through an on line query before submitting the final bid so that such clarifications if provided by HPCL is available to all vendors for their consideration. Revision on tax rates, if any for the successful bidder will be dealt as per the relevant clauses in GCC/GTC.

13.4 COMPLETE SCOPE OF WORK

The complete scope of work has been defined in the bidding document. Only those bidders who take complete responsibility for the complete scope of work as contained in the bidding document shall be considered for qualifying.

14.0 EVALUATION OF PRICE BIDS

14.1 The “PRICE BIDS” of only substantially responsive bidders shall be considered for opening.

14.2 Bidders shall quote the prices in Indian Rupees only.

14.3 The quoted prices shall be checked by the bidder to determine the arithmetical correctness of the same before submitting his price bid.

14.4 HPCL reserves their right to extend price /purchase preference to NSIC/Public Sector Enterprises as admissible under the prevailing policies of Government of India.

14.5 HPCL reserves their right to negotiate the quoted prices with L1 bidder before award of work.
14.6 HPCL reserves the right to delete any of the items in the Schedule of Quantities (SOQ) at the time of placement of Fax of Intent/Purchase Order. The decision of HPCL shall be final and binding.

14.7 The bidder shall quote for all the items of the Price Bid. In case any bidder fails to quote for more than 10 items then the bid shall be treated as nonresponsive and shall be rejected. For bids to be responsive, it may be noted that any item(s) left unquoted, then such offer will be loaded with the highest quoted rate for those item(s) for evaluation purpose. If such bidder happens to be the successful Bidder,

14.8 The bidder shall read the above clauses along with other relevant clauses provided in the E tender terms and conditions.

15.0 REBATE

No suo-moto reduction in prices quoted by bidder shall be permitted after opening of the bid. If any bidder unilaterally reduces the prices quoted by him in his bid after opening of bids, the bid(s) of such bidder(s) will be liable to be rejected. Such reduction shall not be considered for comparison of prices but shall be binding on the bidder in case he happens to be a successful bidder for award of work.

16.0 CONTRACT AGREEMENT

16.1 Purchase Order (PO) shall be prepared after award of works. Successful bidder shall be intimated regarding award of works through Fax/Letter of Intent. Until the final PO documents are prepared and executed, this Bidding Document together with the annexed documents, modification, deletions agreed upon by the HPCL and Bidder’s acceptance thereof shall constitute a binding contract between the successful bidder and the HPCL based on terms contained in the aforesaid documents and the finally submitted and accepted prices. In case the successful bidder wishes to sign a contract document then he or she may clearly specify in the cover letter of his unpriced bid that he or she intends to enter into contract with HPCL. No clause/ terms in contract document shall be in contradiction to PO/tender terms or accepted deviations. Such contract will be executed after issuance of PO and all cost towards execution of the contract shall be to the bidders account. All documents of the PO shall also become a part of the contract and the date of LOI/PO (whichever is earlier) shall be considered as the date of commencement of job.

16.2 The Contract document/PO shall consist of the following:

a) Original Bidding Document along with its enclosures issued.

b) Addendum/Corrigendum to Bidding Document issued, if any.
c) Fax/Letter of Intent.

d) The detailed Letter of Award/Acceptance along with Statement of Agreed Variations (if any) and enclosures attached therewith.

17.0 The rates quoted in the tender shall include all charges for clearing of site before commencement and after completion, necessary scaffolding, equipment, storage sheds, security & safety as well as working on all day including Sundays and Holidays, protection of the public and safety of adjacent roads, walls, houses, buildings and all other erections, matters or things etc. The Contractor shall take down and remove any or all such scaffolding, etc., as occasion shall require or when ordered so to do, fully reinstate and make good all matters and things disturbed during the execution of work and to the satisfaction of Employer/Architect. The rates quoted shall be deemed to be for the finished work. The rates shall also be firm and shall not be subject to Octroi, local taxes, railway freights or any other conditions whatsoever. Tenderers must include in their rates, VAT, sales tax, excise duty, octroi, on works contracts and any other tax and duty or other levy levied by the Central Government or any State Government or local authority, if applicable and prevalent during the entire contract period. No claim in respect of sales tax, excise duty, octroi or other taxes, duties or levies whether existing or levied in future shall be entertained by the Employer unless it is mentioned separately elsewhere in the tender document.

The Contractor shall provide a site office for use of HPCL as per the specification provided in the BOQ along with one Personal Computer, one A3& A4 size laser printer, internet connection & required storage space in the site office, office furniture including tables and chairs as indicated by the client.

18.0 The Contractor shall not be entitled to any compensation for any loss suffered by him on account of delays, in commencing or executing the work, whatever the cause of delays may be, including delays arising out of modifications to the work entrusted to him or in any sub-contract connected therewith or delays in awarding contracts for other trades of the project or in commencement of completion of such works or in procuring Government controlled or other building materials or in obtaining water and power connections for execution of work or for any claim in respect thereof. The Employer does not accept liability for any sum besides the tender amount, subject to such variations as are provided for herein.

19.0 The Tenderers shall before tendering carefully examine the Tender Documents including these Information and Instructions to Tenderers, General Conditions of Contract, Special Conditions of Contract, Specifications, drawings and other matters referred to therein, the Bill of Quantities, and if there should be or appear to be any ambiguity in / or discrepancy between any of these documents or between figured and measured
dimensions and other aspects upon the Drawings, he shall immediately refer the matter to the Architect/HPCL for clarification, before the pre-bid meeting.

Time is the essence of the contract and the works must be completed within the time schedule as indicated in the tender document. Any tender who disagrees with the time schedule of completion and stipulates a longer period is liable to be rejected.

20.0 Each page of the tender documents should be signed/digitally signed by the person or persons submitting the tender in token of his/their having acquainted himself/themselves with the General Conditions of Contract, Specifications, Special Conditions, etc., as laid down. Any tender with any of the documents not signed will be rejected.

The tender submitted on behalf of a firm shall be signed by all the partners of the firm or by a person who has the necessary authority on behalf of the firm to enter into the proposed contract. Otherwise, the tender may be rejected by the Employer.

Tender shall contain full address, Telephone Nos., Fax No., E mail Ids for serving notices / addendum’s required to be served to the Tender in connection with the Tender.

The Tender Form and the documents attached to it shall not be detached one from the other, and no alteration or mutilation (other than filling in all the blank spaces) shall be made in any of the documents attached hereto. Any alterations or erasures to the entries in the tender documents shall be made by a separate letter; otherwise it will not be entertained. The tender form must be filled in English and all entries must be made by hand and written in ink.

All documents of the tender are to be read in conjunction with each other and rates quoted by the tenderer shall take this aspect into consideration.

21 The Tender shall accompany the following information and documents:

a) A detailed program for all Works in the form of a CPM chart showing the Tenderer’s proposed sequence of operations together with the estimated time for each activity, including preparation of shop drawings, supply and installation to ensure adherence to the overall completion period as indicated in the documents in line with the compulsory milestones provided in the tender.

b) Full details of any special methodology or technique, the Tenderer proposes to use.

c) The Tenderer’s proposals for supervising the work and supervisory personnel / other staff proposed to be deployed during the execution period.
d) Schedules of labour requirements showing category-wise break-up of the labour force, for each month of execution period.

e) True copy of latest Income Tax and Sales Tax Clearance Certificates and license under Labour Regulations issued by the competent authorities in favor of the Tenderer.

f) The tenderer shall attach to his tender a copy, duly authenticated by a notary, of the documents containing the constitution of the consortium, company or firm by which the Tender is submitted so as to indicate by what persons and in what manner a contract may be entered by the consortium, company or firm and what persons would be directly responsible for the due performance of the contract and can give valid receipt on behalf of the consortium, company or firm.

g) List of all the works in hand at the time of tendering along with tendered cost, agreed completion date and percentage progress achieved for each of the said works.

h) List of proposed sub contractors / associates, if any, along with their credentials in respect to the trades of works.

i) Information regarding any changes from the previous submission made by the Tenderer for prequalification in respect of following aspects.
   - Details of business and technical organization.
   - Financial resources.

22.0 For certain items if alternatives have been provided for in the Bills of Quantities, the Employer reserves the right to use either of the alternate items fully or partly, solely at his discretion. This is irrespective of the Employer’s right to vary the quantity of any item(s) substantially no claim in this respect shall be entertained.

23.0 No tender will be considered which is not accompanied by EMD in the form of Demand Draft / Cheque as specified in the instruction to bidders. The DD / Cheque should be from a Nationalized Bank drawn in favour of Hindustan Petroleum Corporation Limited, which is to be lodged on the understanding that, in the event of the Tenderer withdrawing his Tender before the expiry of offer validity from the date fixed for receiving the Tenders or such other extended dates as determined, the EMD will be forfeited, and on the understanding that if the Tender is accepted Initial Security Deposit referred would be furnished as stipulated. The Earnest Money Deposit will be returned to the unsuccessful Tenderers within one month after the date fixed for receiving tenders or
at such date as may have been requested by the Employer and accepted by the Tenderer. In the case of the successful Tenderer, the Earnest Money Deposit shall be returned after the Initial Security Deposit for the whole work has been received by the Employer, to their full satisfaction as stated herein below. In case the successful Tenderer fails to commence the work awarded to him, the EMD shall be forfeited.

24.0 The successful tenderer to whom the Contract is awarded shall deposit a sum as specified in the Appendix in the form of Bank Guarantee as Security Deposit. The Security Deposit shall be deposited within 14 days from the date of receiving of letter of intent / award failing which the employer at his discretion may revoke the letter of intent / award and forfeit the Earnest Money Deposit. The security deposit shall be submitted in the form of a Bank Guarantee from a Nationalized / scheduled bank, as per the format attached herewith drawn in favour of Hindustan Petroleum Corporation Limited. The Bank Guarantee for Security Deposit shall be valid for 15 months from the date of issuing letter of intent.

25.0 The client does not bind itself to accept, the lowest or any tender and reserves to itself the right to accept or reject any or all the tenders, either in whole or in part, without assigning any reasons for doing so. The client also has the right to re-invite the tender at his sole discretion.
2. PREAMBLE

TO

SCHEDULE OF QUANTITIES
PREAMBLE TO SCHEDULE OF QUANTITIES

I. GENERAL

This Preamble is to be read in conjunction with the description of various items given in the Schedule of Quantities/Bill of quantities (SOQ/BOQ). These items are deemed to be a part of the SOQ/BOQ and shall be read along with the same. The rates quoted for various items in SOQ/BOQ are deemed to include the various provisions made herein. Whether specifically mentioned or not in the SOQ/BOQ, the requirements given below shall be deemed to be included:

1. Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Meaning</th>
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<tr>
<td>BWP</td>
<td>Boil Water Proof</td>
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<tr>
<td>M.S.</td>
<td>Mild Steel</td>
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<tr>
<td>O.B.T. Wood</td>
<td>Old Burma Teak Wood</td>
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<tr>
<td>B.T.W.</td>
<td>Burma Teak Wood</td>
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<tr>
<td>C.P. Teak Wood</td>
<td>Central Province Teak Wood</td>
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<tr>
<td>Rmt.</td>
<td>Running Meter</td>
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<tr>
<td>Sqm.</td>
<td>Square Meter</td>
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<tr>
<td>Cum./m3</td>
<td>Cubic Meter</td>
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<tr>
<td>T.W.</td>
<td>Teak Wood</td>
</tr>
<tr>
<td>Q.R.O.</td>
<td>Quote Rate only</td>
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<tr>
<td>C / C</td>
<td>Centre to Centre</td>
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<tr>
<td>C.M.</td>
<td>Cement Mortar</td>
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<tr>
<td>M.T.</td>
<td>Metric Ton</td>
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<tr>
<td>C.P.</td>
<td>Chrome Plated</td>
</tr>
<tr>
<td>No.</td>
<td>Number/Each</td>
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<tr>
<td>MM</td>
<td>Millimeter</td>
</tr>
<tr>
<td>G.I.</td>
<td>Galvanized Iron</td>
</tr>
<tr>
<td>A.C.</td>
<td>Asbestos Cement</td>
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<tr>
<td>C.I.</td>
<td>Cast Iron</td>
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All dimensions are in mm unless otherwise stated.

2. The quoted rate shall be all inclusive and cover the cost of material including wastage, freight, all types of taxes, duties, royalties, erection, construction, testing of materials, samples brought for approval, tools and tackles, plant and equipments, supervision, overheads, profit and any other expenditure incurred for completion of work as per
drawings, specifications and to the full satisfaction of HPCL/Consultants.

3. The rates quoted shall be valid for working at all heights, depths and on all floor levels. No extra payment shall be made for scaffolding, staging, ladders, etc., for transportation of men and material at higher or lower levels.

4. The contractor will have to carry out the work in accordance with the drawings, technical specifications and / or other conditions laid down in tender document and to the full satisfaction of HPCL / Consultants.

5. HPCL / Consultants reserve right of operating any item for any work on any floor.

6. Rates for doors shall include all hardware brass/stainless steel Heavy duty hardware, locks, special door handles, door buffers etc. as specified in relative items. Size and type of door closer / floor-spring shall be suitable for types of door. The contractor shall give guarantee for performance of door closer / floor-spring from himself as well as from manufacturer.

7. After completion of work the site shall be handed over absolutely clean, after ensuring that all floors, walls, toilets, site area etc. are spotless clean.

8. The rates for all grades of concrete shall include cost of mixing by mixer machine/RMC, concrete pump, boom placer, compaction by mechanical vibrator, cost of mix design and testing cubes etc.

9. Grades of concrete are specified in Newton per sq.mm.

10. Unless otherwise mentioned explicitly in this tender document, the method of measurement will be as per I.S. 1200

11. Wherever contractor proposed to use "equivalent" makes (i.e. other than specified) he shall obtain corporation's prior approval. Corporation may consult Consultants before giving approval to the same. Any additional cost and time lost due to this will be on Contractor's account and no claims will be entertained.
12. The contractor should take approval for make & manufacturer from the consultants / HPCL before using any material which does not appear in the list of approved manufacturers.

13. Wood to be used shall be of following species for all items of works unless otherwise specified
   i. For exposed woodwork: -OBTW/ 1st class T.W as specified in items.
   ii. For covered woodwork: - Second class T.W as specified in the specification.

14. All internal framework to be coated with wood preservative & fire retardant paint from approved make.

15. Rate for all items include materials, labour, testing of materials at laboratory or site, tools & tackle, lift & lead charges, transportation charges, loading - unloading charges, insurance cover as per tender, all taxes & duties including works Contract Tax, VAT, service tax etc. Polishing & painting charges wherever applicable, arranging in position, cleaning, making mock-up etc. up to the entire satisfaction of Project-in-charge.

16. The basic rates excluding taxes for some main items (if applicable) are mentioned in the schedule of quantities. Any actual variation in basic rates on & above shall be paid extra after producing necessary bills/invoice after amendment of the PO. Any rate difference shall be reimbursed by adding rate difference to the quoted rates of the respective items after duly certified by Engineer-in-charge/Consultants and after obtaining necessary approval from the competent authority for the same. If the basic rates of items procured are less than the basic rate, the difference in the basic rate will be recovered from the contractor RA/FINAL bill for the quantity executed under the same item after duly certified by the EIC/Consultant.

17. All materials which shall be brought on site shall be of approved make & manufacturers failing which payment shall be deducted suitably from every running bills/final bill. Percentage of the same shall be assessed by EIC / Consultants and they at their discretion either to ask contractor to remove / rectify the same or to decide the new proper rate of that particular item.

18. Hardwares such as Locks, Handles, Hinges, Tower Bolts, Ball Catches etc. shall be as per approved list of makes & manufacturers. Alternative makes shall be used for these accessories after getting approval of consultants / owner in case of non-availability in market.
19. The rates for storage units shall be all inclusive of hardwares such as locks, handles, demountable hinges/normal but hinges, tower bolts, ball catches, etc. The mode of measurements for storage units shall be front elevation area only unless otherwise mentioned in the item.

20. The payment shall be made based on actual work measured on site by Owner/Consultants representatives.

21. Basic rates of materials - wherever specified - are Exclusive of all taxes and transportation.

22. All items mentioned in the SOQ are for providing, supplying and fixing, commissioning and shall be inclusive of all taxes and duties unless otherwise clearly specified.

49. All brass fittings / fixtures shall have oxidized finish except Knobs & magnetic catches unless specified otherwise.

50. All shutters with locking arrangement shall be provided with brass Shoe for key holes and magnetic catches.

51. All wooden frameworks shall be treated with fire-retardant Paint & anti-termite treatment. All internal faces of skinning & other wood work shall be treated with both the above mentioned treatments from inside.

52. Deleted.

53. Deleted

54. Deleted

55. Deleted

56. Deleted

58. All materials and workmanship shall comply with relevant latest BIS standards, whether the reference nos. are specifically mentioned or not.

59. The plywood of various thicknesses i.e. 4mm and above shall be of marine ply variety
bonded by phenol formaldehyde resin by hot pressing conforming to I.S.710 -1976

60. The flush door shall be 35mm thick unless specified otherwise and solid core of block board type bonded with phenol formaldehyde synthetic resin thermo pressed with 8 mm thick teak wood external lipping. The finish of shutter shall match the adjoining partitions and shall be either laminate or decorative veneer to match the adjoining partition. Wherever the side of the flush shutter abuts plastered surfaces, it shall be finished with matt finish laminate. The rate quoted in flush doors shall include finishing all surfaces to design patterns as in drawing.

61. Wherever edges of polished Italian Marble/Granite either in cladding or in table tops are exposed, the quoted rate shall include chamfering of edges and polishing of edges. Wherever polished granite is specified in floor or in cladding, the quoted rate shall include laying according to patterns or designs required by the Consultants. No extra payment will be made towards cutting and wastage in formation of patterns and designs.

62. All hardware fittings shall be of best quality stainless steel of approved make and design unless specified otherwise in the item specification.

64. The Bidder is required to inspect the site of the work and ascertain for himself site conditions, facilities available and other aspects before quoting for the work. The bidder is also required, before quoting, to carefully peruse the tender documents, the tender drawings and connected details so as to understand clearly the scope and intent of the tender. Any claims by the successful bidder at a later date on account of his failure to comply with the above instructions will not be entertained.

67. HPCL /Consultants reserve the right to insist on selection of material, workmanship, detailing and finishes which they consider are appropriate, and suitable for the intended use. The contractor is not eligible for claims to extra on this account.

68. HPCL /Consultants reserve the right to insist on prototype/mock-up to be made for each item of work for approval before starting the full-fledged execution.

69. HPCL /Consultants reserve the right to suggest or make modification at the prototype/mock-up stage which the contractor shall comply with without any extra cost.
70. HPCL /Consultants will require the contractor to produce samples of all materials, accessories/finishes prior to procurement / manufacture. Failure to comply with these instructions may result in rejection of the work.

71. All the works done under this contract shall be guaranteed for a period of one year from virtual date of completion of works certified by HPCL/Consultants covering, materials, workmanship and finish. Any defects or shrinkage, warping or other forms of deterioration shall be made good by the contractor at his own cost within the guarantee period, immediately on being informed of such defects. Failure to comply will entail HPCL to unilaterally decide on getting the repair done through other agency at the cost and risk of the contractor.

72. The contractor should use only the best material. Teakwood or other timber specified shall be of the best quality, free of defects of any kind. All plywood, particle board, veneer, laminate etc., shall comply with respective Indian standard (BIS). If required by HPCL/Consultant, the contractor will be required to arrange for testing products and produce test certificate from recognized test houses to establish the quality of materials at his own cost. Any defective material not meeting with the standard shall be replaced at the contractor’s own cost. Manufacturer’s test certificates for all items have to be obtained and submitted to client time to time.

73. The bidder shall indicate the makes of all the finishing materials with catalogues in his tender, based on which rates have been quoted. The bidder shall be prepared to produce samples when called for before consideration of the tender further at his own cost and responsibility and without any liability on HPCL.

74. Testing of various materials should be carried out as per the relevant IS standards/equivalent mentioned in the technical specifications attached to the tender.

76. One No. of each item of the Bill of Quantities shall be made first and got approved before proceeding with the remaining quantum of items and work.

81. The Rate quoted shall include the following:

   i. High quality Hardware fittings and specials such as( as per approved list) hinges, handles, mortise locks, multipurpose locks, aldrops, tower bolts, drawer slides, drawer pulls, drawer sliding accessories, sliding door gears and specials, screws
of best quality of approved make etc., wherever necessary. (Samples of all hardware fittings shall be got approved by HPCL / Consultants well in time before procurements.

ii. Scaffolding to any height wherever required internally to the floor height in each floor.

iii. Rectification of damage(s) to flooring, plastering etc., caused during the execution of work.

82. The contractor shall provide and retain the following at site, during course of project to take care of any fire exigencies.
   - Fire extinguishers - 10 nos. DCP / 10 nos. CO2
   - One FIRST-AID box
   - Required personnel protection device such as helmets & shoes etc for the workers

83. The normal working hours for carrying out the job shall be from 8.00 A.M up to 7.30 PM on working days (from Monday to Friday) and shall be 8.00 AM to 6.30 PM on Saturdays, Sundays and all holidays. However the work can be continued during the night hours subjected to the permission given by the EIC and no complaints received from neighbors and police etc in line with the prevailing statutory regulation.

II. SPECIFIC CONDITIONS

1. The various works described in the Schedule of Quantities and in the drawings shall be executed in strict accordance with the specifications and drawings to the entire satisfaction of the Consultants and the HPCL. The quality of materials and workmanship shall be of high quality and shall conform to the relevant I.S. Specifications wherever applicable. The successful bidders will be required to produce for Consultants approval samples of all materials and procurement shall be arranged only after specific approval. Samples of finished work shall also be shown for Consultants approval wherever directed
and finished work shall conform strictly to the approved samples. The decision of the Consultants in this matter will be final.

2. The bidders shall ensure that the place of work is kept neat and tidy during the progress of work and also clean at the end of each day’s work. The contractor shall also ensure that the site is cleared of all rubbish, and other unwanted materials and handed over in a neat and satisfactory conditions as may be directed by HPCL /Consultants.

3. The bidders shall take maximum precaution in protecting persons, things and properties belonging to the HPCL, Public and also their own during the progress of work. The bidders will be solely responsible for any damage caused during the progress of work and the successful bidder shall indemnify the HPCL by suitable guarantee / insurance cover from any claims on any account due to damages caused during their work.

4. Site meetings will be held regularly once in a week, if necessary meeting will be held in between also. The contractor or their authorized representative would be present for the meeting to take instruction and carry out the same for execution.

5. The contractor should maintain measurement books in which he should record measurements of work done from time to time and checked by the Architect/Site Engineer. There should be no corrections or over writing in the measurements.

6. The Contractor on starting the work shall herewith furnish to the Consultants a programme for carrying out the work stage by stage within the stipulated time. A graph or chart on individual work shall be maintained showing the progress week by week. The Contractors shall submit to the Architect a weekly progress report stating the number of skilled and unskilled labourers employed on the works, working hours done, quantity of cement used, place, type and quantity of work done during the period. The supervision at site shall be carried out by HPCL’s representative as well as the representative of the Consultants. The work progress to be reviewed in periodic site meetings at site to be decided by the HPCL and the Consultants. The BAR chart and PERT chart shall be prepared by the contractor in consultation with the Consultants and HPCL and the HPCL’s approval shall be obtained, for the same. After approval the contractor shall faithfully adhere to the schedule and where deviations take place, the contractor shall take remedial action to compensate for the delays in completion of the project.

7. a) The Contractor shall provide at his own cost for all necessary storage on the site
in a specified area for all materials such as timber, cement, lime and other materials, which is likely to deteriorate by the action of sun, rain or other causes due to exposure, in such a manner that all such materials, tools, etc., shall be duly protected from damage by weather or any other cause. All such stores shall be cleared away and the ground left in good and proper order on completion of this contract unless otherwise expressly mentioned therein.

b) The contractor shall provide at his own cost temporary works as per drawings/specifications approved by the Consultants. The contractors should obtain approval of local authorities, if required for the same. The Contractor shall be responsible for removal and disposal of the temporary works before handing over the completed works to the HPCL.

c) The contractor shall enclose the work place by providing temporary partitions and segregate the HPCL Zone separately such that no hindrance or inconvenience is caused to the Employees / Records.

d) All formalities including permission required to be obtained from competent authorities for making the provisions in (a), (b) and (c) above would be done by the contractors at his cost.

e) The Contractor shall erect a display board on site at his cost in accordance with the drawings issued by the Consultants for display of the names of the various agencies involved on the project including the HPCL and the Architect.

8. Provision of toilet for the labour as per labour law and one for HPCL exclusive use shall be made by the contractor. After completion of work, the temporary toilet will be demolished. by the Contractors and area handed over to HPCL.

9. The Contractor shall engage an independent Housekeeping – debris removal agency on a day-to-day basis. Hence Contractor would be responsible for cleaning up the debris and waste materials accrued from his work and dispose the accumulated debris on a daily basis. If the Contractor fails to comply with this requirement, the Employer will be at liberty to direct the cleaning agency to do the regular cleaning responsibility.
10. HPCL/Consultants reserve the right to delete all of these associated works from the scope or include them prior to placement of work order. If awarded, the main agency shall get the associated works carried out only through approved sub-specialist in each trade if specified in the SOQ. Such works shall be done to satisfy standards of HPCL / Consultants and also to meet their requirements and specifications of HPCL. Any suggestions / modifications suggested by HPCL / Consultants for integrating these associated works with the main system of HPCL shall also be got done by the main agency to the satisfaction of HPCL / Consultants. No extra cost is payable on account of executing works through the approved agency for integrating the same with HPCL’s overall scheme or implementing the suggestions given by HPCL/ Consultants. The contractor may note that they have to do day to day coordination with other agencies already mobilized in site for executing other related jobs.

11. The Contractor shall strictly follow and comply with the guidelines (which are applicable to them) given in HPCL during execution.

III. MODE OF MEASUREMENTS

Unless otherwise stated in the Schedule of Quantities the method of measurement for various items in the tender shall be generally in accordance with the I.S.1200 subject to the following:

a) DEMOLITION WORK:

Pre-measurements to be recorded for all dismantling items before starting of the works.

b) WOOD WORK:

No extra measurements will be given for the shape, joints of the partitions counter, tables work etc.

All work shall be measured net as fixed. No extra measurement will be given for shape, joints, played meeting styles of doors and windows and shall be measured in unit of square meter.
Areas over one face inclusive of exposed frame thickness (excluding width of cover mould) shall be measured in case of T.W. Doors, Windows and Ventilators, Louvers. Portions in masonry or flooring shall not be measured.

IMPORTANT NOTE:

If any deviation is found while on execution between the specification and the drawings it is to be expressly noted that the specification will hold good and supersede the drawings.

The bidder is required to peruse carefully all parts of tender documents and drawings if any difference / inconsistency is noticed, he shall bring it to attention of HPCL before submission of tender and shall get clarification required. Failure to do so will not entitle the successful bidder for any claims for extra payments later. It may be noted that all the drgs provided are only for tender purpose and the succesful bidder has to make construction drgs based on the drgs issued by the consultant and get the same approved before commencing the actual work.

1. Any cables / piping encountered during excavation and other any construction activities as specified above, the same shall be separated using Sand Bed and Tiles or to be re-routed, if necessary as directed by the Engineer incharge at no extra cost to HPCL.
2. The contractor shall prepare a detailed date wise schedule of work/Bar Chart of the activities as per PO and submit to Engineer-In-Charge for approval before commencement of activities and keep a track on the schedule in Microsoft Project (MSP) time to time.
3. The Contractor has to give Daily Progress Report (DPR), Monthly Progress Report with photographs every month in hard copy as well as soft copy in an agreeable format.
4. The contractor shall arrange all equipment, tools, manpower, power and water required for execution, testing of building materials before and during the jobs & completion of the job.
5. All the safety precautions including should be taken while executing jobs at site work at height etc., All necessary Personal Protective Equipment such as helmets, shoes shall be arrange by the Contractors as per the directions of Engineer in charge at no extra cost to HPCL.
6. The Contractor has to give progress report with photographs every fortnight in hard copy as well as soft copy.
7. Preparation of site logistics plan, schedule of works as required and directed by Engineer In Charge.
8. Submission of drawings of working plan, scaffolding design, etc. as per site requirement.
9. The contractor has to maintain all the site records including measurement sheet, hindrance register, testing register, level books and other site records in coordination with Architect/HPCL on a daily basis.
3. SCHEDULE OF QUANTITIES
IMPORTANT NOTES TO SCHEDULE OF QUANTITIES

1. Scope of Work, Supply of Material, Technical Specifications, Requirement of relevant Codes, SCC (Special Conditions to Contract), GTC (General Terms & Conditions), Schedule of quantities, Statutory Rules & Guide Lines as applicable, Minimum Equipment/Machinery Deployment and any other requirement to complete the Job/Work as per this Tender Document shall be deemed to be included in SOQ/BOQ of each item.

2. For all Items, Quality Control, Inspection & Job procedure, Project Scheduling & Monitoring Document as per SCC, Submission of all these documents to HPCL for approval deemed to include in quoted rates.

3. The Water and Electrical power required for constructional activity shall be in the Scope of Contractor & shall be deemed to be included in SOR Items.

4. All the Testing Charges for Items as per tender documents elicited in various sections shall be borne by contractor and deemed to be included in quoted rates.

5. All Tools & Tackles, Equipment, and items brought to site by contractor will be permitted to be taken out only after completion of work & fulfillment of necessary formalities.

6. Rate for all items to include deployment of qualified Quality Control & Safety Engineer at site from the date of LOI till completion of job as per PO. QC Engineer & Safety Engineer deployed as per above will report to HPCL site-in-charge on daily basis for complying all the QC/safety jobs mentioned in the PO.

7. The job shall be carried in conjunction with attached job schedule, technical specifications, relevant and applicable codes, sound engineering practices and as directed by Engineer—in—charge complete and this is applicable to all items in the schedule of quantities.

8. The successful bidder is required to submit QAP (Quality assurance plan) & ITP (Inspection Test Plan) and Job procedures for various types of job are to be submitted for HPCL approval as per the job requirements during the execution of the job.
<table>
<thead>
<tr>
<th>SL NO</th>
<th>DESCRIPTION OF THE WORK</th>
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<tbody>
<tr>
<td><strong>EARTH WORK EXCAVATION</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Excavation for Lift up to 1.5m depth</td>
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<tr>
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<td>General earth work excavation in all types of soil for leveling &amp; lowering the ground other than in foundation, etc. up to the basement formation level, sewer lines, sump, stacking the excavated earth &amp; disposable material where ever indicated in site temporarily. Top soil to be taken out and stored onsite with mulching to be reused for garden purposes on site. The item should Include back filling, filling depressions wherever necessary, stacking the sufficient earth for refilling and use as instructed, side trimming, watering, consolidating, shoring (Shoring/strutting design need to be submitted by the consultant after design and approved by the HPCL consultant), bailing out watered complete. Obtaining any approval from any statutory authorities required as per prevailing statutory norms, if any for excavations will in the vendors scope and rate of any such approval shall be included in the quoted rates.</td>
</tr>
<tr>
<td>2</td>
<td>Specification same as item no-1 but for Excavation for Lift from 1.5m to 3.0m depth</td>
</tr>
<tr>
<td>3</td>
<td>Specification same as item no-1 but for Excavation for Lift from 3.0m depth to 4.5m</td>
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<tr>
<td>4</td>
<td>Specification same as item no-1 but for Excavation for drainage and chamber</td>
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<tr>
<td>5</td>
<td>Specification same as item no-1 but for Excavation for compound wall &amp; Generator yard</td>
</tr>
<tr>
<td>6</td>
<td>Excavation for a Lift from 4.5M depth to 6.0M</td>
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<tr>
<td></td>
<td>Earth work excavation in all types of soil for foundations, drain, footings, retaining wall &amp; base slab, below the basement floor level, stacking the excavated earth &amp; disposable materials at ground level, Excluding back filling, Transporting surplus Excavated earth away from the site, but including watering, consolidating, shoring, bailing out water if necessary, etc. complete (Rate to including bailing out water from the excavated trench in case it is required). Necessary shoring should be designed and approved by the consultant before execution for retaining the surrounding earth. Any approval if required for such excavation from any statutory authority is to be obtained by the tenderer. Providing a stable shoring/strutting for the excavation shall be a part of this item and any cost towards the same shall be deemed to be included in the item rate as other constructions are existing in the nearby plot.</td>
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<tr>
<td>7</td>
<td>Specification same as item no-6 but for Excavation from a Lift from 6.0M depth to 7.5M</td>
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<td>8</td>
<td>Earth Filling with excavated earth</td>
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<tr>
<td>Earth Filling with approved quality earth in below flooring, sides of foundation, retaining wall, trenches, lift pits elsewhere directed in layers of not exceeding 150 mm tk including breaking clods, watering, compacting each layer with vibratory compactor and at inaccessible places with wooden/steel rammers to achieve 90-95% proctor density at optimum moisture content, all leads &amp; lifts. Bailing/pumping out of water to keep site dry while back filling ,Cost shall include conveyance of all materials, labor, machinery etc. complete</td>
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| 9 | Earth Disposal |
|----------------------------------|
| Transporting the surplus earth which cannot be reused at the site to any approved dumping place as specified by the Engineer in charge and disposing the same in municipal approved dump yard. |

| 10 | ANTI TERMITE TREATMENT |
|----------------------------------|
| Providing & injecting chemical emulsions for pre-construction anti-termite treatment (all as per IS code 6313 part-II) in column foundation, wall trench foundation, back fill earth in stages as filling progresses for top surface of plinth foundation, junction of wall & floor along external perimeter of the building, surrounding pipes, waste lines & conduits. The work must be carried out by a reputed agency /specialist agency approved by HPCL/architect. The rate shall include cost of labour, materials etc. required for work. Plinth area of the building at Ground Floor level only is to be measured for payment. |

<p>| 11 | ANTITERITE TREATMENT WITH RETUCULATE PIPES |
|----------------------------------|
| Providing Eco friendly anti Termite control by laying sub surface tubing network. Anti-termite with a unique method of laying an 8mm joint less tubing network which is incorporated at preconstruction stage. The tube is made up of LLDP (Low Linear Density Polystyrene) having perforation (dripper) at every running feet (12 inches). Behind every perforation there is a pressure value welded, which is supposed to open on a presence of 2IBS (To maintain equal/even distribution of emulsion). This tube is laid at inner periphery running all wall to wall after completing the loop; junctions are created outside the structure (taking both the dead conduits). Similarly the loop of outer periphery then chemical is to be injected through this network in future. As chemical is injecting through this network it reaches at all entry points of termite (as looping of drainage pipes also done) and creates the barrier. Injecting optimum quantity of chemical Imidaclorpid at 2.5liters/ sqm and creating the barrier at entry points. approx. quantity for the area which has been mentioned in the qty will contain injection of chemical emulsion using imidaclorpid 1:499 @ 2.25 sqm , supply of fixing junction boxes approximately 12 nos and laying LLDP tube for approximately an area of 300 sqm |</p>
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<tr>
<th></th>
<th><strong>PLAIN CEMENT CONCRETE 1:4:8</strong></th>
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<tr>
<td></td>
<td>Providing and laying <strong>P.C.C 1:4:8</strong> of specified thickness wherever specified using 40mm and downsize metal including sub grade preparation, leveling, compacting, all leads and lifts, rough finishing if required at the top surface with necessary curing and shuttering etc. complete at all levels. The item to be executed for foundation, drainage, below floor etc. complete.</td>
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<tr>
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<td><strong>Screed Concrete 1:2:4</strong></td>
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<tr>
<td></td>
<td>Providing and laying Screed concrete in 1:2:4 with 20mm and downgraded stone aggregates for toilet above sunken areas etc. or wherever to required thickness, slope and trowel finished smooth as directed including leveling, compacting, all leads and lifts with necessary curing and shuttering etc. complete at all levels.</td>
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<tr>
<td></td>
<td><strong>REINFORCED CEMENT CONCRETE</strong></td>
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<td></td>
<td><strong>RCC for Footings &amp; Raft - M25</strong></td>
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<tr>
<td></td>
<td>Providing &amp; laying Controlled M-25 Reinforced Cement Concrete using, 20mm &amp; down size stone aggregates with 53 grade Portland puzzolana cement at all levels in footings and raft including providing, fabricating and erecting form work at all levels, heights and places wherever needed/ specified with adequate supports as per drawing including striking/ DE shuttering with 12mm Plastic coated, marine resistant ply board with adjustable steel props to full height without joints and with sufficient bracing. Cost to include sealing the joints with heavy duty brown self-adhesive tape, applying mould releasing agents( Rebol from Fosroc or equivalent) aligning to line and levels including M.S. Ties, PVC Spacer, etc., for Footings &amp; Raft - M25. This item will be used wherever it is not possible to use RMC.</td>
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<tr>
<td></td>
<td>Specification same as item no-14 but for Columns &amp; Pedestals of <strong>Grade M35</strong></td>
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<td></td>
<td>Specification same as item no-14 but for Lintel, Chajja, Loft etc. - <strong>M25</strong></td>
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<tr>
<td></td>
<td>Specification same as item no-14 but for Staircase waist slab &amp; beam - <strong>M25</strong></td>
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<td></td>
<td>Specification same as item no-14 but for Roof Slab, beams at all levels - <strong>M25</strong></td>
</tr>
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<td></td>
<td>Specification same as item no-14 but for Retaining Wall - <strong>M25</strong></td>
</tr>
<tr>
<td>20</td>
<td>READY MIX CONCRETE - for footing &amp; raft-M25</td>
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<td>Providing, batching, mixing, transporting through transit mixers, pumping and laying Ready mix Reinforced Cement Concrete of specified grade including the mix design at all levels and heights of specified grade using Pozzolana Portland cement of grade 53 from approved manufacturer, sand, 20mm and down size coarse aggregates, necessary admixtures approved by Consultants (Conplast SP 430SRV from Fosroc or equivalent), including all leads and lifts, pumping using line pump or boom placer, vibrating/ compaction, scaffolding wherever necessary, curing as directed, including providing, fabricating and erecting form work at all levels, heights and places wherever needed/ specified as per drawing including striking/ DE shuttering with 12mm Plastic coated, marine resistant ply board with adjustable steel props to full height without joints and with sufficient bracing. Cost to include sealing the joints with heavy duty brown self-adhesive tape, applying mould releasing agents( Rebol from Fosroc or equivalent) aligning to line and levels including M.S. Ties, PVC Spacer, etc., for the concrete.</td>
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<td>(Design mix shall be as approved by the consultants. W/C ratio shall be as per consultant’s recommendation- GRIHA norms for Green building to be followed, and min 15% Fly ash to use to replace cement as per norms, etc as per IS/ECBC codes). The RMC manufacturer shall be as per the approved list provided along with the tender.</td>
</tr>
<tr>
<td>21</td>
<td>Specification same as item no-20 but for RCC for Columns &amp; Pedestals of Grade M35</td>
</tr>
<tr>
<td>22</td>
<td>Specification same as item no-20 but for RCC for Lintel, Chajja, Loft etc. - M25</td>
</tr>
<tr>
<td>23</td>
<td>Specification same as item no-20 but for RCC for Staircase waist slab &amp; beam - M25</td>
</tr>
<tr>
<td>24</td>
<td>Specification same as item no-20 but for RCC for Roof Slab, beams at all levels - M25</td>
</tr>
<tr>
<td>25</td>
<td>Specification same as item no-20 but for RCC for Retaining Wall - M25</td>
</tr>
<tr>
<td>26</td>
<td>REINFORCING STEEL</td>
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<tr>
<td></td>
<td>Providing &amp; fabricating reinforcement steel of high yield strength anticorrosive ribbed bars of various diameters and grade conforming to IS1786 for RCC Work. The work includes cutting, bending, fabricating, &amp; placing in position according to drawings. Cost to include chairs, spacers, supply &amp; use of 18G black annealed binding wire double fold to tie the bars in position &amp; providing FRP cover blocks for main reinforcement to ensure specified cover. Quantity of steel as per drawing and with</td>
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authorized overlaps only shall be measured and paid for. Steel used shall be of as Fe 500 D - TISCO, SAIL, RINL.

<table>
<thead>
<tr>
<th>27</th>
<th><strong>STRUCTURAL STEEL</strong></th>
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<tr>
<td></td>
<td>Providing &amp; fixing structural steel for lattice canopy as per design for supporting Solar PV panels on terrace duly fixed to the Terrace RCC slab. The rate of steel work shall include carrying the steel to terrace assembly, welding, jointing, building up new sections, cost of fasteners (nuts, bolts and washers) etc. The rate shall also include one coat zinc rich primer, after properly cleaning the steel surface, necessary bolts &amp; washers for fixing including grouting of bolts with 1:3 non shrink cement grout etc., complete all as per design, details, drawings, specifications etc. with all lead &amp; lift for all materials &amp; labor and as directed, at all heights. The item also include preparing shop drawings, obtaining consultants approval, supplying, fabricating, delivering at site, hoisting and fixing in position, including all temporary staging and supporting work and making all structural steel work in accordance with the design, drawing prepared by the consultant for trusses, purlins, girders, brackets, etc. with connections using plates, channels and angles, gusset plate, foundation bolt, cleats, fasteners etc., steel conforming to IS 226 and IS 2062 with minimum yield strength of 250Mpa and up to 355Mpa.</td>
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<tr>
<th>28</th>
<th><strong>Door/Window Grills</strong></th>
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<tr>
<td></td>
<td>Providing, fabricating and fixing in position Door/Window Grills with Semi-decorative MS grill work made out of MS square bars and MS flats as per design weighing approx. 20 kg/sqm with necessary screw lugs inserts, spot welding and one coat of red oxide primer etc. as detailed in drawing and as directed. Necessary grouting of supports to the RCC/Wall shall also be included in the item.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>29</th>
<th><strong>Powder Coated Grills</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing &amp; fixing in position 3 mm mesh thick powder coated/Anodized aluminum grills for the windows as per detailed drawing and design and as per instructions of EIC.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>30</th>
<th>SS Pipes - 50 mm Dia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing &amp; fixing 2&quot; dia heavy duty S.S pipes for COMPOUND WALL as per detailed drawing and design and as per instructions of EIC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>31</th>
<th><strong>MS Louvers</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing &amp; fixing louvered M.S ventilators as per the detailed drawing and specifications.</td>
</tr>
<tr>
<td>32</td>
<td><strong>Stone Masonry</strong></td>
</tr>
<tr>
<td>----</td>
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</tr>
<tr>
<td></td>
<td>Providing and constructing <strong>Size stone masonry</strong> in foundation, walls, drain, retaining walls, compound walls, pillars etc., using sized stones in CM 1:6 with necessary quoin, through bond stone and header stone at regular intervals including dressing the stone and edge poking by chisel / hammer true to the required shape and size, curing, scaffolding, racking out joints, staging, leads and lifts etc. at all levels and locations specified.</td>
</tr>
<tr>
<td></td>
<td>Note-MASONRY- 30% of OPC/PPC to be replaced by Fly ash for all masonry works as per GRIHA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>33</th>
<th><strong>230mm Fly ash Brick masonry</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing and constructing 230 mm thick Fly Ash Brick masonry in cement mortar 1:6 using defect less, sharp edged table molded, uniform size ,approved quality bricks adequately soaked in water before use for super structure etc., including racking, scaffolding, curing etc. Complete as directed. Note-MASONRY- 30% of PPC to be replaced by Fly ash for all masonry works as per GRIHA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>34</th>
<th><strong>Masonry for chambers</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Specification same as above but for chambers as per drgs &amp; instructions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>35</th>
<th><strong>Half Brick wall Masonry</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing and constructing 115 mm thick Fly Ash Brick masonry in cement mortar 1:4 using defect less, sharp edged table molded, uniform size, approved quality bricks including providing 4&quot; thick RCC band at every 4th course and adequately soaked in water before use for super structure etc., including racking, scaffolding, curing etc, complete as directed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>36</th>
<th><strong>Half brick Masonry for chambers</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Specification same as above but for chambers as per drgs &amp; instructions.</td>
</tr>
</tbody>
</table>

**PLASTERING / POINTING**
<table>
<thead>
<tr>
<th></th>
<th>Note: All corner, column &amp; beam joints shall use Arpitha/approved equivalent mesh before plastering to avoid the corner cracks. 30% of OPC/PPC used to be replaced by Fly ash for all plastering works as per GRIHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>8 mm ceiling plaster</td>
</tr>
<tr>
<td></td>
<td>Providing &amp; plastering to RCC ceiling in CM 1:3 with 8mm tk, including providing &amp; removing double scaffolding, smooth lime rendering, curing for 7 days, hacking etc., complete. With all lead &amp; lift as directed by engineer in charge.</td>
</tr>
<tr>
<td>38</td>
<td>12 mm thick internal plaster</td>
</tr>
<tr>
<td></td>
<td>Providing &amp; plastering to internal block masonry wall/concrete surface 12mm tk in CM1:5, including providing &amp; removing double scaffolding, rounding off all corners wherever required, smooth lime rendering (hydrating the area 24hrs before starting of the work), curing, hacking etc., complete. With all lead &amp; lift as directed by engineer in charge.</td>
</tr>
<tr>
<td>39</td>
<td>20 mm external plaster</td>
</tr>
<tr>
<td></td>
<td>Providing sand faced finish plastering to stone/brick masonry/concrete surface in 2coats with 12mm tk in CM 1:4 first coat &amp; finishing coat of 8 mm tk including integral water proofing compound of approved make in CM1:3 using coarse sand including providing &amp; removing double scaffolding, curing, hacking etc. complete. With all lead &amp; lift as directed by engineer in charge.</td>
</tr>
<tr>
<td>40</td>
<td>Plaster for Drainage &amp; chambers</td>
</tr>
<tr>
<td></td>
<td>Specification same as above but for drainage chambers etc. complete as per specifications, drgs and instructions from EIC/Architect</td>
</tr>
<tr>
<td>41</td>
<td>Toilet plaster</td>
</tr>
<tr>
<td></td>
<td>Preparing surface Providing and applying rough plastering over Toilet Walls and others for Dadoing or cladding in CM1:5 with 15-20mm thick, including providing &amp; removing scaffolding, curing, hacking etc., complete. With all lead &amp; lift as directed by engineer in charge.</td>
</tr>
<tr>
<td>42</td>
<td>Drip Groove</td>
</tr>
<tr>
<td></td>
<td>Providing and making plaster drip course/groove in plastered surface or moulding to R.C.C. projections</td>
</tr>
<tr>
<td>WATERPROOFING</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td><strong>NOTE:</strong> Sub contractor/applicator to be approved by Client/Architect/Consultants/Project Managers after evaluating the credentials. Few approved agencies are already provided in the tender in the approved make/subcontractors in the tender. The work has to be executed by the approved agency only and the contractor has to provide a guarantee for the water proofing for 10 years from the date of completion of work.</td>
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</table>

<table>
<thead>
<tr>
<th>43</th>
<th><strong>TOILET WATER PROOFING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing waterproofing for the Toilets by chemical method as follows: Brushing, cleaning &amp; hacking the surface area to provide acrylic polymer modified cementious coating or superior coating in 2 layers one after the other with 1mm tk as on floors/walls as per manufacturers' specification including making of watta as required at all edges. The cost to include 2coats of waterproofing plaster done in CM1:4 of 20mm thickness with waterproofing admixture finished to required slope with a minimum guarantee period of 10yrs.</td>
<td></td>
</tr>
<tr>
<td>Note: waterproofing to be done up to 1m ht of walls for toilet /kitchen/pantry and Plan area shall be the mode of measurement.</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>44</th>
<th><strong>Water Proofing- Basement</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing water proofing for the external retaining wall &amp; raft slab area by cleaning and chasing the construction joint, grouting with crystallization based non shrink grouts approved by the consultants all along the construction joints/cracks/ honey comb/tie rods holes etc. After grouting an approved self-adhesive SBS membrane/PVC membrane shall be fully laid on the external side of retaining wall and over PCC under raft slab (positive side) including application of suitable primer, sealing all the overlapping joints by applying suitable chemical/welding if required complete as per specification. The item also includes providing 30 mm thick protective concrete screed for horizontal area and protective board of 6mm thk expanded polyethylene board as per complete specification after membrane laying. The work has to be completed by the recommendation of the approved manufacturer and a work procedure will be approved after finalization of the agency in line with the broad guidelines provided in the specification.</td>
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<thead>
<tr>
<th>45</th>
<th><strong>TERRACE WATER PROOFING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing and applying high performance low VOC waterborne modified synthetic rubber based / or,100% polyurethane based liquid applied waterproofing elastomeric tanking membrane of approved water proofing agency applied in 2 coats as per manufactures specifications applied on the horizontal areas and on vertical surface up to 1000 mm height, above the F.F.L., ponding with water for 3 days to test water tightness etc in Flat roof slab. The work has to be completed by the recommendation</td>
<td></td>
</tr>
</tbody>
</table>
of the approved manufacturer and a work procedure will be approved after finalization of the agency in line with the broad guidelines provided in the specification.

<table>
<thead>
<tr>
<th>46</th>
<th><strong>Light Weight Filling</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing and applying for Toilet sunk slab &amp; terrace waterproofing works infill/protective slope making layer with aerated concrete bat coba/equivalent materials appropriately wetted and placed over the water proofing coating to obtain required level, slope etc. to the floor as per water proofing agency recommendation. Item to also include, all accessories, men material for a lift up to terrace / each floors up in the building for materials, pre-application preparation cleaning after the finish etc. complete.</td>
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<tr>
<th>47</th>
<th><strong>JOINERIES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aluminum sliding windows</strong></td>
<td></td>
</tr>
<tr>
<td>Providing and fixing aluminum fixed cum sliding windows fabricated as per drawing and fixed at all levels, elevations and heights having a main frame work of vertical and horizontals, out of specially designed approved extruded sections to withstand the designed wind pressure of Lucknow and other live loads, and be dust-resistant, sound insulated &amp; water-tight, sections from approved makes Tender List only. All aluminum sections shall be 63400 (H9) grade conforming to IS 8147, finished with AC25 grade Architectural quality electrolytic color anodic coating conforming to IS 1868 of approved color. Rate shall include to fix the main frames into masonry wall / RC concrete surface with necessary clamps, fastening straps, nuts, bolts, rivets, washers and other fastening materials shall be in stainless steel or aluminium. The section unit weight per running meter is subjected to tolerance on the wall thickness as per IS 6977/ Equivalent BS. The sizes and dimensions are subject to slight variations and for which no extra payment will be paid. Window shutter shall be provided with 5+8+5 mm DGU with desiccant filled 8 mm thick non-corrosive micro-perforated spacer sandwiched between 2 toughened float glass panes each 5 mm thk. Thick toughened glass using tinted glass as approved. Clear float Glass of approved make, as per design for all panels and with snap fit aluminum color anodized beading with special water proof cascades, Neoprene etc. complete, as directed. Necessary silicone-based weather sealant as per approved make shall be provided at the junctions between wall and main frames. Item finished complete with all integrated handles, stays, clip-locking mechanisms etc. as approved, item finished cleaned complete ensuring all requisite airtight behavior of system in closed/shut position.</td>
<td></td>
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<table>
<thead>
<tr>
<th>48</th>
<th><strong>Door/Window Frames-Sal wood</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing &amp; fixing in position <strong>Sal Wood</strong> frame of 2 1/2&quot;X 5&quot; / approved equivalent size as per requirement including all necessary hardware’s , all as per design shown on the drawing. The rate shall be including providing ant termite treatment for the back</td>
<td></td>
</tr>
</tbody>
</table>
### Side of the Frame

The wood selected shall be as per Griha guidelines.

### Toilet & Other Room Doors

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door/Window Frames-TW</td>
<td>Providing &amp; fixing in position 1st class Teak wood frame of 2 1/2&quot;X 5&quot;/approved equivalent size as per requirement including all necessary hardware’s, all as per design shown on the drawing. The rate shall be include of providing anti termite treatment to the wooden frame in contact with wall surface. The wood selected shall as per Griha guidelines.</td>
</tr>
</tbody>
</table>

### MISCELLANEOUS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>TW GLASS RAILING</td>
</tr>
<tr>
<td>TW GLASS RAILING</td>
<td>Supplying &amp; fixing 900mm high Glass Handrail with Teak Wood frame of size 4&quot; x 11/2&quot; for Vertical members as well as balustrade, 10 mm thick toughened glass to be placed between TW frames with 1/2&quot; x1/2&quot; TW beading including hardware’s, specified polish etc. all as per drawings &amp; details complete. The glass edges shall be beveled and smoothed before fixing it to the frame. The item also include fixing the verticals using SS studs/pipes to the RCC surface after making necessary cut outs in RCC and grouting the same with non-shrink epoxy grout.</td>
</tr>
</tbody>
</table>

### Under Ground Sump Construction

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>R.C.C M 25 for base slab (R.M.C)-Sump</td>
</tr>
<tr>
<td>52</td>
<td>R.C.C M 25 for side walls (R.M.C)-Sump</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>53</td>
<td>R.C.C M 25 for Covering Slab (R.M.C)-Sump</td>
</tr>
<tr>
<td>54</td>
<td>Water proof plastering for side walls etc – Sump</td>
</tr>
<tr>
<td></td>
<td>The item include providing and applying 2 coats of crystallization based water proofing coating including application of grouting with crystallization based non shrink grouts of approved make followed by 20 mm thick plaster in CM 1:4 including water proofing admixture, curing ponding etc. complete as per instructions, specification as approved manufacturers specification. The specification for plaster is similar to item of plaster provided earlier.</td>
</tr>
<tr>
<td>55</td>
<td>Site Office Porta Cabin</td>
</tr>
<tr>
<td></td>
<td>Supply, erection, commissioning of project office using porta cabin of approx. size 30sq.m for the use of HPCL/Architect as per specifications and drawings, including foundation on PCC/RCC and sewerage connection to pit as per direction by EIC including all dismantling associated with it. The item shall be completed as per drgs, directions and attached specification. The item includes required toilet facilities, electrical connection, furniture for office requirement, printers, desktop computer etc. complete. Proper electrical connections with light fixtures &amp; plug points adequately in all units as shown in attached drawing with modifications as suggested/approved by EIC. Contractor has to provide power for the office during the contract period. Contractor shall dismantle and take away the porta cabin along with all accessories from the site as per requirement of client after contract delivery period is completed.</td>
</tr>
<tr>
<td>56</td>
<td>O/H water tank Construction</td>
</tr>
<tr>
<td></td>
<td>Providing &amp; constructing R.C.C Over head tank using R.C.C walls, reinforcement, water proofing etc., complete as per attached drgs, specification &amp; directions from EIC. The specification of the individual items shall be similar to such items (Item no-14) already given in the tender except that the concreting has to be done in the top floor.</td>
</tr>
<tr>
<td>57</td>
<td>R.C.C M 25 for Covering Slab (R.M.C)-OHW</td>
</tr>
<tr>
<td>58</td>
<td>Water proof plastering for floors &amp; walls etc.-OHW</td>
</tr>
<tr>
<td></td>
<td>The item include providing and applying 2 coats of crystallization based water proofing coating including application of grouting with crystallization based non shrink grouts of approved make followed by 20 mm thick plaster in CM 1:4 including</td>
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</tr>
<tr>
<td>59</td>
<td><strong>External Wall plastering-OHW</strong></td>
</tr>
<tr>
<td></td>
<td>The specification of this item similar to the specification external plaster provided earlier</td>
</tr>
<tr>
<td>60</td>
<td><strong>Solid core flush door</strong></td>
</tr>
<tr>
<td></td>
<td>Providing and fixing approved quality factory made solid core flush door in single leaf anti-termite treated type plywood with finish as specified elsewhere, flush door 35 thk. ply board shutter to be ready factory made with both-side hardwood ply board faced Pine-wood core in continuous gapless section with butt joints tightly factory bonded with phenol formaldehyde adhesive of brand as approved. TW lipping on all edges of the door shutter 4mm thick, with 25mm thick ply panel core, BWR and anti termite treated. The door frame of 75 x 100 TW type to be fixed and integrated into support frame by approved screws min. 90 mm long as per the drawing inclusive of all walling holdfasts &amp; horns, fixing implements, accessories installed finished and lift up to 20 mts etc. complete. Item to be completed in all respects including all hardwares &amp; fittings as per approved makes &amp; as per drawings &amp; instructions from Project-in-charge/Architect</td>
</tr>
<tr>
<td>61</td>
<td><strong>Façade cladding tiles</strong></td>
</tr>
<tr>
<td></td>
<td>Providing and fixing of <strong>FAVETON BERSAL (or approved equivalent)</strong> Extruded Hollow Clay/ Ceramic Ventilated Rain screen Facade Tiles of dimensions 300/400mm (c/c) x max 1000mm (c/c) x 16mm thickness/approved equivalent size in horizontal direction on the building facade. The facade tiles shall be rigid and of adequate strength and shall satisfy all the performance parameters of an external cladding tile. The tiles shall have a total thickness of 16 mm (±10%) and shall be installed using the ventilated rain screen principle, with provision for uninterrupted natural ventilation of the space between the cladding panels and the structural wall from top to bottom. The tiles shall be fixed to an extruded aluminum support framework consisting of vertical aluminum tubular sections measuring 40x40mm spaced at maximum 700mm c/c/approved equivalent intervals, fixed to the wall using aluminum L-brackets spaced at maximum 1000mm distance vertically. The item has to be completed as per manufacturer’s specification</td>
</tr>
<tr>
<td>62</td>
<td><strong>Exterior Lap sliding elements for façade cladding</strong></td>
</tr>
</tbody>
</table>
|   | Providing and fixing of Prodema Ex or Fundermax - Max Exterior lap sliding elements (or approved equivalent) 8 mm thickness shall be installed as a Ventilated Facade using the exposed-fastening system with rivets to an aluminium substructure. Behind the facade panels there should be a minimum 20mm wide uninterrupted ventilated air
chamber. Only vertical battens should be used. Joints between panels should observe the following: The panels should have freedom of movement of 1.8mm per linear metre of panel, both lengthways and widthways; A minimum joint of 8mm is recommended; Joints should guarantee adequate ventilation and drainage. The maximum distance between fastenings shall be 450mm if there are only two fastenings in one direction, and 600mm if there are three or more fastenings in one direction. The fastenings located near the panel edge shall be at a minimum distance of 20 mm and at a maximum distance of 40 mm from the panel edge. Slats of profile 4100 x 250 mm/approved equivalent size made of veneer finish on bakelite backing or or high pressure laminate with acrylic coating on compressed kraft paper using mounting clips fixed to vertical aluminium sections of minimum 75 mm width in the corner joints and 50 mm width otherwise. Only horizontal slats should be used. The vertical battens are to be spaced maximum 500 mm with panels installed starting from the bottom. Provision of mesh in the bottom and the top of the cladding system. The bottom of the structure to be minimum 20 mm higher than the finished floor level. The item has to be completed as per manufacturer’s specification.

<table>
<thead>
<tr>
<th>63</th>
<th>Structural Double Glazing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing and fixing <strong>structural double glazing</strong> as per the detailed drawing using DGU of 6mm+12mm+6mm thk reflective toughened glass of approved color manufactured by reputed manufacturer such as Glaverbell, Modiguard, St.Gobain etc., using structural sealant of Dow Corning D995/GE/Wacker Germany etc., complete as per detailed drawing. The entire structural glazing is carried with structural sealant DC-995 or GE/Wacker. While the weather proofing/water proofing be done with weather sealant DC789/793 or GE/Wacker. The entire façade will be designed to safely carry dead load, wind load etc. the wind load may be calculated based on recommendation of IS 875 (Part III). The entire façade should be water proof. The façade be fixed to the structure through Hot dip galvanized with epoxy coating MS brackets/aluminum structural members and anchor fasteners. A minimum opening shall be provided as open able glazing as per drgs &amp; instructions</td>
<td></td>
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<thead>
<tr>
<th>64</th>
<th>Spider Glazing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing &amp; fixing <strong>Dorma/approved equivalent double glazed unit</strong> with spider glazing, hardware’s such as Arm spider, point bracket etc., and 8mm + 12mm + 13.5mm laminate glass of approved color manufactured by reputed manufacturer such as Glaverbell, Modiguard, St.Gobain, Ashai etc., using structural sealant of Dow Corning D995/GE/Wacker Germany etc., complete as per detailed drawing. The entire structural glazing sealant is carried with structural sealant DC-995 or GE/Wacker. The entire façade will be designed to safely carry dead load, wind load etc. the wind load may be calculated based on recommendation of IS 875 (Part III). Vendor to provide structural details and get the same approved by HPCL/Consultant I before commencing works.</td>
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<table>
<thead>
<tr>
<th>65</th>
<th>Vacuum Dewatering concrete</th>
</tr>
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<tbody>
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<td></td>
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</tbody>
</table>
Providing & laying **VACCUM DEWATERING CONCRETE** flooring, min thickness of floor 15cm, the slab must not be reinforced with metallic fibers. Acceptable maximum tolerance is 5mm under a 2m straight edge. The slab will be given a quartz treatment in one block, with Master top 100 (BASF), Duroquartz (Durocem) or equivalent laid at a rate of 5kg/m2. Final surface treatment by curing and waxing ( Mastyerkurel 15 BASF, Durocuring, or equivalent). Top finish with epoxy coating.

**Grass Pavers**

Providing & applying Grass paver’s of size 330x330x120mm/approved equivalent size of - Rosa cometa-Basant beaton or approved equivalent of appropriate color- to withstand truck and traffic load, including planting turf grass of approved quality and watering till green. The item includes preparing the sub base to take the grass pavers for medium to heavy traffic grass pavers to be laid on the top of a 50 mm sand cushion, providing curbe stones for edge restraints and to be installed as per manufactures specification.

Basic Price of grass pavers only is Rs 1884 per sqmt

**SANITARY FIXTURES:**

**EWC**

Supplying, installing, testing and commissioning approved make white colour European water closet(suite) constellation series floor mounted pattern type 'P' or 'S'trap with 2/4 Lts. Capacity porcelain integrated close coupled cistern with all internal fittings of the cistern. The quoted price shall also include 1no. 15mm CP angle cock, CP Inlet connection pipe, CP wall flange, colour plastic solid seat and cover with rubber buffers and flap, heavy duty plastic hinges, etc., complete. Basic price of EWC is Rs 15000 per piece.

**Wash Basin**

Supply, Installing, testing and commissioning approved make Oval wash basin white color fixed under counter with 15mm C.P. Sensor tap unit of jaguar or approved equivalent , 32mm dia CP waste coupling,32 mm dia heavy duty CP bottle trap with extension pipe, CP wall flanges, 1 No.15mm dia C.P. angle cocks, 1 no.C.P. Flexible inlet connection pipes, CI brackets etc., complete including silicon sealant. Basic price of Wash Basin is Rs 22000 per piece.

Note: The item has to meet the designed low volume flow rate 2.75 liters/min of water for sink to meet the requirement of Griha standards.
<table>
<thead>
<tr>
<th>69</th>
<th><strong>Kitchen Sink</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply, installing, testing and commissioning of approved make kitchen sink with single bowl &amp; Single drain board made of Stainless steel 1 No. 40 mm dia CP bottle trap with extension pipe, CP wall flange, CP waste coupling, and 1 No. 15 mm dia sink cock unit wall mounted type with swinging spout, C.I. brackets etc. Complete. Basic price of Kitchen Sink is Rs 18000 per piece including Tax component.</td>
<td></td>
</tr>
<tr>
<td>Note: The item has to meet the designed low volume flow rate 2.75 liters/min of water for sink to meet the requirement of Griha standards.</td>
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<table>
<thead>
<tr>
<th>70</th>
<th><strong>Toilet Paper Holder</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing and fixing approved make C.P. toilet paper holder with all harwares. Basic price is Rs 750 per piece.</td>
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<thead>
<tr>
<th>71</th>
<th><strong>Health Faucet</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply, installing, testing and commissioning of approved make 15 mm CP health faucet with CP flexible tube 1.0m long, CP crutch, nozzle etc. Complete. Basic price is Rs 3100 per piece.</td>
<td></td>
</tr>
<tr>
<td>Note: The item has to confirm with low volume flow rate 6.0 liters/min of water for Health Faucet to meet the requirement of Griha standards.</td>
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<tr>
<th>72</th>
<th><strong>Bib Tap</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing &amp; fixing of approved make 15mm CP hose bib with necessary CP wall flanges etc. Complete. (Landscape Area). Basic price is Rs 900 per piece</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>73</th>
<th><strong>CP Towel Ring</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply, fixing of approved make C.P. towel ring including C.P. screws with fischer plugs etc., complete. (Near Wash Basin &amp; Kitchen Sink). Basic price is Rs 1200 per piece.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>74</th>
<th><strong>Robe Hook</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplying, fixing approved make C.P. twin robe hook with C.P. screws etc., complete. Fixed on the toilet door. Basic price is Rs 750 per piece including Tax component.</td>
<td></td>
</tr>
</tbody>
</table>

| 75 | **Urinals** |
Supplying, installing, testing and commissioning approved make white/coloured integrated EPS urinals with 40mm C.P. dome type waste coupling 40mm C.P. bottle trap with C.P. extension pipe, 15mm dia solenoid valve unit & Battery operated sensor unit for automatic flushing with necessary electrical etc., C.P. spreader unit GI expansion bolts, including core cutting and water proofing etc., (Urinal partition excluded). Basic price is Rs 25000 per piece including Tax component.

Note: We have designed for low volume flow rate 1.50 liters/min of water for Urinals to meet the requirement of Griha standards.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>76</td>
<td><strong>Liquid Soap Dispensers</strong></td>
</tr>
<tr>
<td></td>
<td>Supplying and fixing approved make FRP Liquid Soap dispensers complete with CP fixing screws and first fill of liquid soap. Basic price is Rs 1600 per piece.</td>
</tr>
<tr>
<td>77</td>
<td><strong>Automatic Hand Drier</strong></td>
</tr>
<tr>
<td></td>
<td>Supplying and fixing approved make Automatic Hand drier Sensor operated working on 230V electric supply complete including wiring. Basic price is Rs 8000 per piece.</td>
</tr>
<tr>
<td>78</td>
<td><strong>SOIL PIPES</strong></td>
</tr>
<tr>
<td></td>
<td><strong>40 mm dia UPVC Pipe</strong></td>
</tr>
<tr>
<td></td>
<td>Supplying, laying, jointing, testing and commissioning 40 mm dia approved make UPVC pipes class III 6 Kg/cm2 with solvent cement joints confirming to IS 4985 for kitchen sink, wash basin outlets &amp; anti syphonage pipes. The quoted rate shall include necessary chasing in walls making good the same in C.M. 1:4, necessary fittings viz., elbows, tees etc., including M.S angle with G.I clamps complete.</td>
</tr>
<tr>
<td>79</td>
<td><strong>50 mm dia UPVC Pipe</strong></td>
</tr>
<tr>
<td></td>
<td>Specification same as above item no 78 but with 50 mm dia UPVC pipe</td>
</tr>
<tr>
<td>80</td>
<td><strong>63 mm dia UPVC Pipe</strong></td>
</tr>
<tr>
<td></td>
<td>Specification same as above item no 78 but with 65 mm dia UPVC pipe</td>
</tr>
<tr>
<td>81</td>
<td><strong>75 mm dia UPVC Pipes -SWR grade</strong></td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>82</td>
<td><strong>110 mm dia UPVC Pipes - SWR grade</strong></td>
</tr>
<tr>
<td>83</td>
<td><strong>160 mm dia UPVC Pipes - SWR grade</strong></td>
</tr>
<tr>
<td>84</td>
<td><strong>Floor Trap</strong></td>
</tr>
<tr>
<td>85</td>
<td><strong>Gully Traps</strong></td>
</tr>
<tr>
<td>86</td>
<td><strong>Inspection Chambers</strong></td>
</tr>
<tr>
<td>87</td>
<td><strong>Brick Masonry Manhole</strong></td>
</tr>
<tr>
<td>88</td>
<td><strong>MS Foot Rests</strong></td>
</tr>
<tr>
<td>----</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>Providing MS Foot rests including fixing in manhole 20x20x10 cm cement concrete blocks 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20mm nominal size) as per standard design with 20x20mm square bar.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>89</th>
<th><strong>Core Cutting Slabs for 125mm pipes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing, Supplying &amp; Drilling/Core Cutting of required dia outlets using low vibration mechanical means up to 125 mm dia. Cost to include identification of embedded reinforcement using proformeter, closing of core cut using self sealing non-shrink grouts of approved make either single or double component with necessary form work, staging, tools, etc.,</td>
</tr>
</tbody>
</table>

- RCC slabs (115mm to 200mm Thick) a) For 125 mm dia pipes

**WATER SUPPLY SYSTEM:**

<table>
<thead>
<tr>
<th>90</th>
<th>Concealed 15 mm nominal outer dia. Pipes.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing and fixing Chlorinated Polyvinyl (CPVC) Pipes, having thermal stability for hot &amp; cold water supply including all CPVC plain &amp; brass threaded fittings, fixing the pipe with clamps at 1.00m spacing. This includes jointing of pipes &amp; fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in charge. Concealed work including cutting chases and making good the walls etc. All hot pipes shall be thermally insulated with thermal insulation- 9 mm nitrile rubber or equivalent for the entire length.</td>
</tr>
</tbody>
</table>

<p>| 91 | Specification same as item 90 but with 20 mm nominal outer dia. Pipes. |</p>
<table>
<thead>
<tr>
<th></th>
<th>Specification same as item 90 but with 25 mm nominal outer dia. Pipes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>92</td>
<td>25 mm dia CPVC pipe - Exposed on wall.</td>
</tr>
<tr>
<td>93</td>
<td>Supplying, installing, fixing, jointing, testing and commissioning of 25 mm dia chlorinated Polyvinyl chloride (CPVC) pipes, having thermal stability for hot &amp; cold water supply including all CPVC plain &amp; brass threaded fittings including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes &amp; fittings with one step CPVC solvent cement and testing of joints complete as per direction of Engineer in Charge. Internal work - Exposed on wall. The item include providing any scaffolding for doing the work.</td>
</tr>
<tr>
<td>94</td>
<td>32 mm dia</td>
</tr>
<tr>
<td>95</td>
<td>Specification same as item 93 but with 32 mm dia CPVC pipes</td>
</tr>
<tr>
<td>96</td>
<td>40 mm dia</td>
</tr>
<tr>
<td>97</td>
<td>Specification same as item 93 but with 40 mm dia CPVC pipes</td>
</tr>
<tr>
<td>98</td>
<td>50 mm dia</td>
</tr>
<tr>
<td>99</td>
<td>Specification same as item 93 but with 50 mm dia CPVC pipes</td>
</tr>
<tr>
<td>100</td>
<td>63 mm dia</td>
</tr>
<tr>
<td>101</td>
<td>Specification same as item 93 but with 63 mm dia CPVC pipes</td>
</tr>
<tr>
<td>102</td>
<td>50 mm nominal outer dia. External works</td>
</tr>
<tr>
<td>103</td>
<td>Providing and fixing Chlorinated Polyvinyl (CPVC) 50 mm nominal outer dia. Pipes having thermal stability for hot &amp; cold water supply including all CPVC plain &amp; brass threaded fittings i/c fixing the pipe with clamps at 1.00m spacing. This includes jointing of pipes &amp; fittings with one step CPVC solvent cement, trenching, refilling &amp; testing of joints complete as per direction of engineer in charge. External work.</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>99</td>
<td>25 mm nominal bore GM Gate Valve</td>
</tr>
<tr>
<td></td>
<td>Supply &amp; fixing 25 mm dia NB gun metal gate value in the water supply system with all accessories &amp; required hardware in the CPVC pipes as per approved make, drgs and instructions of EIC.</td>
</tr>
<tr>
<td>100</td>
<td>32 mm nominal bore GM Gate Valve</td>
</tr>
<tr>
<td></td>
<td>Supply &amp; fixing 32 mm dia NB gun metal gate value in the water supply system with all accessories &amp; required hardware in the CPVC pipes as per approved make, drgs and instructions of EIC.</td>
</tr>
<tr>
<td>101</td>
<td>40 mm nominal bore GM Gate Valve</td>
</tr>
<tr>
<td></td>
<td>Supply &amp; fixing 40 mm dia NB gun metal gate value in the water supply system with all accessories &amp; required hardware in the CPVC pipes as per approved make, drgs and instructions of EIC.</td>
</tr>
<tr>
<td>102</td>
<td>50 mm nominal bore GM Gate Valve</td>
</tr>
<tr>
<td></td>
<td>Supply &amp; fixing 50 mm dia NB gun metal gate value in the water supply system with all accessories &amp; required hardware in the CPVC pipes as per approved make, drgs and instructions of EIC.</td>
</tr>
<tr>
<td>103</td>
<td>65 mm nominal bore GM Gate Valve</td>
</tr>
<tr>
<td></td>
<td>Supply &amp; fixing 65 mm dia NB gun metal gate value in the water supply system with all accessories &amp; required hardware in the CPVC pipes as per approved make, drgs and instructions of EIC.</td>
</tr>
<tr>
<td>104</td>
<td>20 mm dia nominal bore brass ball valve</td>
</tr>
<tr>
<td></td>
<td>Providing and fixing 20 mm dia NB ball valve (brass) of approved quality including necessary hardware, High or low pressure, with plastic floats complete as per approved make, drgs and instructions of EIC.</td>
</tr>
<tr>
<td>105</td>
<td>P.C.C. pedestals</td>
</tr>
<tr>
<td></td>
<td>Supplying and fixing in position P.C.C. pedestals 400x230x230mm with MS brackets &amp; GI clamps for laying pipes on terrace. The pedestals are required for laying pipes &amp; cables exceeding 80 mm dia. But not exceeding 300 mm dia. The item to be completed with all shuttering, de-shuttering, one coat of plaster which will be paid separately, complete as per specification, drgs &amp; instructions from EIC</td>
</tr>
<tr>
<td>106</td>
<td>32 mm dia -, outlet/ vent/ over flow pipes</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>Supplying, fixing and testing 32 mm inlet, outlet, vent and over flow GI C class pipes for overhead tank, approx. size 0.5m, with PVC rungs, etc complete. All puddle flanges to be hot dip galvanized as shown in the drawing attached technical specifications &amp; instructions from EIC.</td>
</tr>
<tr>
<td>107</td>
<td>50 mm dia -, outlet/ vent/ over flow pipes</td>
</tr>
<tr>
<td></td>
<td>Supplying, fixing and testing 50 mm inlet, outlet, vent and over flow GI C class pipes for overhead tank, approx. size 0.5m, with PVC rungs, etc complete. All puddle flanges to be hot dip galvanized as shown in the drawing attached technical specifications &amp; instructions from EIC.</td>
</tr>
<tr>
<td>108</td>
<td>65 mm dia -, outlet/ vent/ over flow pipes</td>
</tr>
<tr>
<td></td>
<td>Supplying, fixing and testing 65 mm inlet, outlet, vent and over flow GI C class pipes for overhead tank, approx. size 0.5m, with PVC rungs, etc complete. All puddle flanges to be hot dip galvanized as shown in the drawing attached technical specifications &amp; instructions from EIC.</td>
</tr>
<tr>
<td>109</td>
<td>80 mm dia -, outlet/ vent/ over flow pipes</td>
</tr>
<tr>
<td></td>
<td>Supplying, fixing and testing 80 mm inlet, outlet, vent and over flow GI C class pipes for overhead tank, approx. size 0.5m, with PVC rungs, etc complete. All puddle flanges to be hot dip galvanized as shown in the drawing attached technical specifications &amp; instructions from EIC.</td>
</tr>
<tr>
<td>110</td>
<td>100 mm dia -, outlet/ vent/ over flow pipes</td>
</tr>
<tr>
<td></td>
<td>Supplying, fixing and testing 100 mm inlet, outlet, vent and over flow GI C class pipes for overhead tank, approx. size 0.5m, with PVC rungs, etc complete. All puddle flanges to be hot dip galvanized as shown in the drawing attached technical specifications &amp; instructions from EIC.</td>
</tr>
<tr>
<td>111</td>
<td>Manhole frame and cover 600 X 600mm -</td>
</tr>
<tr>
<td></td>
<td>Supply &amp; fixing 600 mm x 600 mm manhole with CI frame and heavy duty cover applicable for the overhead tank application of approved make complete as shown in the drawing attached technical specifications &amp; instructions from EIC.</td>
</tr>
<tr>
<td>112</td>
<td>PVC rungs</td>
</tr>
<tr>
<td></td>
<td>Supply &amp; installation of PVC rungs of 25 mm Thick x 175 mm wide x 265 mm length reinforced inside with 10 mm steel rod bent in U/approved shape to be used as footsteps in UG Sump tank, Overhead tanks &amp; Man Holes with necessary civil work</td>
</tr>
<tr>
<td>113</td>
<td>Submersible pump Basement Sump to Overhead Tank</td>
</tr>
</tbody>
</table>
Supplying, installing, testing and commissioning approved make Submersible pump for pumping water from the underground sump to OHWT made of C.I Construction suitable for building application as per attached specification. The quoted rate shall also include for providing necessary safety devices viz. dry run protection, over load relays etc., complete working on 230V, 50Hz, 1Ph, with starter & pump panels etc. the rate shall be inclusive of all necessary fittings including foundation bolts, grouting the pumps and required connection with the pipes

Duty of Pump :

7.0cum/hr @ 50.0m Head

1 No. Working + 1 No. Stand By .Payment will be done as nos and the rates of common facilities along with pump should be considered by the vendor while quoting for the item.

114 Submersible pump Basement Sump to Drain

Supplying, installing, testing and commissioning approved make Submersible pump for pumping out water from basement sump to drain made out of C.I Construction suitable for building application as per attached specification. The quoted rate shall also include for providing necessary safety devices viz. dry run protection, over load relays etc., complete working on 230V, 50Hz, 1Ph, with starter & pump panels. The

Duty of Pump :

5.0cum @ 15.0m Head

1 No. Working + 1 No. Stand By Payment will be done as nos and the rates of common facilities along with pump should be considered by the vendor while quoting for the item.

115 4 core 1.5sqmm copper armoured cable

Supply & laying and termination of 4 core 1.5sqmm copper armoured cable for control instruments to be laid in a 32mm dia. PVC 6Kg/sqcm pipes including the 32 mm pipes and its accessories.

116 Grease Trap

Providing and constructing Grease trap in BBM 230mm thick in CM 1:4, neatly plastered in CM 1:4 on both internal and External sides, installing SS tray with suitable handle, FRC Manhole frame and cover 600mmx600mm setin CC 1:2:4, Baffles etc., complete as per drawings. Size : 900x600x1250mm
# Submersible pump (From Pump Room Sump to Drain)

Supplying, installing, testing and commissioning approved make Submersible pump for pumping from pump room sump to drain made of C.I Construction suitable for building application. The quoted rate shall also include for providing necessary safety devices viz. dry run protection, over load relays etc., complete working on 230V, 50Hz, 1Ph, with starter.

**Duty of Pump:**

1.0 Lps @ 15.0m Head

1 No. Working + 1 No. Stand By Payment will be done as nos and the rates of common facilities along with pump should be considered by the vendor while quoting for the item.

# Solar water heater of 500 Lts capacity

Supplying, Installing, Testing and Commissioning of Solar water heater of 500 Lts capacity complete include in solar collector panels, SS storage drum made of S.S 304 with insulation and cladding and back up electrical heating element, frontal piping, etc, complete as per specification. The installation has to be done by the manufacturer including the piping connection and insulation.

# RAIN WATER HARVESTING SYSTEM:

## Masonary chamber

Providing masonry chamber 60X60X75 cm, inside with 75 class designation brick work in cement mortar 1:4 (1 cement : 4 coarse sand) for sluice valve, with C.I surface box 100 mm. Top diameter 160 mm bottom diameter and 180 mm deep (inside) with chained lid and RCC top slab 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) necessary excavation foundation concrete 1:5:10 (1 cement: 5 fine sand : 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12 mm thick finished with a floating coat of neat cement complete as per standard design:

## Hume Pipes - NP2 class

Providing and laying non-pressure NP2 class (light duty) R.C.C pipes 300 mm dia with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete:
| 121 | Providing & construction Rain water recharge pit as per relevant construction drawing attached as per Indian standards. The pit shall be construction of RCC Rings with RCC top slab and PCC bed at bottom and Recharge pit Filling of 40mm jelly & sand. The item to be completed as per detailed specifications & drgs and instructions from EIC.  
Size of Recharge pit: 1.2mdia x 3.0m depth |
| 122 | **Sand Filter**  
Supplying, installing, testing and commissioning approved make Raw Water Pressure sand filter with necessary Accessories complete with Frontal piping, valves, suitable supports for mounting pressure gauges, orifice plates. The Filter shall be made of FRP with necessary protective coating. The cost of filter shall also include initial charge of underbed & multi-grade filter media to suit the requirement etc., complete as per standards. Max. working Pressure = 3.0kg/sqcm. The Max flow rate = 6.0cum/hr. |
| 123 | **Activated Carbon Filter**  
Supplying, installing, testing and commissioning approved make activated carbon filter in MS vessel construction with internals, electrical control system complete with Frontal piping, valves, suitable supports for mounting, pressure gauge, orifice plate etc., complete as per the detailed specification for the efficient working of system. The maximum working Pressure shall be 3.5 Kg/Sqcm. Max flow rate = 6.0cum/hr. |
| 124 | **Centrifugal Monoblock Pump**  
Supplying, installing, testing and commissioning approved make centrifugal monobloc pumps for Filter feed water inside the Pump room. The quoted rate shall include Automatic control panel with level switches, starters, dry run preventer, O/L relays, necessary wiring up to the pumps and control panel, the pumps shall run 415V 50Hz electric supply, foot valve, NRV of Dia 40 mm etc. Complete. 1no. working+ 1no.standby  
Duty of pump = 5.0cum/hr @ 30.0m head. |
| 125 | **MISSCELLANIOUS ITEMS**  
**STRUCTURAL STEEL**  
Supply, Fabrication, Erection of structural steel confirming to IS 2062 including 2 coats of red oxide primer & 2 coats of approved enamel paint of Steel items including all channels, suspension supports, steel plate, anchor bolts, cross angles, brackets, etc. including grouting, welding, tools, tackles as required etc. The payment shall be made for the actual quantities measured. This item shall be operated for cable trenches, |
panel, DB base frames, chequered plate supports in trench, vertical tray supports and other miscellaneous structural works.

<table>
<thead>
<tr>
<th>126</th>
<th>SOLAR PANEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply, erection, testing and commissioning of MNRE approved 2KVA, SOLAR PACK for Internal and common area Lighting with the following as per the attached detailed specification, drgs &amp; instructions from EIC.</td>
<td></td>
</tr>
<tr>
<td>General Grid connect Rooftop system with Crystalline Silicon Module cells of suitable capacity.</td>
<td></td>
</tr>
<tr>
<td>Grid connect Solar PV Inverter.</td>
<td></td>
</tr>
<tr>
<td>DC input and AC output for 230V, 50 Hz, Max. Ac out Put current 10A,</td>
<td></td>
</tr>
<tr>
<td>Output Current THD &lt;3% at nominal power</td>
<td></td>
</tr>
<tr>
<td>Power Factor 0.99 at nominal Power</td>
<td></td>
</tr>
<tr>
<td>IP54 (Outdoor)</td>
<td></td>
</tr>
<tr>
<td>LCD Display</td>
<td></td>
</tr>
<tr>
<td>Standard Communication Interfaces</td>
<td></td>
</tr>
</tbody>
</table>

**FIRE HYDRANT & SPRINKLER SYSTEM.**

<table>
<thead>
<tr>
<th>127</th>
<th>Fire pipeline 150mm nominal dia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplying, fixing and testing of 150 mm dia approved make Heavy quality (Class ‘C’) MS pipes with ISI brand Malleable specials confirming to IS 1239 PI &amp; II such as tees, elbows, check nuts, unions, flanges, nipples, etc. including cutting, threading, welding, fixing in/on walls, ceiling (using HI-TECH pipe supports/ M.S angles iron brackets), underground, etc., as per drawing. The quoted rate shall include for chasing the walls, making bore in walls and making good the chased surfaces in cement mortar, painting the exposed fire hydrant pipes with one coat of primer and two coats of enamel paint (Fire red) of approved color etc. Complete.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire pipeline 100mm nominal dia</td>
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</tr>
<tr>
<td>128</td>
<td>Specification same as item no 127 but with 100 mm dia pipe</td>
</tr>
<tr>
<td></td>
<td>Fire pipeline 80mm nominal dia</td>
</tr>
<tr>
<td>129</td>
<td>Specification same as item no 127 but with 80 mm dia pipe</td>
</tr>
<tr>
<td></td>
<td>Fire pipeline 63mm nominal dia</td>
</tr>
<tr>
<td>130</td>
<td>Specification same as item no 127 but with 63 mm dia pipe</td>
</tr>
<tr>
<td></td>
<td>Fire pipeline 50mm nominal dia</td>
</tr>
<tr>
<td>131</td>
<td>Specification same as item no 127 but with 50 mm dia pipe</td>
</tr>
<tr>
<td></td>
<td>Fire pipeline 40mm nominal dia</td>
</tr>
<tr>
<td>132</td>
<td>Specification same as item no 127 but with 40 mm dia pipe</td>
</tr>
<tr>
<td></td>
<td>Fire pipeline 32mm nominal dia</td>
</tr>
<tr>
<td>133</td>
<td>Specification same as item no 127 but with 32 mm dia pipe</td>
</tr>
<tr>
<td></td>
<td>Fire pipeline 25mm nominal dia</td>
</tr>
<tr>
<td>134</td>
<td>Specification same as item no 127 but with 25 mm dia pipe</td>
</tr>
<tr>
<td></td>
<td>Butterfly valves 100mm dia</td>
</tr>
<tr>
<td>135</td>
<td>Supplying, installing, testing and commissioning approved make CI butterfly valves of 100 mm dia confirming to IS13039 with necessary nuts &amp; bolts etc., complete as per</td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>136</td>
<td>Butterfly valves 150mm dia</td>
</tr>
<tr>
<td>137</td>
<td>25mm dia AIR RELEASE VALVE with accessories</td>
</tr>
<tr>
<td>138</td>
<td>Fire hose cabinet with accessories</td>
</tr>
<tr>
<td></td>
<td>i 63mm dia instantaneous 'pattern Single headed 'hydrant 'valve</td>
</tr>
<tr>
<td></td>
<td>ii 2 length of 15M. 63mm dia 'CP hose with coupling</td>
</tr>
<tr>
<td></td>
<td>iii 1 no. brass branch pipe with nozzle</td>
</tr>
<tr>
<td></td>
<td>iv 1no. 19mm reinforced rubber hose reel 30.m long with M.S. drum.</td>
</tr>
<tr>
<td></td>
<td><strong>FIRE FIGHTING APPLIANCES</strong></td>
</tr>
<tr>
<td>139</td>
<td>Carbon-di- oxide type Capacity: 2 kg.</td>
</tr>
<tr>
<td>140</td>
<td>ABC Capacity : 5Kg.(Car parking area)</td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
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</tr>
<tr>
<td>141</td>
<td>Supply &amp; fixing of 5 kg DCP as per relevant Indian standards and attached specifications.</td>
</tr>
<tr>
<td>142</td>
<td>2 Fire buckets with stand (Car parking area)</td>
</tr>
<tr>
<td>143</td>
<td>Supply &amp; fixing of fire buckets with sand as per relevant Indian standards and attached specifications.</td>
</tr>
<tr>
<td>144</td>
<td>Water Carbon-di-oxide (Lobby area)</td>
</tr>
<tr>
<td>145</td>
<td>Supply &amp; fixing of water Co2 extinguishers as per relevant Indian standards and attached specifications.</td>
</tr>
<tr>
<td>146</td>
<td>100 mm nominal dia check valves</td>
</tr>
<tr>
<td>147</td>
<td>Supplying, fixing and testing approved make 100 mm carbon steel check valve slim seal PN16 with necessary flanges, nuts &amp; bolts etc., complete confirming to API/BIS as per drgs attached specifications and instructions of EIC.</td>
</tr>
<tr>
<td>148</td>
<td>Fire brigade inlet connection of 2 nos. 63mm dia hydrant valves</td>
</tr>
<tr>
<td>149</td>
<td>Supplying, installing and commissioning of fire brigade inlet connection comprising of 2 nos. 63mm dia hydrant valves with CI non-return valve, CI butterfly valve, connected to 100 mm dia fire hydrant wet riser pipe as per drgs and attached specifications.</td>
</tr>
<tr>
<td>150</td>
<td>Fire brigade inlet connection of 4 nos. 63mm dia hydrant valves</td>
</tr>
<tr>
<td>151</td>
<td>Supplying, installing and commissioning of fire brigade inlet connection comprising of 4 nos. 63mm dia hydrant valves with CI non-return valve, CI butterfly valve, connected to U.G.Sump as per drgs attached specifications and instructions of EIC.</td>
</tr>
<tr>
<td>152</td>
<td>150mm dia Y strainer with accessories</td>
</tr>
<tr>
<td>153</td>
<td>Supplying, installing, testing and commissioning approved make Cast Iron body brass 'Y' strainer with necessary flanges, nuts &amp; bolts etc., complete on to the suction line as per drgs attached specifications and instructions of EIC.</td>
</tr>
<tr>
<td>154</td>
<td>15mm brass sprinkler bulbs pendent type</td>
</tr>
<tr>
<td>155</td>
<td>Supplying, installing, testing and commissioning approved make 15mm brass sprinkler bulbs pendent type designed to operate at 68deg.C etc. complete as per drgs attached specifications and instructions of EIC.</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>148</td>
<td><strong>80 mm dia pipe fitted with single headed 63mm dia landing valve</strong></td>
</tr>
<tr>
<td></td>
<td>Supplying, installing, testing and commissioning of yard hydrant comprising of 80 mm dia pipe fitted with single headed 63mm dia landing valve as per design and providing 30.0m long 63mm dia CP hose in MS cabinet with glass door and supporting frame etc., complete as per drgs attached specifications and instructions of EIC.</td>
</tr>
<tr>
<td>149</td>
<td><strong>Providing, coating and Wrapping of 100 mm Dia GI pipe</strong></td>
</tr>
<tr>
<td></td>
<td>Providing, coating and Wrapping of 100 mm dia Buried G.I.pipes with 2 mm thick pipe coat including the all accessories as per drgs attached specifications and instructions of EIC.</td>
</tr>
<tr>
<td>150</td>
<td><strong>Sprinkler control valve complete 100mm dia.</strong></td>
</tr>
<tr>
<td></td>
<td>Supplying, installing, testing and commissioning of 100 mm dia hydraulically operated sprinkler control valve with water motor gond bell and trims as required, pressure gauges, drain valves, ball valves check valves, strainers etc. complete Alarm valve as per drgs attached specifications and instructions of EIC.</td>
</tr>
<tr>
<td>151</td>
<td><strong>Centrifugal pump Duty of pumps: 2280 LPM @ 70.0m Head.</strong></td>
</tr>
<tr>
<td></td>
<td>Supplying, Installing, testing &amp;commissioning approved make CI body Centrifugal pump end suction type coupled to Electric motor of suitable HP, fitted on a common base frame and rated for Fire duty. The quoted price shall also include 2nos Pressureguages fitted on suction &amp; delivery sides of the pump. The pumps shall run on 400/440V, 3ph, and 50Hz electric supply. Duty of pumps: 2280 LPM @ 70.0m Head. The item shall be executed as per attached specification, drugs and instruction from EIC.</td>
</tr>
<tr>
<td>152</td>
<td><strong>Fire hydrant multistage pump 2280Lpm @ 70.0m head</strong></td>
</tr>
<tr>
<td></td>
<td>Supplying, Installing, testing and commissioning of fire hydrant multistage pump capable of delivering 2280Lpm @ 70.0m head coupled to water cooled diesel engine of adequate HP. It shall be fitted with a radiator on a common base frame with complete ancillary units such as cooling system, non-return valve, Y strainer, fuel tank of adequate capacity, Pressure gauge, pressure switch, batteries etc., complete. The item shall be executed as per attached specification, drugs and instruction from EIC.</td>
</tr>
<tr>
<td>153</td>
<td><strong>Jockey pump of capacity 180.0 LPM at 70.0m. Head</strong></td>
</tr>
<tr>
<td></td>
<td>Supplying, Installing, testing and commissioning electrically driven jockey pump of capacity 180.0 LPM at 70.0m. Head with all the necessary accessories viz .Pressure gauges etc., operating on 3Ph 50Hz, 400/440V AC supply including foundation, bolts etc. Complete. The item shall be executed as per attached specification, drugs and instruction from EIC.</td>
</tr>
<tr>
<td>154</td>
<td><strong>Sprinkler Pump: 2280 LPM @ 90.0m Head</strong></td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Supplying, Installing, testing &amp; commissioning approved make Centrifugal pump end suction type coupled to Electric motor of suitable HP, fitted on a common base frame and rated for Fireduty. The quoted price shall also include 2 nos. Pressure gauges fitted on suction &amp; delivery sides of the pump. The pumps shall run on 400/440V, 3ph, and 50Hz electric supply. Duty of pumps: 2280 Lpm @ 90.0m Head. (Sprinkler Pump). The item shall be executed as per attached specification, drugs and instruction from EIC.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>155</th>
<th><strong>Common control panel for firefighting system</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supplying, installing, testing and commissioning COMMON control panel for firefighting system consisting of electrical motor driven 60HP Main fire pump, Diesel engine driven pump 60HP, Sprinkler pump 50HP &amp; Jockey pump 25HP including the starters, MCCB &amp; metering device capable of connecting to the BMS system with potential free contacts etc., MS power coated box control wiring etc. complete. The panel shall be completed as per attached specification, drgs &amp; instructions from EIC.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>156</th>
<th><strong>Stainless steel corrugated flexible pipe hose for dropping sprinklers</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stainless steel corrugated flexible pipe hose for dropping sprinklers below false ceiling, pipe shall be 16 bar pressure rating UL/FM approved and 1000 mm long 25 mm dia with union / reducer collar, clamps etc. as required. The item shall be executed as per attached specification, drugs and instruction from EIC.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>157</th>
<th><strong>Supply &amp; fixing of approved type rosette plates</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supply &amp; fixing of approved type rosette plates (Recessed type, in two pieces) for Sprinklers below false ceiling area. The Rosette shall be fabricated by M.S. plate of 2mm thick and the finish shall be powder coated and color shall be as approved by architects / clients. The item shall be executed as per attached specification, drugs and instruction from EIC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>158</th>
<th><strong>2 Runs of 1.5 Sq.mm unarmored cable.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supply, Laying, Testing and Commissioning of 2 Runs of 1.5 Sqmm FRLS unarmored cable including terminations on both ends. The item shall be executed as per attached specification, drugs and instruction from EIC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>159</th>
<th><strong>Twin core 1.5sq.mm cross - section flexible control cable</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supplying, installing, testing and commissioning approved make twin core 1.5sq.mm cross - section flexible control cable made of PVC insulated copper conductor. PVC sheathed. Confirming to IS 1554 etc., completed as per detailed specification. The item shall be executed as per attached specification, drugs and instruction from EIC</td>
</tr>
<tr>
<td>160</td>
<td><strong>25mm dia PVC conduit with accessories</strong></td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Supplying and laying of 25mm dia heavy duty PVC conduit with necessary fitting like elbow, collars etc. The item shall be executed as per attached specification, drugs and instruction from EIC</td>
</tr>
</tbody>
</table>

**SIGNAGES**

<table>
<thead>
<tr>
<th>161</th>
<th><strong>Fire Signage</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing &amp; fixing Signage with printed “IN CASE OF FIRE, USE STAIRS UNLESS INSTRUCTED OTHERWISE&quot; of 1.5cm height letters in red with white back ground. The size of the board shall be 25cm x 30 cm and shall be fixed at the height of 2 mts. from finished floor near Manual call points. The item to be completed as per drgs, specifications &amp; instructions from EIC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>162</th>
<th><strong>Floor identification signage</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing &amp; fixing Floor identification signage ( i.e., GROUND FLOOR …etc.) at each stair enclosure on every floor, indicating the floor number in words, lettering size shall be 7.5 cm with contrasting color from back ground. Size shall be 15cm x 60cm. The item to be completed as per drgs, specifications &amp; instructions from EIC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>163</th>
<th><strong>Signage&quot; FIRE ORDER&quot;</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Providing and fixing in position the signage’s “FIRE ORDER&quot; it should contain the following matter on 3mm thick &quot;Opaque&quot; PVC foam board of computerized cut, PVC non-reflective self-adhesive vinyl painted foam board of 3’ x 4’.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>164</th>
<th><strong>GRIHA Compliance</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The scope of this item deals with the Commitment &amp; Compliance to Green Building norms as per GRIHA for achieving the 11 points under the criteria assigned to the contractor as per the Technical specifications during the construction of the building. This payment shall be released upon achievement of all the points. The scope of the work is given in the attached technical specifications and no money will be released unless contractor attains all the points.</td>
</tr>
</tbody>
</table>

| 165 | **Supply of Passenger Lifts (10 (TEN) / 680KG capacity)** |
Design, Supply of the following automatic machine room less elevators having 9 stops/ 9 landing (STILT, first to 7 Floors, Terrace floor) and all door opening on same side having approx. 25mtr travel, speed of 1.0 mtr/sec speed, and with variable voltage variable frequency (VVVF) drive, microprocessor based control system, automatic rescue device, anti-failure system, car and center opening power door, Duplex full collective type of control having headroom height maximum up to 4800mm with emergency light and alarm, intercom telephone, position indicator, direction indicator in the car and on all floors. The control system has to be provided with necessary soft/hard points capable of connecting to building automation system. LIFT OF 10 (TEN) PASSENGER / 680KG CAPACITY - GEAR LESS, MACHINE ROOM LESS - as per technical specification attached.

**166 Installation of Passenger Lifts (10 (TEN) / 680KG capacity)**

Installation, testing & commissioning of following automatic machine room less elevators having 9 stops/ 9 landing (STILT, first to 7 Floors, Terrace floor) and all door opening on same side having approx. 25mtr travel, speed of 1.0 mtr/sec speed, and with variable voltage variable frequency (VVVF) drive, microprocessor based control system, automatic rescue device, anti-failure system, car and center opening power door, Duplex full collective type of control having headroom height maximum up to 4800mm with emergency light and alarm, intercom telephone, position indicator, direction indicator in the car and on all floors. The control system has to be provided with necessary soft/hard points capable of connecting to building automation system. LIFT OF 10 (TEN) PASSENGER / 680KG CAPACITY - GEAR LESS, MACHINE ROOM LESS - as per technical specification attached. The item also include obtaining statutory approval for installation and running of lifts from the required central/state agency.

**167 Supply of Car Hoist**

Design, fabrication & Supply of Car Hoist System for single car of approved make for taking car to the basement with platform with Four Column supports rigidly grouted to the floor with anchor bolts on a leveled concrete floor with a pallet for car lift. The movement of the pallets is through chain system, with necessary mounting structural and other safety devices as per detailed specification. The item to be completed as detailed specifications, drgs and instructions of EIC. The loading & unloading and keeping the supply items in proper & safe place will be in the scope of the contractor till commission and handing over the system to HPCL.

**168 Supply of Hydraulic double stack parking system**

Design, Fabrication, Supply of Hydraulic double stack parking system as per approved manufacturer and as per detailed specifications mentioned in the technical specifications.

**169 Installation of Car Hoist**
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Installation</strong>, testing &amp; commissioning of the supplied Car Hoist system including the supports, pallet and necessary control &amp; safety system as per attached specification, drgs and instructions from EIC. The loading &amp; unloading and keeping the supply items in proper &amp; safe place will be in the scope of the contractor till commission and handing over the system to HPCL. The item also include obtaining statutory approval for installation and running of lifts from the required central/state agency.</td>
<td></td>
</tr>
<tr>
<td><strong>Installation of Stacked Car Parking</strong></td>
<td></td>
</tr>
<tr>
<td>Installation, testing and commissioning of the Stacked Car Parking system for the basement, stilt and other areas as per manufactures specification, drugs, detailed technical specification and local development authority’s by laws and instruction of EIC. The item also include obtaining statutory approval for installation and running of stacked car parking from the required central/state agency.</td>
<td></td>
</tr>
<tr>
<td><strong>Pervious Concrete with recharge bed</strong></td>
<td></td>
</tr>
<tr>
<td>Providing &amp; laying Controlled Pervious cement concrete using stone aggregates, cement with no fines with admixtures, additives of approved manufacturer like BASF/Equivalent as per mix design (in the scope of the contractor) at places including providing recharge bed on soil for storm water drains / recharge pit / other places as per instruction with 40% air voids, fabricating and erecting form work, preparation and placing wherever needed/ specified as per drawing including striking/ de-shuttering. Air Voids should be in range of 15 to 20% or more. The quantity measured will be in terms of cubic volume of pervious concrete.</td>
<td></td>
</tr>
<tr>
<td><strong>Autoclave Aerated Concrete (AAC) Blocks</strong></td>
<td></td>
</tr>
<tr>
<td>Providing and constructing Autoclave Aerated cement concrete (AAC) Block masonry in cement mortar 1:6 for full wall and 1:4 with RCC bands in every fourth layer for half wall using defect less, sharp edged table molded, uniform size, approved quality blocks adequately soaked in water before use for super structure etc., including racking, scaffolding, curing etc., complete as directed. Note-MASONRY- 30% of PPC to be replaced by Fly ash for all masonry works as per GRIHA</td>
<td></td>
</tr>
<tr>
<td><strong>Thermal insulation for roof</strong></td>
<td></td>
</tr>
<tr>
<td>Providing and laying 75 mm thick XPS (extruded polystyrene sheets) interlocking/shiplap joints over the water proofing layer. XPS layer shall have R value of 15 hr.ft²degree F/btu or more. The top to be finished with 200 or more GSM poly propylene Geo textile layer.</td>
<td></td>
</tr>
</tbody>
</table>
4. UNPRICED BID
UNPRICED BID FOR CONSTRUCTION OF OFFICE BUILDING AT LUCKNOW

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>DESCRIPTION OF THE WORK</th>
<th>UNIT</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Excavation for Lift up to 1.5m</td>
<td>Cum</td>
<td>820.00</td>
</tr>
<tr>
<td>2</td>
<td>Excavation 1.5m to 3.0m depth</td>
<td>Cum</td>
<td>710.00</td>
</tr>
<tr>
<td>3</td>
<td>Excavation 3.0m depth to 4.5m</td>
<td>Cum</td>
<td>415.00</td>
</tr>
<tr>
<td>4</td>
<td>Excavation-drainage &amp; chamber</td>
<td>Cum</td>
<td>40.00</td>
</tr>
<tr>
<td>5</td>
<td>Excavation-Compound Wall &amp; Generator yard</td>
<td>Cum</td>
<td>35.00</td>
</tr>
<tr>
<td>6</td>
<td>Lift from 4.5m depth to 6.0m</td>
<td>Cum</td>
<td>370.00</td>
</tr>
<tr>
<td>7</td>
<td>Lift from 6.0m depth to 7.5m</td>
<td>Cum</td>
<td>190.00</td>
</tr>
<tr>
<td>8</td>
<td>Filling with excavated earth</td>
<td>Cum</td>
<td>190.00</td>
</tr>
<tr>
<td>9</td>
<td>Earth Disposal</td>
<td>Cum</td>
<td>1000.00</td>
</tr>
<tr>
<td>10</td>
<td>Anti Termite Treatment</td>
<td>Sq.m</td>
<td>33.00</td>
</tr>
<tr>
<td>11</td>
<td>Anti Termite Treatment with Reticulate pipes</td>
<td>Sq.m</td>
<td>300.00</td>
</tr>
<tr>
<td>12</td>
<td>PLAIN CEMENT CONCRETE 1:4:8</td>
<td>Cum</td>
<td>250.00</td>
</tr>
<tr>
<td>13</td>
<td>Screed Concrete 1:2:4</td>
<td>Cum</td>
<td>25.00</td>
</tr>
<tr>
<td>14</td>
<td>RCC for Footings &amp; Raft - M25</td>
<td>Cum</td>
<td>5.00</td>
</tr>
<tr>
<td>15</td>
<td>Columns &amp; Pedestals of Grade M35</td>
<td>Cum</td>
<td>10.00</td>
</tr>
<tr>
<td>16</td>
<td>Lintel, Chajja, Loft etc. - M25</td>
<td>Cum</td>
<td>5.00</td>
</tr>
<tr>
<td>17</td>
<td>Staircase waist slab &amp; beam - M25</td>
<td>Cum</td>
<td>5.00</td>
</tr>
<tr>
<td>18</td>
<td>Roof Slab, beams at all levels - M25</td>
<td>Cum</td>
<td>5.00</td>
</tr>
<tr>
<td>19</td>
<td>Retaining Wall - M25</td>
<td>Cum</td>
<td>5.00</td>
</tr>
<tr>
<td>20</td>
<td>RMC- for footing &amp; raft-M25</td>
<td>Cum</td>
<td>330.00</td>
</tr>
<tr>
<td>21</td>
<td>RMC for Columns &amp; Pedestals-M35</td>
<td>Cum</td>
<td>165.00</td>
</tr>
<tr>
<td>22</td>
<td>RMC Lintel, Chajja, Loft etc. M25</td>
<td>Cum</td>
<td>55.00</td>
</tr>
<tr>
<td>23</td>
<td>RMC Staircase Waist Slab &amp; beam M25</td>
<td>Cum</td>
<td>70.00</td>
</tr>
<tr>
<td>24</td>
<td>RMC for Roof Slab, beams - M25</td>
<td>Cum</td>
<td>900.00</td>
</tr>
<tr>
<td></td>
<td>Item Description</td>
<td>Unit</td>
<td>Rate</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>25</td>
<td>RCC for Retaining Wall - M25</td>
<td>Cum</td>
<td>100.00</td>
</tr>
<tr>
<td>26</td>
<td>Reinforcing Steel</td>
<td>TM</td>
<td>245.00</td>
</tr>
<tr>
<td>27</td>
<td>Structural Steel</td>
<td>TM</td>
<td>15.00</td>
</tr>
<tr>
<td>28</td>
<td>Door/Window Grills</td>
<td>Sq.m</td>
<td>20.00</td>
</tr>
<tr>
<td>29</td>
<td>Powder Coated Grills</td>
<td>Sq.m</td>
<td>150.00</td>
</tr>
<tr>
<td>30</td>
<td>SS Pipes- 50 mm Dia</td>
<td>Rmt</td>
<td>24.00</td>
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<tr>
<td>31</td>
<td>MS Louvers</td>
<td>Sq.m</td>
<td>15.00</td>
</tr>
<tr>
<td>32</td>
<td>Stone Masonary</td>
<td>Cum</td>
<td>25.00</td>
</tr>
<tr>
<td>33</td>
<td>230 mm brick masonry</td>
<td>Cum</td>
<td>460.00</td>
</tr>
<tr>
<td>34</td>
<td>Masonary for chambers</td>
<td>Cum</td>
<td>460.00</td>
</tr>
<tr>
<td>35</td>
<td>Half Brick wall Masonary</td>
<td>Sq.m</td>
<td>12.00</td>
</tr>
<tr>
<td>36</td>
<td>Half brick Masonary for Chambers</td>
<td>Sq.m</td>
<td>50.00</td>
</tr>
<tr>
<td>37</td>
<td>8 mm ceiling plaster</td>
<td>Sq.m</td>
<td>2200.00</td>
</tr>
<tr>
<td>38</td>
<td>12 m thk internal plaster</td>
<td>Sq.m</td>
<td>4000.00</td>
</tr>
<tr>
<td>39</td>
<td>20 mm external plaster</td>
<td>Sq.m</td>
<td>1700.00</td>
</tr>
<tr>
<td>40</td>
<td>Plaster for Drainage &amp; chambers</td>
<td>Sq.m</td>
<td>200.00</td>
</tr>
<tr>
<td>41</td>
<td>Toilet plaster</td>
<td>Sq.m</td>
<td>460.00</td>
</tr>
<tr>
<td>42</td>
<td>Drip Groove</td>
<td>Rmt</td>
<td>515.00</td>
</tr>
<tr>
<td>43</td>
<td>Toilet Water proofing</td>
<td>Sq.m</td>
<td>120.00</td>
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<tr>
<td>44</td>
<td>Water Proofing- Basement</td>
<td>Sq.m</td>
<td>652.00</td>
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<tr>
<td>45</td>
<td>Terrace Water Proofing</td>
<td>Sq.m</td>
<td>279.00</td>
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<tr>
<td>46</td>
<td>Light Weight Filling</td>
<td>Cum</td>
<td>92.00</td>
</tr>
<tr>
<td>47</td>
<td>Aluminum sliding windows</td>
<td>Sq.m</td>
<td>500.00</td>
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<tr>
<td>48</td>
<td>Door/Window Frames-Sal wood</td>
<td>Cum</td>
<td>1.00</td>
</tr>
<tr>
<td>49</td>
<td>Door/Window Frames-TW</td>
<td>Cum</td>
<td>1.00</td>
</tr>
<tr>
<td>50</td>
<td>TW Glass Railing</td>
<td>Sq.m</td>
<td>4.50</td>
</tr>
<tr>
<td>51</td>
<td>RMC M25 for base slab Sump</td>
<td>Cum</td>
<td>20.00</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Unit</td>
<td>Rate</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>52</td>
<td>RMC M25 for side walls Sump</td>
<td>Cum</td>
<td>50.00</td>
</tr>
<tr>
<td>53</td>
<td>RMC25 for Covering Slab Sump</td>
<td>Cum</td>
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<td>54</td>
<td>WaterPrf.plastering for side walls etc - Sump</td>
<td>Sq.m</td>
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<td>R.C.C M 25 for side walls (R.M.C)-OHW</td>
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<td>Health Faucet</td>
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<td>Liquid Soap Dispensers</td>
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<td>78</td>
<td>40 mm dia UPVC Pipe</td>
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<td>Item</td>
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<td>Brick Masonry Manhole</td>
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<td>MS Foot Rests</td>
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<td>Core Cutting Slabs for 125mm pipes</td>
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<td>25 mm dia CPVC pipe - Exposed on wall</td>
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<td>94</td>
<td>32 mm dia CPVC pipe - Exposed on wall</td>
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<td>Submersible pump PumpRoom Sump to Drain</td>
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<td>Solar water heater of 500 Lts capacity complete</td>
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<td>Masonary chamber</td>
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<td>Butterfly valves 100mm dia</td>
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<td>Butterfly valves 150mm dia</td>
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<td>25mm dia AIR RELEASE VALVE with accessories</td>
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<td>Fire hose cabinet with accessories</td>
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<td>Carbon-di- oxide type Capacity: 2 kg.</td>
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<td>ABC Capacity : 5Kg.(Car parking area)</td>
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<td>Water Carbon-di-oxide (Lobby area)</td>
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<td>100 mm nominal dia check valves</td>
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<td>2 nos. 63mm dia hydrant valves-Fire brigade inlet connection</td>
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<td>4 nos. 63mm dia hydrant valves-Fire brigade inlet connection</td>
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<td>150mm dia Y strainer with accessories</td>
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<td>15mm brass sprinkler bulbs pendent type</td>
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<td>80 mm pipe with single headed 63mm landing valve</td>
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<td>Providing, Coating &amp; Wrapping-100 mm Dia Gi pipe</td>
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<td>Fire hydrant multistage pump 2280 Lpm @ 70.0m head</td>
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<td>Jockey pump 180.0 Lpm at 70.0m Head</td>
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<td>Centrifugal pump 2280 Lpm @ 90.0m Head</td>
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<td>COMMON control panel for fire fighting system</td>
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<td>SS corrugated flexible sprinkler droppings</td>
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<td>Approved type rosette plates</td>
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<td>S.No.</td>
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<td>2 Runs of 1.5 Sqmm unarmoured cable.</td>
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<td>2C 1.5sq.mm C/S flexible control cable</td>
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<td>25mm dia PVC conduit with accessories</td>
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<td>Signage &quot;IN CASE OF.. OTHERWISE&quot;</td>
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<td>Floor identification signage</td>
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<td>163</td>
<td>Signage&quot; FIRE ORDER&quot;</td>
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<td>164</td>
<td>GRIHA Compliance</td>
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<td>165</td>
<td>Supply of Lift of 10 (TEN) Passenger / 630KG capacity</td>
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<td>Each</td>
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<tr>
<td>166</td>
<td>Installation of Lift of 10 (TEN) Passenger / 630KG capacity</td>
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<tr>
<td>167</td>
<td>Supply of Car Hoist</td>
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<td>Each</td>
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<td>168</td>
<td>Hydraulic double stack parking system</td>
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<td>169</td>
<td>Installation of Car Hoist</td>
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<td>Each</td>
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<tr>
<td>170</td>
<td>Installation of Stacked Car Parking</td>
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<td>171</td>
<td>Pervious Concrete with recharge bed</td>
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<td>172</td>
<td>Autoclave Aerated Concrete (AAC) Blocks</td>
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<td>173</td>
<td>Thermal Insulation for Roof</td>
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5. TIME SCHEDULE
DESCRIPTION OF WORK:

CONSTRUCTION OF A MULTI STOREYED GREEN OFFICE BUILDING (B+G+7) WITH ASSOCIATED SERVICES VIZ. SANITARY, FIRE FIGHTING, LIFTS, etc. & WORKS RELATED TO OBTAINING GRIHA RATING AT LUCKNOW HPCL’S NCZ OFFICE BUILDING PROJECT SITE

<table>
<thead>
<tr>
<th>PART</th>
<th>LOCATION</th>
<th>COMPLETION PERIOD</th>
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<tr>
<td>FROM DATE OF ISSUE OF FOI/LOI/PO</td>
<td>LUCKNOW NCZ OFFICE BUILDING</td>
<td>LUCKNOW, UTTAR PRADESH 15(FIFTEEN) MONTHS</td>
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</table>

The phased completion schedule is given in SCC

NOTE:

1) Time for completion shall be reckoned from the date of issue of Fax/ Letter of Intent/Purchase Order by HPCL.

2) Time for completion shall include the time required for mobilization, demobilization, carrying out the works as per requirements of Contract Document and instructions of HPCL Engineer-in-Charge.
6. **SPECIAL CONDITIONS OF CONTRACT**
1.0 **GENERAL**

1.1 Special Conditions of Contract (SCC) shall be read in conjunction with the General Conditions of Contract (GCC) also referred to as General Terms & Conditions of Works Contract, Schedule of Quantities, specifications of work, drawings and any other document forming part of this Contract wherever the context so requires.

1.2 Notwithstanding the sub-division of the document into these separate sections and volumes, every part of each shall be deemed to be supplementary of every other part and shall be read with and into the Contract so far as it may be practicable to do so.

1.3 Where any portion of the GCC is repugnant to or at variance with any provisions of the Special Conditions of Contract, then unless a different intention appears, the provision(s) of the Special Conditions of Contract shall be deemed to override the provision(s) of GCC only to the extent that such repugnancy or variations in the Special Conditions of Contract are not possible of being reconciled with the provisions of GCC.

1.4 Wherever it is stated in this Bidding Document that such and such a supply is to be affected or such and such a work is to be carried out, it shall be understood that the same shall be affected and/or carried out by the Contractor at his own cost, unless a different intention is specifically and expressly stated herein or otherwise explicit from the context. Contract Price shall be deemed to have included such cost.

1.5 The materials, design & workmanship shall satisfy the applicable relevant Indian Standards, the job specifications contained herein & codes referred to. Where the job specifications stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied. In the absence of any Standard / Specifications / Codes of practice for detailed specifications covering any part of the work covered in this bidding document, the instructions / directions of Engineer-in-Charge will be binding upon the Contractor.

1.6 In case of contradiction between relevant Indian standards, GCC, Special Conditions of Contract, Specifications, Drawings and Schedule of Rates, the following shall prevail in order of precedence.
i) Detailed Purchase Order along with Statement of Agreed Variations, if any, and its enclosures.

ii) Fax of Intent (FOI)/Letter of Intent (LOI)

iii) Schedule of Quantities and Technical specifications

iv) Special Conditions of Contract

v) Drawings/data sheets/job procedures

vi) Instructions to Bidders

vii) General Conditions of Contract

viii) Relevant Indian Standards.

1.7 SAFETY, FIRE FIGHTING AND SPECIFIC REQUIREMENTS OF HPCL

1.7.1 Contractor shall provide adequate number of standard lengths of IS Stamped Fire hoses, IS Stamped DCP Fire extinguishers, fire buckets with sand and nozzles. These items can be taken back by the Contractor after completion of work. Sand shall also be maintained dry by the Contractor with fresh supply, whenever required. Work permit may not be issued by HPCL in the absence of above items.

1.7.2 Safety Helmets shall be provided to all the employees of Contractor including that of his labour contractors.

1.7.3 Safety Belts and Harnesses shall be provided by the Contractor in adequate number for the workers working at heights and proper safety nets around the building.

1.7.4 Proper earthing shall be provided for all equipment and generators.

2.0 THE WORK

2.1 Scope of Work & Scope of Supply

2.1.1 The scope of work and Scope of Supply covered in this Contract will be as described in Scope of work provided in the Instructions to bidders, Schedule of Quantities, Technical Specifications, etc.

2.2 Time Schedule
The Completion period for this job shall be **15(FIFTEEN) Months** from the date of LOI.

2.2.1 Time is the essence of this Contract. The period of completion given includes the time required for mobilization as well as testing, rectifications, if any, retesting, demobilization and completion in all respects to the satisfaction of the Engineer-in-Charge.

2.2.2 A joint program of execution of work will be prepared by the Engineer-in-Charge and Contractor. This program will take into account the time of completion period of the Contract.

2.2.3 Monthly execution program will be drawn up by the Engineer-in-Charge jointly with the Contractor based on availability of materials, work fronts and the joint program of execution as referred to above. The Contractor shall scrupulously adhere to the Targets / Program by deploying adequate personnel, Construction Equipment, Tools and Tackles and also by Timely Supply of required materials coming within his scope of supply as per Contract. In all matters concerning the extent of target set out in the monthly program and the degree of achievement, the decision of the Engineer-in-Charge will be final and binding upon the Contractor.

2.2.4 Contractor shall give every day category-wise labour and equipment deployment report along with the progress of work done on previous day in the proforma prescribed by the Engineer-in-Charge.

2.3 **Measurement of Works**

2.3.1 Mode of measurement will be as specified in Specifications or SOR.

2.4 **Payment Terms**

2.4.1 Payment will be released within 15 days of submission of duly certified Running Account Bills at Disbursement section at Mumbai after deduction of WCST(Works Contract Sales Tax) or VAT whichever is applicable, IT(Income Tax) and any other statutory deduction as applicable from time to time, Any MRR(Materials Received Report- An internal document forwarded by HPCL Site –in-Charge/ Engineer to Disbursement Section along with Contractor’s Bill and duly certified measurement sheets for release of payment) Deductions, LD, etc. In case of Final Bill, Payment will be released within 45 days of submission of duly certified Final Bill along with all requisite documents, drawings, etc. Payment
break up for various items covered in SOR/PRICED BID is as indicated as Appendix 1 to SCC. No further alteration is permitted in approved payment break up.

2.5 **Temporary Works**

2.5.1 All temporary works, enabling works, including dewatering of surface and subsoil water, preparation and maintenance of temporary drains at the work site, preparation and maintenance of approaches to working areas, adequate lighting, wherever required, for execution of the work, shall be the responsibility of the Contractor and all costs towards the same shall be deemed to have been included in the quoted prices.

2.6 **Quality Assurance**

2.6.1 Detailed quality assurance programme to be followed for the execution of Contract under various divisions of works will be mutually discussed and agreed to.

2.6.2 The Contractor shall establish, document and maintain an effective quality assurance system as outlined in the specifications and various codes and standards.

2.6.4 The Owner/EIC or their representative shall reserve the right to inspect/witness, review any or all stages of work at shop/site as deemed necessary for quality assurance and/or timely completion of the work.

2.6.5 In case Contractor fails to follow the instructions of Engineer-in-Charge with respect to above clauses, next payment due to him shall not be released unless and until he complies with the instructions to the full satisfaction of Engineer-in-Charge

2.7 **Leads**

2.7.1 For the various works, in case of contradiction, leads mentioned in the Schedule of Quantities shall prevail over those indicated in the Technical specifications.
3.0     ROYALTY, INCOME TAX, SERVICE TAX AND PRICES

3.1     Royalty

3.1.1     All royalties etc., as may be required for any Borrow Areas, including right of way etc., to be arranged by Contractor shall be deemed to have been included in the quoted prices.

3.1.2     Contractor’s quoted rates should include the royalty on different applicable items as per the prevailing State Government rates. In case, Owner is able to obtain the exemption of royalty from the State Government the Contractor shall pass on the same to Owner for all the items involving royalty. Any increase in prevailing rate of royalty shall be borne by the Contractor at no extra cost to the Owner.

3.2     Income Tax

3.2.1     Income Tax at the prevailing rate as applicable from time to time shall be deducted from Contractor’s Bills as per Income Tax Act and quoted rates shall be inclusive of this. Owner will issue the TDS (Tax Deduction at Source) Certificate.

3.3     Firm Prices

3.3.1     The contract price shall remain firm and fixed till the completion of work in all respects and no escalation in prices on any account shall be admissible to the Contractor except for statutory variations as per General Terms and Conditions (GTC).

3.2     Provident Fund

3.3     4.1.1 The Contractor shall strictly comply with the provisions of Employees Provident Fund Act and register himself with Regional Provident Fund Commissioner (RPFC) before commencing work. The Contractor shall deposit Employees and Employers contributions to the RPFC every month. The Contractor shall furnish along with each Running bill, the challan/receipt for the payment made to the RPFC for the preceding month. The Contractor shall furnish the code...
number allotted by the RPFC Authority to the Engineer-in-Charge before commencing the work.

4.1.2 In case the RPFC challan / receipt, as above, is not furnished, Owner shall deduct 16% (sixteen percent) of the payable amount from Contractor’s running bill and retain the same as a deposit. Such retained amounts shall be refunded to Contractor on production of RPFC Challan / receipt for the period covered by the related running bill.

4.2 Labour License

4.2.1 Before starting of work, Contractor shall obtain a license from concerned authorities under the Contract Labour (Abolition and Regulation) Act 1970, and furnish copy of the same to Owner.

4.3 Labour Relations

4.3.1 In case of labour unrest/labour dispute arising out of non-implementation of any law, the responsibility shall solely lie with the Contractor and they shall remove/resolve the same satisfactorily at his cost and risk.

4.3.2 The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour and to preserve peace and protection of persons and property in the neighbourhoods of the Works against such conduct.

4.4 Employment of Local Labour

4.4.1 The Contractor shall ensure that local labour skilled and / or unskilled, to the extent available shall be employed in this work. In case of non-availability of suitable labour in any category out of the above persons, labour from outside may be employed.

4.4.2 The Contractor shall not recruit personnel of any category from among those who are already employed by other agencies working at site but shall make maximum use of local labour available.

4.5 Site Cleaning
4.5.1 The Contractor shall clean and keep clean the work site from time to time to the satisfaction of the Engineer-in-Charge for easy access to work site and to ensure safe passage, movement and working.

4.5.2 The Contractor shall dispose of the unserviceable materials, debris etc., to the earmarked area within the premises or any other location outside the premises as decided by the Engineer-in-Charge. No extra payment shall be paid on this account.

4.5.3 **Review/Approval of Drawings, Design and other documents submitted by Contractor**

4.5.3.1 HPCL/EIC will normally require and utilize a maximum time frame of seven (07) working days from the date of Receipt for Review/Approval of Drawings, Design and other documents submitted by Contractor. Upon Review of the submitted documents, HPCL may give their comments and ask for redesign/ resubmission after necessary rectifications/ modifications and the time frame of 7 working days will be applicable for same.

4.6 **Protection of Existing Facilities**

4.6.1 Contractor shall obtain all clearance (work permit) from the Owner, as may be required from time to time, prior to start of work. Work without permit shall not be carried out within the existing premises.

4.6.2 Contractor shall obtain plans and full details of all existing and planned facilities/services/utilities from the Owner and shall follow these plans closely at all times during the performance of work. Contractor shall be responsible for location and protection of all facilities/utilities and structures at his own cost.

4.6.3 Despite all precautions, should any damage to any structure / utility etc. occur, the Contractor shall contact the Owner / authority concerned and Contractor shall forthwith carry out repair at his expenses under the direction and to the satisfaction of Engineer-in-Charge and the Owner/concerned authority.

4.6.4 Contractor shall take all precautions to ensure that no damage is caused to the existing facilities etc., during construction. Existing structures/facilities/utilities damaged / disturbed during construction shall be repaired and restored to their original condition by Contractor after completion of construction to the complete satisfaction of Owner.
4.7 Work Front

4.7.1 The work involved under this Contract may include such works as have to be taken up and completed after other agencies have completed their jobs. The Contractor will be required and bound to take up as and when the fronts are available for the same and no claim of any sort whatsoever shall be admissible to the Contractor on this account. Only extension of time limit shall be admissible, if the availabilities of work fronts to the Contractor are delayed due to any reason not attributable to the Contractor and the same is clearly recorded.

4.8 Site Facilities

4.8.1 The Contractor shall arrange for the following facilities at site, for workmen deployed/engaged by him / his sub-contractor, at his own cost:

i) Arrangement for First Aid.
ii) Arrangement for clean & potable drinking water.
iii) Any other facility/utility as may be required under the Contract as per the existing legislation/regulations.

4.9 Contractor’s Site Office and Stores

4.9.1 Owner shall provide land only for contractor’s site office and stores and fabrication yard, if any at site. However, same shall be dismantled prior to submission of Final Bill. Also the office/stores, etc. to be relocated if found hindering the project in a planned manner.

4.9.2 The Contractor shall remove all temporary buildings / facilities etc., before leaving the site after completion of works in all respect.

4.10 Construction Power and Water

4.10.1 Owner shall not provide power and the Contractor shall be exclusively responsible to make his own arrangements for supply of power, without any extra cost to the Owner.

4.10.2 Water required for the works shall be arranged by the Contractor. The contractor has to make all necessary arrangement for drawing water including making temporary storage, pumping etc.
4.10.3 CEMENT:

Cement required for execution of the job under the entire scope of work (other than for Ready Mix Concrete where the cement is from the RMC manufacturer scope which will be supplied by contractor through RMC vendor) contained in this tender shall be supplied at provided at site by the contractor at his own cost. Contractor to include the cost of cement required for execution of various items included in this tender in their quoted rates. Cement shall be of 43/53 Grade PPC as specified in the technical specifications of Ultra Tech Cement/ Ambuja / ACC / Lafarge/Bindi/ Birla cement/approved equivalent Makes only and shall conform to IS relevent standards of latest edition. Contractor to produce Invoice Copy of every batch of cement procured at site to EIC. However, HPCL’s decision with regard to the specific brand of cement to be procured for the execution of the work shall be final and binding on the contractor. Testing of cement to be done at approved laboratory as per IS-456 standard and as per other IS Codes specific for the cement, etc.

Cement shall be procured and brought to site at least 15 days in advance. Sample from every batch of cement brought to site shall be tested for standard test as per the specification of relevant IS standards in approved Laboratory and Test Certificate shall be submitted to EIC for verification. Only after obtaining approval of EIC, cement shall be put into use. Manufacturer’s Batch Test Certificates backed by Factory’s Invoice for the batch will also be acceptable for approval of cement. Contractor shall bring cement well in advance before full consumption of previous lot. No claims for extension of completion period for stoppage of work on account of non-availability of cement / delays is testing procedures will be entertained/accepted by HPCL.

For all computation purposes, the theoretical cement consumption shall be considered as per IS standards. Cement cost shall be recovered for under-consumption at the penal rate of Rs.7000/- per MT. Empty cement bag shall be the property of the contractor. Theoretical weight of cement in a bag will be considered as 50 Kgs.

The contractor will be required to maintain a stock register for receipt, issuance and daily consumption of cement at site. Cement shall be regulated on the basis of 1st receipt to go as 1st issue. Cement not consumed within 3 months after bringing to site shall not be used and shall be removed from site with prior written permission of EIC.

All RA bills including the final bills will be accompanied by Cement Consumption Statements giving the detailed working of cement used.

Contractor shall construct suitable temporary go down at site for storage of cement under his lock and key. The contractor will be fully responsible for safe custody of cement.
HPCL will not entertain any claims by the Contractor for theft, loss or damages to cement. Contractor shall not remove from the site any cement bags at any time.

Permissible wastage shall be total 3% of the theoretical consumption. However, these wastage shall be considered in excess of the theoretical quantity required for the various items of work. No extra payment will be made towards this wastage and the same will be in the contractor’s account. The contractor shall be penalised for any under-consumption of cement at the rate of Rs. 7000/- per MT.

4.10.4 STEEL:

Entire quantity of reinforcement / structural steel required for the project shall be supplied and provided at site by the contractor at his own cost. Contractor to include the cost of steel reinforcement / structural steel required to be used against various items of this scope of work in their quoted rates. HPCL shall not supply any reinforcement / structural steel. The contractor shall make necessary arrangement at his own cost for unloading, storage of steel in the open duly fenced under locking arrangement. The reinforcement steel shall be procured from Tata/SAIL/RINL only and will produce invoice for the same to EIC for every batch of procurement along with Manufacturer’s Test Certificate.

In the case of steel reinforcement or structural steel the theoretical quantity of steel shall be taken as the quantity required as per design or as authorized by EIC /HPCL’s Engineer including authorized lap lengths/chairs etc. No further claim towards additional wastage due to lap length / full length bars or other consideration including rolling margin will be entertained. No payment will be made or measurement recorded for binding wires which shall be of 22 SWG gauge and shall be provided by the contractor.

For the purpose of dealing and accounting, only linear measurements will be taken and any difference in weight based on linear measurement and actual weight shall be to contractor’s account. Quoted rate shall be deemed to include the above and the wastage mentioned below. No claim whatsoever shall be entertained on account of wastage and difference in weight as referred to above.

All binding wires required for tying the reinforcement in position etc. will be supplied by the contractor. Cost of this binding wire and labour will be included in the item for binding and placing reinforcement in position.

It will be necessary that the contractor get the steel tested at his own cost at a Govt. approved laboratory as per the testing schedule or as per the EIC’s advise,
for strength and other properties specified in IS – 1786 latest edition before using it in the work.

The contractor will be required to maintain a register for recording details of steel receipt, steel utilized and balance at site.

Final bill will be accompanied by steel consumption statement.

In every case, it shall be the contractor’s responsibility to ensure the standard of quality and the correctness of quantity of steel procured at site by him.

The permissible wastage (wastage defined as bars having less than 0.3 mt. Length) shall be of 3% of theoretical consumption. Recovery for less consumption as per theoretical consumption will be recovered at Rs.50,000/- per MT. All scrap (scrap defined as pieces of steel bars measuring less than 3 mt. in length) shall be the property of the contractor. The wastage quantity shall not be considered to be included within the theoretical quantity and no extra shall be payable on account of wastage.

4.11 Construction

4.11.1 Rules and Regulations

4.11.2 Contractor shall observe in addition to Codes specified in respective specification, all national and local laws, ordinances, rules and regulations and requirements pertaining to the work and shall be responsible for extra costs arising from violations of the same.

5.0 Procedures

5.1 Various procedures and method statements to be adopted by Contractor during the construction as required as per the respective specifications shall be submitted to Engineer-in-Charge in due time for approval.

5.2 Security

5.2.1 As the premises will be protected area, entry into the area shall be restricted and may be governed by issue of photo gate passes. The Contractor shall arrange to obtain through the Engineer-in-Charge, well in advance, all necessary entry permits/gate passes for his staffs and labourers and entry
and exit of his men and materials shall be subject to vigorous checking by the security staff. The Contractor shall not be eligible for any claim or extension of time whatsoever on this account.

5.2.2 It shall be the responsibility of the contractor to safeguard all his materials/owned from theft, damage etc. For this purpose the contractor shall be allowed to keep his own security inside HPCL premises

5.3 Drawings and Documents

5.3.1 Drawings accompanying the Bidding Document are indicative of scope of work and issued for bidding purpose only. Purpose of these drawings is to enable the bidder to make an offer in line with the requirements of the owner.

5.4 Rounding off

5.4.1 All payments to and recoveries from the Contractor shall be rounded off to the nearest rupee. Wherever the amount to be paid/recovered consists of a fraction of a rupee (paise), the amount shall be rounded off to the next higher rupee if the fraction consists of 50 (fifty) paise or more and if the fraction of a rupee is less than 50 (fifty) paise, the same shall be ignored.

5.5 Contractor’s Billing System

5.5.1 HPCL will provide an approved format for Measurement sheets, Bill Summary and Bill Abstract. Contractor has to ensure that these data are updated for each subsequent RA and Final Bill.

5.5.1 HPCL will utilize these data for processing and verification of the Contractor’s bill.

5.6 Site Organization

5.6.1 The Contractor shall without prejudice to his overall responsibility to execute and complete the works as per specifications and time schedule progressively deploy adequate qualified and experienced personnel together with skilled/unskilled manpower and augment the same as decided by Engineer-in-Charge depending on the exigencies of work to suit the construction schedule without any additional cost to Owner.
5.6.2 The Contractor shall provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer-in-Charge may consider necessary for the proper fulfilling of the Contractor’s obligations under the Contract. Such superintendence shall be given by sufficient persons having adequate knowledge of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents) for the satisfactory and safe execution of the Work. The workmen deployed by the Contractor should also possess the necessary license etc., if required under the existing laws, rules and regulations.

5.7 Additional / Extra Works

Owner reserves the right to execute any additional works / extra works, during the execution of work, either by themselves or by appointing any other agency, even though such works are incidental to and necessary for the completion of works awarded to the Contractor.

5.8 Responsibility of Contractor

5.8.1 It shall be the responsibility of the contractor to obtain the approval for any revision and/or modifications decided by the contractor from the Owner / Engineer-in-Charge before implementation. Also such revisions and / or modifications if accepted / approved by the Owner / Engineer-in-Charge shall be carried out at no extra cost to the owner. Any change required during functional requirements or for efficient running of system, keeping the basic parameters unchanged and which has not been indicated by the contractor in the data / drawings furnished along with the offer shall be carried out by the contractor at no extra cost to the owner.

5.8.2 All expenses towards mobilization at site and demobilization including bringing in equipment, work force, materials, dismantling the equipment, clearing the site etc. shall be deemed to be included in the prices quoted and no separate payments on account of such expenses shall be entertained.

5.8.3 It shall be entirely the contractor’s responsibility to provide, operate and maintain all necessary construction equipment, steel scaffoldings and safety gadgets, cranes and other lifting tackles, tools and appliances to perform the work in a workman like and efficient manner and complete all the jobs as per time schedule.
5.8.4 Preparing approaches and working area for the movement of his men and machinery.

5.8.5 The procurement and supply in sequences and at the appropriate time of all materials, and consumables shall be entirely the contractor’s responsibility and his rates for execution of work will be inclusive of supply of all these items.

5.9 **Coordination with other agencies**

5.9.1 Contractor shall be responsible for proper coordination with other agencies operating at the site of work so that work may be carried out concurrently, without any hindrance to others. The Engineer – in – Charge shall resolve disputes, if any, in this regard, and his decision shall be final and binding on the Contractor.

5.10 **Underground and overhead structures**

5.10.1 The Contractor will familiarize himself with and obtain information and details from the Owner in respect of all existing structures, and utilities existing at the job site before commencing work. The Contractor shall execute the work in such a manner that the said structures, utilities, etc. are not disturbed or damaged, and shall indemnify and keep indemnified the Owner from and against any destruction thereof or damages thereto.

5.11 **Documents required with final bill**

5.11.1 Statement of final bills – issue of No Claim/ No Due Certificate

5.11.2 The Contractor shall furnish a No-Claim/No-Due declaration indicating that there are no balance dues to his sub-vendor/sub-contractors/labour contractors along with the Final Bill.

5.12 **Working hours**

5.12.1 Depending upon the requirement, time schedule / drawing/ programme and the target set to complete the job in time, the works may also have to continue beyond normal working hours/night hours / holidays or during such periods without causing any inconvenience to the neighbours/others with due permission from EIC, for which no extra claim shall be entertained. However for all such working contractor’s responsible representative shall be available at
site to receive the work permit to be issued by HPCL. Without responsible representative of the contractor, no work shall be allowed inside the premises.

6.0 TESTS, INSPECTION AND COMPLETION

6.1 Tests and Inspection

6.1.1 The Contractor shall carry out the various tests as enumerated in the technical specifications of this Bidding Document and technical documents that will be furnished to him during the performance of the work at no extra cost to the Owner.

6.1.2 All the tests either on the field or at outside laboratories concerning the execution of the work and supply of materials by the Contractor shall be carried out by Contractor at his cost.

6.1.3 The work is subject to inspection at all times by the Engineer-in-Charge. The Contractor shall carry out all instructions given during inspection and shall ensure that the work is being carried out according to the technical specifications of this bidding document, the technical documents that will be furnished to him during performance of work and the relevant codes of practice.

6.1.4 Compressed air for carrying out works, if required shall be arranged by the Contractor at his own cost.

6.1.5 For material supplied by Owner, Contractor shall carry out the tests, if required by the Engineer-in-Charge, and the cost of such tests shall be reimbursed by the Owner at actual to the Contractor on production of documentary evidence.

6.1.6 All results of inspection and tests will be recorded in the inspection reports, proforma of which will be approved by the Engineer-in-Charge. These reports shall form part of the completion documents. Any work not conforming to execution drawings, specifications or codes shall be rejected and the Contractor shall carry out the rectifications at his own cost.

6.2 Final Inspection

After completion of all tests as per specification the whole work will be subject to a final inspection to ensure that job has been completed as per
requirement. If any defect is noticed, the Contractor will be notified by the Engineer-in-Charge and he shall make good the defects with utmost speed. If however, the Contractor fails to attend to these defects within a reasonable time (time period shall be fixed by the Engineer-in-Charge) then Engineer-in-Charge may have defects rectified at Contractor’s cost.

6.3 **Inspection of Supply Items**

6.3.1 All inspection and tests on bought out items shall be made as required by specifications forming part of this contract. Various stages of inspection and testing shall be identified after receipt of Quality Assurance Programme from the contractor / manufacturer.

6.3.2 Inspection calls shall be given for association of Owner, as per mutually agreed programme in prescribed proforma, giving details of equipment and attaching relevant test certificates and internal inspection report of the contractor. All drawings, general arrangement and other contract drawings, specifications, catalogues etc. pertaining to equipment offered for inspection shall be got approved by Owner and copies shall be made available to Owner beforehand for undertaking inspection.

6.3.3 The contractor shall ensure full and free access to the inspection engineer of Owner at the contractor’s or their sub-contractor’s premises at any time during contract period to facilitate him to carry out inspection and testing assignments.

6.3.4 The contractor / sub–contractor shall provide all instruments, tools, necessary testing and other inspection facilities to inspection engineer of Owner free of cost for carrying out inspection.

6.3.5 Where facilities for testing do not exist in the contractor’s / sub-contractor’s laboratories, samples and test pieces shall be drawn by the contractor / sub-contractor in presence of Inspection Engineer of Owner and duly sealed by the later and sent for tests in Government approved test house or any other testing laboratories approved by the Inspection Engineer at the contractor’s cost.

6.3.6 The contractor shall comply with the instructions of the Inspection Engineer fully and with promptitude.
6.3.7 The contractor shall ensure that the equipment / assemblies / component of the plant and equipment required to be inspected are not assembled or dispatched before inspection.

6.3.8 The contractor shall not offer equipment for inspection in painted conditions unless otherwise agreed in writing with the Owner.

6.3.9 The contractor shall ensure that the parts once rejected by the inspection engineer are not used in the manufacture of the plant and equipment. Where parts rejected by the inspection engineer have been rectified or altered, such parts shall be segregated for separate inspection and approval, before being used in the work.

6.3.10 On satisfactory completion of final inspection and testing, all accepted part of the work and equipment shall be stamped suitably and inspection certificate shall be stamped suitably and inspection certificate shall be issued in requisite copies for all accepted items. For stage inspection and for rejected items, only inspection memo shall be issued indicating therein the details of observations and remarks.

6.3.11 All inspections and tests shall be made as required by the specifications forming part of this contract. Contractor shall advise HPCL in writing at least fifteen days in advance of the date of final inspection / tests. Manufacturers inspection or testing certificate for equipment and materials supplied may be considered for acceptance, at the discretion of Engineer-in-Charge. All costs towards testing etc. shall be borne by the contractor within their quoted rates.

6.4 Documentation

6.4.1 Completion Documents

The following documents shall also be submitted by the Contractor in triplicate as part of completion documents:

a) Test certificate for materials supplied by the Contractor.
b) Certified records of field tests on materials / equipment, as applicable.
c) Material appropriation statement as required.
d) Six sets of drawings showing therein the as built conditions of the work duly approved by the Engineer-in-Charge along with one set of reproducible on polyester film (drawings prepared by Contractor) along with soft form of the same.
7.0 OTHERS

7.1 Dispute Settlement between Govt. Dept. / PSU & PSE

7.1.1 In the event of any disputes or differences between the Contractor and the Owner, if the Contractor is a Government department, a Government company or an undertaking in the public sector, then such disputes or differences shall be resolved amicably by mutual consultation or through the good offices or empowered agencies of the Government. If such resolution is not possible, then the unresolved disputes or differences shall be referred to arbitration of an arbitrator to be nominated by the Secretary, Department of legal affairs (Law Secretary) in terms of the Office Memorandum No. 55 / 1 / 75 – CF dated 19th December 1975 issued by the Cabinet Secretariat (Dept. of Cabinet Affairs) as modified from time to time. The Arbitration Conciliation Act 1996 shall not be applicable to the arbitrator under this clause. The award of the arbitrator shall be binding upon parties to the dispute, provided, however any party aggrieved by such award may make a further reference for setting aside or revision of the award to Law Secretary whose decision shall bind the parties finally and conclusively.

7.2 Project Scheduling and Monitoring

The following schedules / documents / reports shall be prepared and submitted by the CONTRACTOR for review / approval at various stages of the contract.

7.2.1 After placement of Purchase Order

Upon placement of Purchase Order, Contractor has to furnish a detailed bar chart within 15 days of issue of FOI/LOI.

7.2.4 Project Review Meetings

7.2.4.1 The CONTRACTOR shall present the programmed and status at various review meetings as required.

Monthly Review Meeting

Level of Participation: Senior Officers of Owner & Contractor.
Agenda
a) Progress Status/ statistics.
b) Completion Outlook
c) Major hold ups / slippages.
d) Assistance required.
e) Critical issues.
f) Client query / approval.

Venue : Site

7.2.5 Progress Reports

I) Monthly Progress Report

This report shall be submitted in three copies on a monthly basis within Ten calendar days from cut-off date as agreed upon, covering overall scenario of the work. The report shall include but not be limited to the following:

a) Brief introduction of the work.
b) Activities executed / achievements during the month.
c) Scheduled vs actual percentage progress and progress curves for sub-ordering, manufacturing / delivery, sub-contracting, construction activities and overall quantum wise status of purchase orders against scheduled.
d) Areas of concern / problems / hold ups, impact and action plans.
e) Resource deployment status.
f) Annexure giving status summary for Material Requisitions and deliveries, sub-contracting and construction

Distribution: To the owner-Two copies & One at Site.

II) Daily Report:

Daily report in duplicate as outlined in 2.2.4 of SCC and any other additional information/data/guideline/job procedure sought by Engineer-in-Charge shall be submitted without fail to HPCL at site by contractor.

7.3 General Environment Requirement
The contractor has to ensure efficient use of natural resources like water, fuel oil and lubricants. The contractor should ensure proper awareness to workers to maintain a green and clean environment inside / outside the building premises. The contractor must collect and dispose of all the waste and scrap materials at the designated place only as directed by Engineer – in Charge.

7.4 DEFECT LIABILITY PERIOD/Warranty Period

As per clause No. 5n of GTC.

7.5 Form C/D etc will not be issued by M/s HPCL

APPENDIX -1 TO SCC

TERMS OF PAYMENTS

1.1 The basis and terms of payment without prejudice to any other mode of recovery available to Owner, shall be as given below:

1.2 The Contractor shall be paid monthly running account bills at stages of completion of individual item / work, based on the joint measurement, in the following manner after deductions of necessary dues payable by Contractor to the Owner such as Retention money, Taxes, Duties etc. in accordance with various provisions made elsewhere in this document.

1. CIVIL & OTHER WORKS NOT MENTIONED BELOW

95% -progressively till completion of the concerned job
5% -after completion and acceptance by HPCL/Architect as per SOQ/BOQ

2. REINFORCEMENT/STRUCTURAL STEEL

60%  against supply.
35%  after completion of concreting & certified by HPCL/Architect engineer.
5%  after completion and acceptance by HPCL/Architect as per SOQ/BOQ

3. FIRE FIGHTING, PHE & ASSOCIATED WORKS(PLUMBING FIXTURES) & TANKS (if any) & SHEETING (if any)

60%  against Supply
35%  Completion of fabrication, fixing & certification by HPCL/Architect
5% after completion and acceptance by HPCL/Architect as per SOQ/BOQ

4. LIFTS

80% Against Supply (80% of quoted rate or 100% supply invoice amount, whichever is lower will be paid.)
15% against Installation & Commissioning
5% against completion and acceptance by HPCL/Architect as per SOQ/BOQ

For payment against supply of this item, the vendor has to provide an additional bank guarantee of the amount paid for supply by HPCL which will be released after successful commissioning of the lifts.

5. GRIHA

100% against achievement of 11 points assigned to under GRIHA Criteria. No claim on this item of the contractor will be entertained if he fails to achieve 100% compliance, i.e., even if 10 points are obtained against 11 points, this item will not be paid.

1.3 SPECIAL PAYMENT TERMS REGARDING PROJECT PROGRESS

The following clauses should also be read along with relevant clauses in BQC wherein, bidder is required to provide detailed work break down structure for the project along with manpower / machinery deployment plan. The project progress will be monitored as per the baseline project plan approved during the technical evaluation including the three mandatory critical milestones and cash flow statement. It is required that the vendor strictly follow the project plan provided along with the bid during project execution. To ensure that the successful bidder adhere to the approved plan during project execution following additional payment terms/conditions will also be applicable during the project delivery period including any extensions provided by the client.

1. The bidder will maintain a register to record the details of the resource deployed at site on a daily basis. The financial progress of the work will be recorded on a weekly basis and forwarded to Architect/HPCL for record. The progress will be reviewed on a fortnightly basis against the approved plan and deviation will be recorded in the register.

2. Shortfall in resource deployment, both manpower and machines will be, reviewed on a daily/weekly basis and corrective actions to augment the shortfall will be done by the successful bidder on his own initiative without any notices from HPCL. In case the bidder fails to take corrective actions to maintain progress as committed, notice will be
given to the bidder for increasing resources at site and maintain the progress as approved on a daily/weekly basis.

3. The successful bidder will expedite his work to ensure that the physical and financial progress of the work matches the approved schedule and resource deployment plan and the monthly cash flow schedule necessarily meeting the three milestone provided earlier. The vendor has to necessarily meet the below mandatory milestones points.

   a. Completion of basement roof slab – At the earliest but not later than four months from the date of LOI
   b. Completion of all roof slabs- At the earliest but not later than twelve months from the date of LOI
   c. Completion of all works as per the scope of the tender: - At the earliest but not later than fifteen months from the date of LOI.

4. Based on the performance up to these mandatory checkpoints & agreed milestones completion at any stage of project execution, if in the opinion of HPCL/Architect it is assessed that the successful bidder does not have the capability or intention to expedite the work by deploying more resources as needed, HPCL reserves the right to terminate the contract without any further notice and complete the work under “risk and cost” of the successful bidder under relevant clauses of GCC.

5. The payments for the work completed be will regulated based on the schedule and resource deployment plan submitted by the successful bidder and approved after mutual discussions and amendments as mentioned earlier in BQC & SCC.

6. Successful bidder can submit his running bills on a monthly basis to ensure that cash flow is maintained and progress of the work is not hampered on account of this.

7. The timelines for processing and releasing payments after submission of bills by successful bidder at site office will take approximately 21 days(max), as under:-

   (a) Scrutiny of bills jointly by HPCL and successful bidder, - 07 days
   Corrections if any and resubmission, and
   Forwarding to HQ HPCL
   (b) Scrutiny at HQ HPCL and issue of payment - within 15 days

8. The payments due after verification of joint measurements to the successful bidder will be assessed by comparing the approved schedule and resource deployment plan, and
monthly cash flow schedule with the actual progress at site as described in the succeeding paragraphs.

9. Value of material at site, due as per terms of the contract including that provided in SCC, will also be considered for assessing financial progress of the work for the purpose of payments.

10. In case of matching progress, full entitlement less the retention and other statutory deductions as per PO terms and conditions will be released.

11. In case there is a shortfall in the work physically executed against the approved milestone plan/cash flow statement, payment will be regulated as under:-

(a) The payment entitled will be based on the physical work completed at site against measurement jointly done and certified.
(b) An amount equal to 10% of the value of the shortfall from the committed progress will be withheld from the payment till such time the progress in line with the approved milestones is achieved.
(c) Example :-

<table>
<thead>
<tr>
<th>Scheduled milestone expenditure</th>
<th>Rs 1,00,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual physical progress</td>
<td>Rs 90,000</td>
</tr>
<tr>
<td>Payment due as per PO</td>
<td>Rs 90,000</td>
</tr>
<tr>
<td>Shortfall in progress</td>
<td>Rs 10,000</td>
</tr>
<tr>
<td>Amount to be withheld</td>
<td>Rs 1,000</td>
</tr>
<tr>
<td>Amount due for payment</td>
<td>Rs 89,000</td>
</tr>
</tbody>
</table>

12. In case the successful bidder expedites the work and makes up for the delays in the approved plan in subsequent months, the amount so retained will be released in the next running bill.

NOTES :

1. For Each stage, necessary testing shall be completed prior to claiming the percentage break-up as given clause 1.2 of Appendix-1 to SCC.

2. Partial bill will be processed only after submission of duly certified copy of proof of payment towards royalty, if applicable.

3. Final bill will be processed only after submission of “No objection certificate” from relevant statutory authorities towards payment of royalty, if any.
7. TECHNICAL SPECIFICATIONS
1.0. Introduction:

1.1. The intent of this technical specification covers all construction of all civil works as covered in the scope of contract as per drawings supplied by Owner.

1.2. All civil works shall be carried out as per design/drawings standardized by the Consultant / Owner and the specification provided by the Consultant / Owner. All standard drawings are enclosed with the tender documents. In case any item is not covered under specification then the same shall be carried out as per CPWD specification and applicable Standards and Codes. Any item for which specification is not provided herein and is not covered under CPWD specification shall be executed as per manufacturer guidelines. All materials shall be of best quality conforming to relevant Indian Standards and Codes. In case of any conflict between Standards/ Code and Technical Specification, the provisions of Technical Specification shall prevail, and the Architect’s decision on interpretation shall be final.

1.3. The Contractor shall furnish all labor, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with drawings, specifications and direction of Owner.

1.4. Excavated earth is to be disposed from site as instructed, only into approved landfill areas and dumpyard, and the contractor will indemnify HPCL from any liability towards the same. The cost of excavation to include for necessary lead and lift as specified.

1.5. All materials including cement, reinforcement steel and structural steel etc. shall be arranged by the Contractor. All testing required shall be arranged by the Contractor at his own cost. The contractor shall execute the work as per the standard Field Quality Plan (FQP) of HPCL.

1.6. The bidder shall fully apprise himself of the prevailing conditions at the proposed site. Climatic conditions including monsoon patterns, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically
brought out in the specifications. All considerations under the Government’s Green Rating of Integrated Habitat Assessment- GRIHA - to be mandatorily followed by the contractor while executing all aspects of the works.

1.7. Level and date of concreting shall be marked on the building from outside at every floor level with proper paint, etc.

1.8. All levels and survey work shall be measured by total station and electronic level machine at all floors and places.

2.0. Schedule Items:

2.1. The work shall be executed in accordance with the specification stipulated in the Bill of Quantity and other bidding documents read along with CPWD (Central Public Works Department) specifications-2009 for civil works and IS codes with up-to-date corrections For non-schedule items specification as given along with tender document and similar items of CPWD shall be applicable.

2.2. The list of references for civil works are CPWD specifications, relevant IS codes and best practices.

2.3. For deep excavations, necessary shoring is to be done, the design of which will be provided by the contractor, after assessing site and soil conditions, and work only to be commenced on site after the same is duly approved by the Architect / HPCL. Any approval if required from the Mineral department or any other statutory body that has jurisdiction on such excavations has to be obtained by the contractor.

2.4. All earth used for back filling should be of approved quality.

2.5. Portland Pozzolana Cement (PPC ) of IS 1489(part-1) shall be used for all other cement & concrete works. This will supersede other specifications of cement to be used for the works.

2.6. For ready mixed cement concrete, in addition to the CPWD specification, the following also to be noted:

2.6.1. The cost towards cement quantity reduced from the specified quantity in the item due to mixing of fly ash shall be deducted as per relevant BOQ item

2.6.2. The design mix shall be submitted to Engineer in Charge for approval.

2.7. The technical specification for Anti termite treatment (ATT) shall be as per Cl No 2.28.4.1 and 2.28.4.2 (i) & (ii) of CPWD specification Vol – I. Method of measurement for application of external is in Sqm measured (Length of the wall x
Height of wall) and for treatment below floors the length and breadth of the basement floor shall be measured in Sqm. The anti-termite treatment is a specialized pre construction method of reticulate piping laid in site with post construction injection method of treatment carried out for Basement, Ground floor and Upper floor areas with Disbursement of Solution of “imidaclorprid” @ 2.5Ltr. /Sq. Mtr. at plinth level. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups confirming the technical requirements for approval of Engineer-In-charge before placement of order.

2.8. All hard ware fittings shall be of best quality and shall be selected as per the Instructions of Engineer in Charge.

2.9. VDF and epoxy flooring where required should conform to the relevant IS codes

3.0. SCHEDULE ITEMS:

3.1 Earth work/Excavation:

3.1.1 Before the earth work is started, the area coming under cutting and filling shall be cleared of shrubs, rank vegetation, grass, brushwood, trees and saplings of girth up to 30cm measured at a height of one metre above ground level and rubbish removed up to a distance of 50 metres outside the periphery of the area under clearance. The roots of trees and saplings shall be removed to a depth of 60cm below ground level or 30 cm below formation level or 15 cm below sub grade level, whichever is lower, and the holes or hollows filled up with the earth, rammed and leveled.

3.1.2 Existing structures and services such as old buildings, culverts, fencing, water supply pipe lines, sewers, power cables, communication cables, drainage pipes etc. within or adjacent to the area if required to be diverted/removed, shall be diverted/dismantled as per directions of the Engineer-in-Charge and payment for such diversion/dismantling works shall be made separately.

3.1.3 Lead of 50 m mentioned in the ‘Schedule of Quantities’ is the average lead for the disposal of excavated earth within the site of work. The actual lead for the lead for the disposal of earth may be more or less than the 50 m for which no cost adjustment shall be made in the rates.

3.1.4 Disposal of Earth shall be disposed off at the specified location or as decided by the Engineer-in-Charge. The contractor has to take written permission about place of disposal of earth before the earth is disposed off, from Engineer-in-Charge.
3.1.5 A masonry pillar to serve as a bench mark will be erected at a suitable point in the area, which is visible from the largest area. This bench mark shall be constructed and connected with the standard bench mark as approved by the Engineer-in-Charge. Necessary profiles with strings stretched on pegs, bamboos or ‘Burjis’ shall be made to indicate the correct formation levels before the work is started. The contractor shall supply labour and material for constructing bench mark, setting out and making profiles and connecting bench mark with the standard bench mark at his own cost. The pegs, bamboos or ‘Burjis’ and the bench mark shall be maintained by the contractor at his own cost during the excavation to check the profiles.

3.1.6 The ground levels shall be taken at 5 to 15 metres intervals (as directed by the Engineer-in-Charge) in uniformly sloping ground and at closer intervals where local mounds, pits or undulations are met with. The ground levels shall be recorded in field books and plotted on plans. The plans shall be drawn to a scale of 5 metres to one cm or any other suitable scale decided by the Engineer-in-Charge. North direction line and position of bench mark shall invariably be shown on the plans. These plans shall be signed by the contractor and the Engineer-in-Charge or their authorized representatives before the earth work is started. The labour required for taking levels shall be supplied by the contractor at his own cost.

3.1.7 During the excavation the natural drainage of the area shall be maintained. Excavation shall be done from top to bottom. Undermining or undercutting shall not be done.

3.1.8 In firm soils, the sides of the trenches shall be kept vertical upto a depth of 2 metres from the bottom. For greater depths, the excavation profiles shall be widened by allowing steps of 50 cms on either side after every 2 metres from the bottom. Alternatively, the excavation can be done so as to give slope of 1:4 (1 horizontal : 4 vertical). Where the soil is soft, loose or slushy, the width of steps shall be suitably increased or sides sloped or the soil shored up as directed by the Engineer-in-Charge. It shall be the responsibility of the contractor to take complete instructions in writing from the Engineer-in-Charge regarding the stepping, sloping or shoring to be done for excavation deeper than 2 metres.

3.1.9 The excavation shall be done true to levels, slope, shape and pattern indicated by the Engineer-in-Charge. Only the excavation shown on the drawings with additional allowances for centering and shuttering or as required by the Engineer-in-Charge shall be measured and recorded for payment.

3.1.10 While carrying out the excavation for drain work care shall be taken to cut the side and bottom to the required shape, slope and gradient. The surface shall then be properly dressed. If the excavation is done to a depth greater than that shown on the drawing or as
required by the Engineer-in-Charge, the excess depth shall be made good by the contractor at his own cost with stiff clay puddle at places where the drains are required to be pitched and with ordinary earth, properly watered and rammed, where the drains are not required to be pitched. In case the drain is required is to be pitched, the back filling with clay puddle, if required, shall be done simultaneously as the pitching work proceeds. The brick pitched storm water drains should be avoided as far as possible in filled-up areas and loose soils.

3.1.11 In all other cases where the excavation is taken deeper or made wider by the contractor, it shall be brought to the required level/ width by the contractor at his own cost by filling in with earth duly watered, consolidated and rammed.

3.1.12 The excavation shall be done manually or by mechanical means as directed by Engineer-in-charge considering feasibility, urgency of work, availability of labour/mechanical equipments and other factors involved. Contractor shall ensure every safety measures for the workers. Neither any deduction will be made nor any extra payment will be made on this account.

3.1.13 The earth used for filling shall be free from all roots, grass, shrubs, rank vegetation, brushwood, tress, sapling and rubbish. Filling with excavated earth shall be done in regular horizontal layers each not exceeding 20 cm in depth. All lumps and clods exceeding 8 cm in any direction shall be broken. Each layer shall be watered and consolidated with steel rammer or ½ tonne roller. Where specified, every third and top must layer shall also be consolidated with power roller of minimum 8 tonnes. Wherever depth of filling exceeds 1.5 metre vibratory power roller shall be used to consolidate the filing unless otherwise directed by Engineer-in-charge. The top and sides of filling shall be neatly dressed. The contractor shall make good all subsidence and shrinkage in earth fillings, embankments, traverses etc. during execution and till the completion of work unless otherwise specified.

3.1.14 Earthworks and all components thereof should satisfy the following tests and codes:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>IS No.</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS 632</td>
<td>Gamma – BHC (Lindane) emulsifiable concentrates</td>
</tr>
<tr>
<td>2</td>
<td>IS 1200 (Pt 1)</td>
<td>Method of measurement of earth work</td>
</tr>
<tr>
<td>3</td>
<td>IS 1200 (Pt-27)</td>
<td>Method of measurement of earth work (by Mechanical Appliances)</td>
</tr>
<tr>
<td>4</td>
<td>IS 4081</td>
<td>Safety code for Blasting and related drilling operation</td>
</tr>
<tr>
<td>5</td>
<td>IS 4988 (Part IV)</td>
<td>Excavators</td>
</tr>
<tr>
<td>6</td>
<td>IS 6313 (pt-II)</td>
<td>Anti Termite measures in buildings (pre-constructional)</td>
</tr>
<tr>
<td>7</td>
<td>IS 6313(pt-III)</td>
<td>Anti Termite Measures in Buildings for existing buildings</td>
</tr>
<tr>
<td>8</td>
<td>IS 6940</td>
<td>Methods of test for pesticides and their formulations</td>
</tr>
<tr>
<td>9</td>
<td>IS 8944</td>
<td>Chlorpyrifos emulsifiable concentrates</td>
</tr>
<tr>
<td>10</td>
<td>IS 8963</td>
<td>Chlorpyrifos – Technical specifications</td>
</tr>
<tr>
<td>11</td>
<td>IS 12138</td>
<td>Earth moving Equipments</td>
</tr>
</tbody>
</table>
3.2 CONCRETE WORKS

3.2.1 Desirable properties of mortars for use in masonry are:

(a) Workability

(b) Water retentivity

(c) Rate of stiffing

(d) Strength

(e) Resistance to rain penetration

(f) Durability

3.2.2 WATER used for mixing and curing shall be clean and free from injurious quantities of alkalies, acids, oils, salts, sugar, organic materials, vegetable growth or other substance that may be deleterious to bricks, stone, concrete or steel. Potable water is generally considered satisfactory for mixing. The PH value of water shall be not less than 6. The physical and chemical properties of ground water shall be tested along with soil investigation and if the water is not found conforming to the requirements of IS 456-2000, the tender documents shall clearly specify that the contractor has to arrange good quality water for construction indicating the source. Water found satisfactory for mixing is also suitable for curing. However, water used for curing shall not produce any objectionable stain or unsightly deposit on the surface. Sea water shall not be used for mixing or curing. Water from each source shall be tested before the commencement of the work and thereafter once in every three months till the completion of the work. In case of ground water, testing shall also be done for different points of drawdown. Water from each source shall be got tested during the dry season before monsoon and again after monsoon.

3.2.3 CEMENT:

The cement used shall be any of the following grade and the type selected should be appropriate for the intended use.

(a),(b),(c) Deleted

(d) Rapid hardening Portland cement conforming to IS 8041.
(e) Portland slag cement conforming to IS 455.

(f) Portland Pozzolana cement (flyash based) conforming to IS 1489 (Part 1).

(g) Portland Pozzolona cement (calcined clay based) conforming to IS 1489 (part 2).

(h) Hydrophobic cement conforming to IS 8043

(i) Low heat Portland cement conforming to IS 12600.

(j) Sulphate resisting Portland cement conforming to IS 12330

(k) White cement conforming to IS 8042

Different types of cement shall not be mixed together. In case more than one type of cement is used in any work, a record shall be kept showing the location and the types of cement used.

Compressive strength requirement of each type of cement for various grades when tested in accordance with IS 4031 (part 6) shall be as under:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Strength in N/mm² not less than for</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gr. 33</td>
</tr>
<tr>
<td>Age at testing</td>
<td></td>
</tr>
<tr>
<td>72 + 1 hr</td>
<td>16</td>
</tr>
<tr>
<td>168 + 2 hrs</td>
<td>22</td>
</tr>
<tr>
<td>672 + 4 hrs</td>
<td>33</td>
</tr>
</tbody>
</table>

Setting Time: Setting time of cement of any type of any grade when tested by Vicat apparatus method described in IS 4031 shall conform to the following requirement:

(a) Initial setting time: Not less than 30 minutes

(b) Final setting time: Not more than 600 minutes

Every delivery of cement shall be accompanied by a producer’s certificate conforming that the supplied cement conforms to relevant specifications. These certificates shall be endorsed to the Engineer-in-Charge for his record. Every consignment of cement must have identification marks on packages indicating date of manufacturing grade and type of cement batch no. etc. Cement brought to works shall not be more than 6 weeks old from the date of manufacture.

Cement in bags shall be stored and stacked in a shed which is dry, leak-proof and as moisture-proof as possible. Different types of cement shall be stacked and stored separately. Storage of cement at the work site shall be at the contractor’s expense and risk. Any damage occurring to cement due to faulty storage in contractor’s shed or on account of negligence on his part shall be the liability of the contractor.
3.2.4 FINE AGGREGATE- Aggregate most of which passes through 4.75 mm IS sieve is known as fine aggregate.

Fine aggregate shall consist of natural sand, crushed stone sand, crushed gravel sand stone dust or marble dust, fly ash and broken brick (Burnt clay). It shall be hard, durable, chemically inert, clean and free from adherent coatings, organic matter etc. and shall not contain any appreciable amount of clay balls or pellets and harmful impurities in such form or in such quantities as to cause corrosion of metal or affect adversely the hardening, the strength, the durability or the appearance of mortar, plaster or concrete.

The sum of the percentages of all deleterious material shall not exceed 5%. Fine aggregate must be checked for organic impurities such as decayed vegetation humps, coal dust etc.

The maximum quantity of silt in sand shall not exceed 8%.

Fine aggregate containing more than allowable percentage of silt shall be washed as many times as directed by Engineer-in-charge so as to bring the silt content within allowable limits for which nothing extra shall be paid.

Type and grading of fine aggregate to be used shall be specified. It shall be coarse sand, fine sand, stone dust or marble dust, fly ash and surkhi. Use of sea sand shall not be allowed.

Grading of sand for use in masonry mortar shall be conforming to IS 216

Grading of sand for use in plaster shall be conforming to IS 1542

<table>
<thead>
<tr>
<th>IS Sieve Designation</th>
<th>Percentage passing by mass</th>
<th>IS Sieve Designation</th>
<th>Percentage passing by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm</td>
<td>100</td>
<td>10 mm</td>
<td>100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>100</td>
<td>4.75 mm</td>
<td>95 to 100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>90 to 100</td>
<td>2.36 mm</td>
<td>95 to 100</td>
</tr>
</tbody>
</table>

3.2.5 FLY ASH
Fly ash is finely divided residue resulting from the combustion of pulverized coal in boilers. Fly ash is the pulverized fuel ash extracted from the flue gases by any suitable process such as cyclone separation or electrostatic precipitation. The ash collected from the bottom of boilers is termed as bottom ash. Fly ash is finer than bottom ash. Siliceous fly ash (ASTM Class F) containing calcium oxide less than 10% by mass is normally produced from burning anthracite or bituminous coal and possesses pozzolanic properties. Calcareous fly ash (ASTM Class C) is produced by burning lignite or sub-bituminous coal and contains calcium oxide more than 10% by mass; the content could be as high as 25%. This fly ash has both hydraulic and pozzolanic properties. It shall be clean and free from any contamination of bottom ash, grit or small pieces of pebbles. It is obligatory on the part of supplier/ manufacture that the fly ash conforms to the requirements if mutually agreed upon & shall furnish a certificate to this effect to the purchaser or his representative.

The chemical properties of fly ash shall be as per IS 3812 (part 1 & 2) depending on the usage. The physical properties shall be as outlined below.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Characteristics</th>
<th>Requirement of Fly Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>For use as Pozzolana</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>(i)</td>
<td>Fineness- Specific surface in m²/kg by Blaine’s permeability method, min</td>
<td>320</td>
</tr>
<tr>
<td>(ii)</td>
<td>Lime reactivity – average compressive strength in N/mm² Min</td>
<td>4.5</td>
</tr>
<tr>
<td>(iii)</td>
<td>Compressive strength at 28 days in N/ mm²</td>
<td>Not less than 80 per cent of the strength of corresponding mortar cubes</td>
</tr>
<tr>
<td>(iv)</td>
<td>Soundness of autoclave test expansion of specimens, per cent, max</td>
<td>0.8</td>
</tr>
<tr>
<td>(v)</td>
<td>Particles retained on 45 micron IS sieve (wet sieving) in percent maximum</td>
<td>34</td>
</tr>
</tbody>
</table>

3.2.6 COARSE AGGREGATE- Aggregate most of which is retained on 4.75 mm IS Sieve and contains only as much fine material as is permitted in IS 383 for various sizes and grading is known as coarse aggregate. Coarse aggregate shall be specified as stone aggregate, gravel or brick aggregate and it shall be obtained from approved/ authorized sources.

(a) Stone Aggregate: It shall consist of naturally occurring (uncrushed, crushed or broken) stones. It shall be hard, strong, dense, durable and clean. It shall be free from veins, adherent coating, injurious amounts of disintegrated pieces, alkali, vegetable matter and other deleterious substances. It shall be roughly cubical in shape. Flaky and
elongated Pieces shall be avoided. It shall conform to IS 383 unless otherwise specified.

(b) Gravel: It shall consist of naturally occurring (uncrushed, crushed or broken) river bed shingle or pit gravel. It shall be sound, hard and clean. It shall be free from flat particles of shale or similar laminated material, powdered clay, silt, loam, adherent coating, alkali, vegetable matter and other deleterious substances. Pit gravel shall be washed if it contains soil materials adhering to it. These shall conform to IS 383 unless otherwise specified.

(c) Brick Aggregate: Brick aggregate shall be obtained by breaking well burnt or over burnt dense brick/brick bats. They shall be homogeneous in texture, roughly cubical in shape and clean. They shall be free from un burnt clay particles. Soluble salt, silt, adherent coating of soil, vegetable matter and other deleterious substances. Such aggregate should not contain more than one percent of sulphates and should not absorb more than 10% of their own mass of water, when used in cement concrete. It shall conform to IS 306 unless otherwise specified.

(d) Light weight aggregate such as sintered fly ash aggregate may also be used provided the Engineer-in-Charge is satisfied with the data on the proportion of concrete made with them.

Deleterious Material: Coarse aggregate shall not contain any deleterious material, such as pyrites, coal, lignite, mica, shale or similar laminated material, clay, alkali, soft fragments, sea shells and organic impurities in such quantity as to affect the strength or durability of the concrete. Coarse aggregate to be used for reinforced cement concrete. Coarse aggregate to be used for reinforced cement concrete shall not contain any material liable to attack the steel Reinforcement. Aggregates which are chemically reactive with alkalis of cement shall not be used. The maximum quantity of deleterious material shall not be more than five percent of the weight of coarse aggregate when determined in accordance with IS 2386.

3.2.7 Cement Mortar This shall be prepared by mixing cement and sand with or without the addition of pozzolana in specified proportions.

Proportioning on weight basis shall be preferred taking into account specific gravity of sand and moisture content. Boxes of suitable size shall be prepared to facilitate proportioning on weight basis. Cement bag weighting 50 kg shall be taken as 0.035 cubic metre. Other ingredients in specified proportion shall be measured using boxes of size 40 x 35 x 25 cm. Sand shall be measured on the basis of its dry volume in the case of volumetric proportioning.
The mixing of mortar shall be done in mechanical mixers operated manually or by power as decided by Engineer-in-Charge. The Engineer-in-Charge may, however, permit hand mixing at his discretion taking into account the nature, magnitude and location of the work and practicability of the use of mechanical mixers or where item involving small quantities are to be done or if in his opinion the use of mechanical mixer is not feasible. In cases, where mechanical mixers are not to be used, the contractor shall take permission of the Engineer-in-Charge in writing before the commencement of the work.

(a) Mechanical Mixing: Cement and sand in the specified proportions shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least three minutes. only the required quantity of water shall be added which will produce mortar of workable consistency but not stiff paste. Only the quantity of mortar, which can be used within 30 minutes of its mixing, shall be prepared at a time. Mixer shall be cleaned with water each time before suspending the work.

(b) Hand Mixing: The measured quantity of sand shall be leveled on a clean masonry platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture is of a uniform colour. The quantity of dry mix which can be used within 30 minutes shall then be mixed in a masonry trough with just sufficient quantity of water to bring the mortar to a stiff paste of necessary working consistency.

Mortar shall be used as soon as possible after mixing and before it begins to set, and in any case within half hour, after the water is added to the dry mixture.

**Cement Fly ash Sand Mortar** shall be prepared by mixing cement, flyash and sand in specified proportions. Mixing shall be done in a mechanical mixer (operated manually or by power) unless otherwise permitted by the Engineer-in-Charge in writing. Proportioning on weight basis shall be preferred taking into account specific gravity of Fly Ash, sand and moisture content. Boxes of suitable size shall be prepared to facilitate proportioning on weight basis. Cement bag weighting 50 kg shall be taken as 0.035 cubic metre. Other ingredients in the specified proportions shall be measured using boxes of suitable sizes. Sand and flyash shall be measured on the basis of their dry volume in the case of volumetric proportioning.

### 3.2.8 CEMENT CONCRETE

**Grades of Cement Concrete**
The concrete shall be in grade designated as under:

**Notes:**

1. In the designation of concrete mix M refers to the mix and the number to the specified compressive strength of 150 mm size cube at 28 days, expressed in N/mm².

2. For concrete of compressive strength greater than M55, design parameters given in the standard may not be applicable and the values may be obtained from specialized literatures and experimental results. The characteristic strength is defined as the strength of material below which not more than 5 percent of the test results are expected to fall.

**Workability of Concrete**

The concrete mix proportion chosen should be such that the concrete is of adequate workability for the placing conditions of the concrete and can properly be compacted with the means available. Suggested ranges of workability of concrete measured in accordance with IS 1199 are given below:
For most of the placing conditions, internal vibrators (needle vibrators) are suitable. The diameter of the needle shall be determined based on the density and spacing of reinforcement bars and thickness of sections. For tremie concrete, vibrators are not required to be used. In the ‘very low’ category of workability where strict control is necessary, for example, pavement quality concrete, measurement of workability by determination of compacting factor will be more appropriate than slump (see IS 1199) and a value of compacting factor of 0.75 to 0.80 is suggested. In the ‘very high’ category of workability, measurement of workability by determination of flow will be appropriate (see IS 9103).

**Concrete Mix Proportioning**

The determination of the proportion of cement, aggregate and water to attain the required strength shall be made as follows:

(a) By designing the concrete mix: such concrete shall be called ‘Design mix concrete’, for details reference may be made to RCC Chapter.

(b) By adopting nominal concrete mix: such concrete shall be called ‘Nominal mix concrete’. Design mix concrete is preferred to nominal mix. If design mix concrete cannot be used for any reason on the work for grades of M20 or lower, nominal mixes may be used with the permission of Engineer-in-Charge, which, however, is likely to involve a higher cement content.

**Nominal Mix Concrete:** Nominal Mix Concrete may be used for concrete of M20 or lower. The proportions of materials for nominal mix concrete shall be in accordance with the following table. The cement content of the mix specified in the following table for any nominal mix shall be proportionately increased if the quantity of water in the mix has

<table>
<thead>
<tr>
<th>Placing Conditions</th>
<th>Degree of Workability</th>
<th>Slump (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Blinding concrete: shallow sections: Pavements using pavers</td>
<td>Very low</td>
<td>See 4.2.2.2</td>
</tr>
<tr>
<td>Mass concrete: Lightly reinforced sections in slabs, beams, wall, columns, floors</td>
<td>Low</td>
<td>25-75</td>
</tr>
<tr>
<td>Hand placed pavements: canal lining; Strip footing</td>
<td>Medium</td>
<td>50-100</td>
</tr>
<tr>
<td>Heavily reinforced sections in slabs, beams, walls, columns</td>
<td>Medium</td>
<td>75-100</td>
</tr>
<tr>
<td>Slip form work: Pumped concrete</td>
<td>Medium</td>
<td>75-100</td>
</tr>
<tr>
<td>Trench fill</td>
<td>High</td>
<td>100-150</td>
</tr>
<tr>
<td>Tremie concrete</td>
<td>Very High</td>
<td>See 4.2.2.3</td>
</tr>
</tbody>
</table>
to be increased to overcome the difficulty or placement and compaction, so that the water cement ratio as specified is not exceeded.

<table>
<thead>
<tr>
<th>Grade of Concrete</th>
<th>Total Quantity of Dry Aggregates by Mass per 50 kg of cement, to be taken as the Sum of the Individual Masses of Fine and Coarse Aggregates, Kg. Max</th>
<th>Proportion of Fine Aggregate to Coarse Aggregate (by Mass)</th>
<th>Quantity of Water per 50 kg of Cement, max Ltr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5</td>
<td>800</td>
<td>Generally 1:2 but subject to an upper limit of 1: 1½ and a lower limit of 1: 2½</td>
<td>60</td>
</tr>
<tr>
<td>M7.5</td>
<td>625</td>
<td></td>
<td>45</td>
</tr>
<tr>
<td>M10</td>
<td>480</td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>M15</td>
<td>330</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>M20</td>
<td>250</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

**Note:** - The proportion of the fine to coarse aggregate should be adjusted from upper limit progressively as the grading of fine aggregate becomes finer and the maximum size of coarse aggregate becomes larger. Graded coarse aggregate shall be used.

**Note:** - Quantity of water required from durability point of view may be less than the value given above.

**Batching**

To avoid confusion and error in batching, consideration should be given to using the smallest practical number of different concrete mixed on any site or in any one plant. In batching concrete, the quantity of both cement and aggregate shall be determined by mass; admixture, if solid, by mass: liquid admixture may however be measured in volume or mass: water shall be weighed or measured by volume in a calibrated tank (see also IS 4925).

Ready-mixed concrete supplied by ready-mixed concrete plant shall be preferred. For large and medium project sites the concrete shall be sourced from ready-mixed concrete plants or from on site or off site batching and mixing plants (see IS 4926) except where it can be shown to the satisfaction of the Engineer-in-Charge that supply of properly graded aggregate of uniform quality can be maintained over a period of work, the grading aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions when required, the different sizes being stocked in separate stock-piles. The material should be stock-piled for several hours preferably a day before use. The grading of coarse and fine aggregate should be checked as frequently as possible, the frequency for a given job being determined by the Engineer-in-Charge to ensure that the specified grading is maintained.
The accuracy of the measuring equipment shall be within + 2 percent of the quantity of cement being measured and within + 3 percent of the quantity of aggregate, admixtures and water being measured.

Proportion/Type and grading of aggregates shall be made by trial in such a way so as to obtain densest possible concrete. All ingredients of the concrete should be used by mass only.

Volume batching may be allowed only where weigh-batching is not practicable and provided accurate used in concrete have earlier been established. Allowance for bilking shall be made in accordance with IS 2386 (Part 3). The mass volume relationship should be checked as frequently as necessary, the frequency for the given job being determined by Engineer-in-Charge to ensure that the specified grading is maintained.

It is important to maintain the water cement ratio constant at its correct value. To this end, determination of moisture contents in both fine and coarse aggregates shall be made as frequently as possible, the frequency for a given job being determined by the Engineer-in-Charge according to weather conditions. The amount of the added water shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates, IS 2386 (Part 3) may be referred to. To allow for the variation in mass for aggregate due to variations in their moisture content, suitable adjustments in the masses of aggregates shall be made. In the absence of exact data, only in the case of nominal mixes, the amount of surface water may be estimated from the values given in following table.

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Aggregate</th>
<th>Approximate Quantity of Surface Water l/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Percent by mass</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>(i)</td>
<td>Very wet sand</td>
<td>7.5</td>
</tr>
<tr>
<td>(ii)</td>
<td>Moderately wet sand</td>
<td>5.0</td>
</tr>
<tr>
<td>(iii)</td>
<td>Moist sand</td>
<td>2.5</td>
</tr>
<tr>
<td>(iv)</td>
<td>Moist gravel or crushed rock</td>
<td>1.25-2.5</td>
</tr>
</tbody>
</table>

No substitutions in materials used on the work or alteration in the established proportions shall be made without additional tests to show that the quality and strength of concrete are satisfactory.

**Mixing**

Concrete shall be mixed in mechanical batch type concrete mixers conforming to IS 1791 having two blades and fitted with power loader (lifting hopper type). Half bag mixers and mixers without lifting hoppers shall not be used for mixing concrete. In exceptional circumstances, such as mechanical breakdown of mixer, work in remote areas or power breakdown and when the quantity of concrete work is very small, hand mixing may be
done with the specific prior permission of the Engineer-in-Charge in writing subject to
even with the specific prior permission of the Engineer-in-Charge in writing subject to
adding 10% extra cement. When hand mixing is permitted, it shall be carried out on a
water tight platform and care shall be taken to ensure that mixing is continued until the
concrete is uniform in colour and consistency. Before mixing the brick aggregate shall be
well soaked with water for a minimum period of two hours and stone aggregate or gravel
shall be washed with water to remove, dirt, dust and other foreign materials. For
guidance, the mixing time may be 1 1/2 to 2 minutes, for hydrophobic cement it may be
taken as 2 1/2 to 3 minutes.

**Power Loader:** Mixer will be fitted with a power loader complying with the following
requirements.

(a) The hopper shall be of adequate capacity to receive and discharge the maximum
nominal batch of unmixed materials without spillage under normal operating
conditions on a level site.

Note: In such a case the volume of the maximum nominal batch of mixed material is
50% greater than the nominal mixed batch capacity.

(b) The minimum inside width of the feeding edge of the hopper shall be as specified
below in following table.

<table>
<thead>
<tr>
<th>Nominal size of mixer (T, NT or R) (litre)</th>
<th>Minimum inside width of hopper feeding edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>1.0</td>
</tr>
<tr>
<td>200</td>
<td>1.1</td>
</tr>
<tr>
<td>280</td>
<td>1.2</td>
</tr>
<tr>
<td>375</td>
<td>1.4</td>
</tr>
<tr>
<td>500</td>
<td>1.5</td>
</tr>
<tr>
<td>1000</td>
<td>2.0</td>
</tr>
</tbody>
</table>

T = Tilting; NT = Non-tilting; R = Reverse

(c) The design of the loader shall be such that it allows the loading hopper to be
elevated to such a height that the centre line of the chute plate of the hopper when in
discharge position, is at an angle of not less than 50º to the horizontal. A mechanical
device to aid discharge of the contents as quickly as possible from the hopper to the
drum may also be provided. Even when a mechanical device is provided, it is
recommended that the angle of centre line of the chute plate of the hopper when in
discharge position, should be as larger as practicable, preferably not less than 40º to
horizontal.

(d) When the means of raising and lowering the loading hopper includes flexible wire
ropes winding on to a drum or drums, the method of fastening the wire to rope to the
drums shall be such as to avoid, as far as possible any tendency to cut the strands of
the ropes and the fastening should preferably be positioned clear of the barrel of the

drum for example, outside the drums flange. When the loading hopper is lowered to its normal loading position, these should be at least one and a half drums of rope on the drum.

(e) Clutch brake and hydraulic control lever shall be designed so as to prevent displacement by liberation or by accidental contact with any person.

(f) The clutch and brake control arrangements shall also be so designed that the operator can control the falling speed of the loader.

(g) Safety device shall be provided to secure the hopper in raised position when not in use.

**Mixing Efficiency:** The mixer shall be tested under normal working conditions in accordance with the method specified in IS 4643 with a view to check its ability to mix the ingredients to obtain concrete having uniformity within the prescribed limits. The uniformity of mixed concrete shall be evaluated by finding the percentage variation in quantity (mass in water) of cement, fine aggregate and coarse aggregate in a freshly mixed batch of concrete.

The percentage variation between the quantities of cement, fine aggregate and coarse aggregates (as found by weighing in water) in the two halves of a batch and average of the two halve of the batch shall not be more than the following limits:

<table>
<thead>
<tr>
<th>Material</th>
<th>Variation Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>8%</td>
</tr>
<tr>
<td>Fine aggregate</td>
<td>6%</td>
</tr>
<tr>
<td>Coarse aggregate</td>
<td>5%</td>
</tr>
</tbody>
</table>

**Machine Mixing:** The mixer drum shall be flushed clean with water. Measured quantity of coarse aggregate shall be placed first in the hopper. This shall be followed with measured quantity of fine aggregate and then cement. In case fine aggregate is damp, half the required quantity of coarse aggregate shall be placed in the hopper, followed by fine aggregate and cement. Finally the balance quantity of coarse aggregate shall be fed in the hopper, & then the dry materials are slipped into the drum by raising the hopper. The dry material shall be mixed for atleast four turns of the drum. While the drum is rotating, water shall be added gradually to achieve the water cement ratio as specified or as required by the Engineer-in-Charge. After adding water, the mixing shall be continued until concrete of uniform colour, uniformly distributed material and consistency is obtained. Mixing shall be done for at least two minutes after adding water. If there is segregation after unloading from the mixer, the concrete should be remixed. The drum shall be emptied before recharging. When the mixer is closed down for the day or at any time exceeding 20 minutes, the drum shall be flushed cleaned with water.
**Hand Mixing:** When hand mixing has been specifically permitted in exceptional circumstances by the Engineer-in-Charge in writing, subject to adding 10% extra cement, it shall be carried out on a smooth, clean and water tight platform of suitable size. Measured quantity of sand shall be spread evenly on the platform and the cement shall be dumped on the sand and distributed evenly. Sand and cement shall be mixed intimately with spade until mixture is of even colour throughout. Measured quantity of coarse aggregate shall be spread on top of cement sand mixture and mixing done by shoveling and turning till the coarse aggregate gets evenly distributed the cement sand mixture. Three quarters of the total quantity of water required shall be added in a hollow made in the middle of the mixed pile and the material is turned towards the middle of pile with spade. The whole mixture is turned slowly over and again and the remaining quantity of water is added gradually. The mixing shall be continued until concrete of uniform colour and consistency is obtained. The mixing platform shall be washed and cleaned at the end of the day.

**Transportation and Handling**

Concrete shall be transported from the mixer to the place of laying as rapidly as possible by methods which will prevent the segregation or loss of any of the ingredients and maintaining the required workability. During hot or cold weather, concrete shall be transported in deep containers, other suitable methods to reduce the loss of water by evaporation in hot weather and heat loss in cold weather may also be adopted.

**Placing**

The concrete shall be deposited as nearly as practicable in its final position to avoid rehandling. It shall be laid gently (not thrown) and shall be thoroughly vibrated and compacted before setting commences and should not be subsequently disturbed. Method of placing shall be such as to preclude segregation. Care shall be taken to avoid displacement of reinforcement or movement of form work and damage due to rains. As a general guidance, the maximum free fall of concrete may be taken as 1.5 metre.

**Compaction**

Concrete shall be thoroughly compacted and fully worked around embedded fixtures and into corners of the form work. Compaction shall be done by mechanical vibrator of appropriate type till a dense concrete is obtained. The mechanical vibrators shall conform to IS 2505, IS 2506, IS 2514 and IS 4656. To prevent segregation, over vibration shall be avoided. Compaction shall be completed before the initial setting starts. For the items where mechanical vibrators are not to be used, the contractor shall take permission of the Engineer-in-Charge in writing before the start of the work. After compaction the top surface shall be finished even and smooth with wooden trowel before the concrete begins to set.
**Construction Joints**

Concreting shall be carried out continuously upto construction joints. The position and arrangement of construction joints shall be as shown in the structural drawings or as directed by the Engineer-in-Charge. Number of such joints shall be kept minimum. Joints shall be kept as straight as possible. Construction joints should comply with IS 11817.

When the work has to be resumed on a surface which has hardened, such surface shall be roughened. It shall then be swept clean and thoroughly wetted. For vertical joints, neat cement slurry, of workable consistency by using 2 kgs of cement per sqm shall be applied on the surface before it is dry.

For horizontal joints, the surface shall be covered with a layer of mortar about 10-15 mm thick composed of cement and sand in the same ratio as the cement and sand in concrete mix. This layer of cement slurry of mortar shall be freshly mixed and applied immediately before placing of the concrete. Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of particles of coarse aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement slurry @ 2 kgs of cement per sqm. On this surface, a layer of concrete not exceeding 150 mm in thickness shall first be placed and shall be well rammed against old work particular attention being paid to corners and close spots; work, thereafter, shall proceed in the normal way.

**Curing**

Curing is the process of preventing loss of moisture from the concrete. The following methods shall be employed for effecting curing.

**Moist Curing** : Exposed surfaces of concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer of sacking, canvas, Hessian or similar materials and kept constantly wet for at least 7 days from the date of placing concrete and at least 10 days where mineral admixtures or blended cements are used. The period of curing shall not be less than 10 days for concrete exposed to dry and hot weather conditions. In the case of concrete where mineral admixtures or blended cements are used, it is recommended that above minimum periods may be extended to 14 days.

**Membrane Curing** : Approved curing compounds may be used in lieu of moist curing with the permission of the Engineer-in-Charge. Such compound shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set. Impermeable membrane such as polythene sheet covering the concrete surface may also be used to provide effective barrier against the evaporation. Freshly laid concrete
shall be protected from rain by suitable covering. Over the foundation concrete, the masonry work may be started after 48 hours of its compaction but the curing of exposed surfaces of cement concrete shall be continued along with the masonry work for at least 7 days. And where cement concrete is used as base concrete for flooring, the flooring may be commenced before the curing period of base concrete is over but the curing of base concrete shall be continued along with top layer of flooring for a minimum period of 7 days.

**Finishes**

Plastering and special finishes other than those, obtained through form work shall be specified and paid for separately unless otherwise specified.

**Durability of Concrete**

A durable concrete is one that performs satisfactorily in the working environment during its anticipated exposure conditions during service. The materials and mix proportions shall be such as to maintain its intergrity and, if applicable, to protect reinforcement from corrosion.

The factors influencing durability include:

(a) The environment;
(b) The cover to embedded steel;
(c) The type and quality of constituent materials;
(d) The cement content and water/cement ratio of the concrete;
(e) Workmanship, to obtain full compaction and efficient curing; and
(f) The shape and size of the member.

**Requirements for Durability**

General Environment: The general environment to which the concrete will be exposed during its working life is classified into five levels of severity, that is, mild, moderate, severe, very severe and extreme as described in following table.
### Chlorides in Concrete

The total amount of chlorides content (as CI) in the concrete at the time of placing shall be as under:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Environment</th>
<th>Exposure Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Mild</td>
<td>Concrete surfaces protected against weather or aggressive conditions, except those situated in coastal area.</td>
</tr>
<tr>
<td>(ii)</td>
<td>Moderate</td>
<td>Concrete surfaces sheltered from severe rain or freezing whilst wet Concrete exposed to condensation and rain Concrete continuously under water Concrete in contact or buried under non-aggressive soil/ground water Concrete surfaces sheltered from saturated salt air in coastal area.</td>
</tr>
<tr>
<td>(iii)</td>
<td>Severe</td>
<td>Concrete surfaces exposed to severe rain, alternate wetting and drying or occasional freezing whilst wet or severe condensation. Concrete completely immersed in sea water. Concrete exposed to coastal environment.</td>
</tr>
<tr>
<td>(iv)</td>
<td>Very severe</td>
<td>Concrete surface exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet. Concrete in contact with or buried under aggressive sub-soil/ground water.</td>
</tr>
<tr>
<td>(v)</td>
<td>Extreme</td>
<td>Surface of members in tidal zone. Members in direct contact with liquid/solid aggressive chemicals.</td>
</tr>
</tbody>
</table>

### Sulphates in Concrete

The total water-soluble sulphate content of the concrete mix, expressed as SO₃ should not exceed 4 per cent by mass of the cement in the mix. The sulphate content should be calculated as the total from the various constituents of the mix. The 4 per cent limit does not apply to concrete made with supersulphate cement complying with IS 6909.

### Measurements

Dimensions of length, breadth and thickness shall be measured correct to nearest cm. except for the thickness of slab and partition which shall be measured to nearest 5 mm. Areas shall be worked out to nearest 0.01 sq.m and the cubic contents of consolidated concrete shall be worked out to nearest 0.01 cum. Any work done in excess over the specified dimension or sections shown in the drawing shall be ignored.
**Cast-in-situ concrete** and or precast concrete work shall be measured in stages described in the item of work, such as:

(a) At or near the ground level
(b) Upto specified floor level
(c) Between two specified floor levels
(d) Upto specified height above or depth below plinth level/defined datum level.
(e) Between two specified heights or depths with reference to plinth/defined datum level.

No deduction shall be made for the following:

(a) Ends of dissimilar materials for example beams, posts, girders, rafters, purlins, trusses, corbels and steps upto 500 sq cm in cross sections.

(b) Opening upto 0.1 sqmetre (1000 sq.cm)

(c) Volume occupied by pipes, conduits, sheathing etc. not exceeding 100 sq cm each in crosssectional areas.

Cast-in-situ concrete shall be classified and measured as follows:

(a) Foundation, footings, bases for columns
(b) Walls (any thickness) including attached pilasters, buttresses, plinth and string courses, fillets etc.
(c) Shelves
(d) Slabs
(e) Chajjas including portions bearing on the wall
(f) Lintels, beams
(g) Columns, piers abutments, pillars, post and struts
(h) Stair case including stringer beams but excluding landings.
(i) Balustrades, newels and sailing
(j) Spiral staircase (including landings)
(k) Arches
(I) Domes, vaults

(m) Shell roof, arch ribs and folded plates

(n) Chimneys and shaft.

(o) Breast walls, retaining, walls, return walls

(p) Concrete filling to precast components

(q) Kerbs, steps and the like

(r) String or lacing courses, parapets, copings, bed block, anchor blocks, plain window sills and the like

(s) Cornices and molded windows sills.

(t) Louvers, fins, fascia.

Precast cement concrete solid article shall be measured separately and shall include use of molds, finishing the top surfaces even and smooth with wooden trowel, before setting in position in cement mortar 1:2 (1 cement : 2 coarse sand). Plain and molded work shall be measured separately and the work shall be classified and measured as under:

<table>
<thead>
<tr>
<th>Classifications</th>
<th>Method of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Wall panels</td>
<td>In square meters stating the thickness.</td>
</tr>
<tr>
<td>(b) String or lacing courses, coping, bed plates, plain windows sills, shelves, louvers, steps etc.</td>
<td>In cubic meters.</td>
</tr>
<tr>
<td>(c) Kerbs, edgings etc.</td>
<td>In cubic metres.</td>
</tr>
<tr>
<td>(d) Solid block work</td>
<td>In square metres stating the thickness or in cubic metres.</td>
</tr>
<tr>
<td>(e) Hollow block work</td>
<td>In square metres stating the thickness or in cubic metres.</td>
</tr>
<tr>
<td>(f) Light weight partitions</td>
<td>In square metres stating the partition’s thickness.</td>
</tr>
</tbody>
</table>

**Rate**

The rate is inclusive of the cost of labour and materials involved in all the operations described above.

**No fly ash is to be added to Portland Pozzolona cement in any case which itself contains fly ash.** Proportioning shall be done by volume. Boxes of suitable size shall be used for measuring fly ash, sand and aggregate. The internal dimensions of the boxes shall be generally 35x25x40 cm. deep or as otherwise approved by the Engineer-in-charge. The unit of measurement of cement shall be a bag of 50 kg. and this shall be
taken as 0.035 cum. While measuring the aggregate, shaking, ramming or heaping shall not be done. The proportioning of sand shall be on the basis of its dry volume.

**DAMP PROOF COURSE**

**Cement Concrete Layer:** This shall consist of cement concrete of specified proportions and thickness. The surface of brick or stone masonry work shall be levelled and prepared before laying the cement concrete. Edge of damp proof course shall be straight, even and vertical. Side shuttering shall consist of steel forms and shall be strong and properly fixed so that it does not get disturbed during compaction and the mortar does not leak through. The concrete mix shall be of workable consistency and shall be tamped thoroughly to make a dense mass. When the sides are removed, the surface should come out smooth without honeycombing. Continuity shall be maintained while laying the cement concrete layer and laying shall be terminated only at the predetermined location where damp proof course is to be discontinued. There shall be no construction joints in the Damp Proof Course.

**Curing:** Damp proof course shall be cured for at least seven days, after which it shall be allowed to dry.

**Application of Hot Bitumen:** Where so directed, hot bitumen in specified quantity shall be applied over the dried up surface of cement concrete, properly cleaned with brushes and finally with a piece of cloth soaked in kerosene oil. Bitumen of penetration A 90 or equivalent where used shall be heated to a temperature of 160º ± 5ºC. The hot bitumen shall be applied uniformly all over, so that no blank spaces are left anywhere. It will be paid for separately.

**Water Proofing Materials:** Where so specified, water proofing material of approved quality shall be added to the concrete mixture in accordance with the manufacturer’s specification stating the quantity of water proofing material in litres or kg per 50 kg or cement and will be paid for separately.

**Measurements:** The length and breadth shall be measured correct to a cm and its area shall be calculated in square metres correct to two places of decimal. The depth shall not be less than the specified thickness at any section.

**Rate:** The rate is inclusive of the cost of materials and labour involved in all the operations described above except for the applications of a coat of hot bitumen and addition of water proofing materials which shall be paid for separately, unless otherwise specified.

**3.2.8.2 Tests for Cement Concrete-** Cement concrete and components thereof should satisfy the following tests and codes:
<table>
<thead>
<tr>
<th>Material</th>
<th>Clause</th>
<th>Test</th>
<th>Field/ Laboratory</th>
<th>Test procedure</th>
<th>Min. qty of Material for Carrying out test</th>
<th>Frequency of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stone aggregate</td>
<td>4.1.2.2</td>
<td>(a) Percentage of soft or deleterious material</td>
<td>Field or Laboratory.- Test as required</td>
<td>IS 2386-Part II</td>
<td>As required by Engineer-in-charge</td>
<td>For all quantities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.1.2.3 Particle size</td>
<td>Field/ Lab</td>
<td>Appendix ‘A’</td>
<td>45 cum</td>
<td>For every 45 cum or part thereof for RCC Work only. For rest of items as decided by Engineer-in-charge</td>
</tr>
<tr>
<td></td>
<td>4.1.2.5</td>
<td>(a) Estimation of organic impurities</td>
<td>Field/ Lab</td>
<td>IS 2386-Part II</td>
<td>10 cum</td>
<td>For every 40 cum or part thereof</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Surface moisture</td>
<td>Field/ Lab</td>
<td>IS 2386</td>
<td>10 cum</td>
<td>-do-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) Determination of 10% fine value</td>
<td>Field/ Lab</td>
<td>IS 2386</td>
<td>10 cum</td>
<td>-do-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(d) Specific gravity</td>
<td>Field/ Lab</td>
<td>IS 2386</td>
<td>10 cum</td>
<td>-do-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(e) Bulk density</td>
<td>Field/ Lab</td>
<td>IS 2386</td>
<td>10 cum</td>
<td>-do-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(f) Aggregate crushing strength</td>
<td>Field/ Lab</td>
<td>IS 2386</td>
<td>10 cum</td>
<td>-do-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(g) Aggregate impact value</td>
<td>Field/ Lab</td>
<td>IS 2386</td>
<td>10 cum</td>
<td>-do-</td>
</tr>
<tr>
<td>Concrete</td>
<td>4.2.2</td>
<td>Stump test</td>
<td>Field</td>
<td>Appendix ‘D’</td>
<td>15 cum or part thereof</td>
<td></td>
</tr>
</tbody>
</table>
3.2.9 REINFORCED CEMENT CONCRETE

3.2.9.1 MATERIALS

Water, cement, fine and coarse aggregate shall be as specified under respective clauses under concrete work as applicable.

Steel for Reinforcement

The steel used for reinforcement shall be any of the following types:

(a) Mild steel and medium tensile bars conforming to IS 432 (Part I)
(b) High strength deformed steel bars conforming to IS 1786

(c) Hard drawn steel wire fabric conforming to IS 1566

(d) Structural steel conforming to Grade A of IS 2062

(e) Thermo-mechanically treated (TMT) Bars.

Elongation percent on gauge length is 5.65 A where A is the cross sectional areas of the test piece.

Mild steel is not recommended for the use in structures located in earthquake zone subjected to severe damage and for structures subjected to dynamic loading (other than wind loading) such as railway and highway bridges.

Welding of reinforcement bars covered in this specification shall be done in accordance with the requirements of IS 2751.

**Nominal mass/weight:** The tolerance on mass/ weight for round and square bars shall be the percentage given in Table below of the mass/ weight calculated on the basis that the masses of the bar/ wire of nominal diameter and of density 7.85 kg/ cm³ or 0.00785 kg/mm³.

<table>
<thead>
<tr>
<th>Nominal size in mm</th>
<th>Tolerance on the Nominal Mass per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Batch</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Up to 16</td>
<td>±7</td>
</tr>
<tr>
<td>(b) Over 10, up to 16</td>
<td>±5</td>
</tr>
<tr>
<td>(c) Over 16</td>
<td>±3</td>
</tr>
</tbody>
</table>

*For individual sample plus tolerance is not specified
(x) for coil batch tolerance is not applicable
Tolerance shall be determined in accordance with method given in IS 1786.

High strength deformed bars & wires shall conform to IS 1786. The physical properties for all sizes of steel bars are mentioned below in Table below.
Tests: Selection and preparation of Test sample. All the tests pieces shall be selected by the Engineer-in-Charge or his authorized representative either-

(a) From cutting of bars

Or

(b) If he so desires, from any bar after it has been cut to the required or specified size and the test piece taken from and any part of it.

In neither case, the test pieces shall be detached from the bar or coil except in the presence of the Engineer-in-Charge or his authorized representative. The test pieces obtained in accordance with as above shall be full sections of the bars as rolled and subsequently cold worked and shall be subjected to physical tests without any further modifications. No deduction in size by machining or otherwise shall be permissible. No test piece shall be enacted or otherwise subject to heat treatment. Any straightening which a test piece may require shall be done cold.

Tensile Test: 0.2% proof stress and percentage elongation –

This shall be done as per IS 1608, read in conjunction with IS 226.

RE- test: This shall be done as per IS 1786.

Rebend test: This shall be done as per IS 1786.

Chemical composition of reinforcement bars shall be as follows:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Property</th>
<th>Fe 415</th>
<th>Fe 415D</th>
<th>Fe 500D</th>
<th>Fe 550D</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>0.2% Proof stress/yield stress, Min, N/mm²</td>
<td>415.0</td>
<td>415.0</td>
<td>500.0</td>
<td>550.0</td>
</tr>
<tr>
<td>(ii)</td>
<td>Elongation, per cent, Min on gauge length 5.65 √A, where A is the cross-sectional area of the test piece</td>
<td>14.5</td>
<td>18.0</td>
<td>15.0</td>
<td>14.5</td>
</tr>
<tr>
<td>(iii)</td>
<td>Tensile strength, Min</td>
<td>10 Per cent more than the actual 0.2 per cent proof stress/yield stress but not less than 485.0 N/mm²</td>
<td>12 Per cent more than the actual 0.2 per cent proof stress/yield stress but not less than 500.0 N/mm²</td>
<td>10 Per cent more than the actual 0.2 per cent proof stress/yield stress but not less than 555.0 N/mm²</td>
<td>8 Per cent more than the actual 0.2 per cent proof stress/yield stress but not less than 600.0 N/mm²</td>
</tr>
<tr>
<td>(iv)</td>
<td>Total elongation at maximum force, per cent, Min on gauge length 5.65 √A, where A is the cross-sectional area of the test piece</td>
<td>-</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Thermo Mechanically treated reinforcement bars:

(a) There is no BIS code for TMT bars. The available code BIS 1786 pertains to HSD Bars. Therefore there should be no stipulation that TMT bars should conform to relevant BIS code.

(b) The TMT bars are being produced under valid licence from either of the firms namely Tempcore, ThermexEvcon Turbo & Turbo Quench. These firms have acquired patents and are giving licences to various producers to produce TMT Bars.

(c) The TMT bars shall conform to IS 1786 pertaining to Fe 415 D or Fe 500 D or Fe grade of steel as specified.

(d) In design and construction of reinforced concrete building in seismic zone III and above, steel reinforcement of Grade Fe 415 D shall be used. However, high strength deformed steel bars, produced by thermomechanical treatment process of grade Fe 415, Fe 500 and Fe 550 having elongation more than 14.5. % and conform to other requirements of Fe 415 D, Fe 500 D and Fe 550 D respectively of IS 1786 may also be used for reinforcement. In future, latest provision of IS 456 and IS 13920 or any other relevant code as modified from time to time shall be applicable.

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Maximum Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fe 415</td>
</tr>
<tr>
<td>Carbon</td>
<td>0.30</td>
</tr>
<tr>
<td>Sulphur</td>
<td>0.060</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.060</td>
</tr>
<tr>
<td>Sulphur and</td>
<td>0.110</td>
</tr>
<tr>
<td>Phosphorus</td>
<td></td>
</tr>
</tbody>
</table>

Stacking and Storage

Steel for reinforcement shall be stored in such a way as to prevent distorting and corrosion. Care shall be taken to protect the reinforcement from exposure to saline atmosphere during storage, fabrication and use. It may be achieved by treating the surface of reinforcement with cement wash or by suitable methods. Bars of different classifications, sizes and lengths shall be stored separately to facilitate issue in such sizes and lengths to cause minimum wastage in cutting from standard length.

Identification- Care shall also be taken to properly identify these bars at site. The staff shall be specially trained for looking for identification marks on these bars given by the manufacturers which are generally given colour code. It will be advisable to see that only
one type/grade of bars are brought to site and used in the project after conducting tests for each lot.

3.2.9.2 FORM WORK (CENTRING & SHUTTERING)

Form work shall include all temporary or permanent forms or moulds required for forming the concrete which is cast-in-situ, together with all temporary construction required for their support.

Design & Tolerance in Construction

Form work shall be designed and constructed to the shapes, lines and dimensions shown on the drawings with the tolerance given below.

(a) Deviation from specified dimension of cross section of columns and beams
   +12 mm -6 mm

(b) Deviation from dimensions of footings
   (i) Dimension in Plan + 50 mm -12 mm
   (ii) Eccentricity in plan 0.02 times the width of the footing in the direction of deviation but not more than 50 mm.
   (iii) Thickness 0.05 times the specified thickness.

(Note- These tolerance apply to concrete dimensions only, and not to positioning of vertical steel or dowels).

General Requirement

It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be made sufficiently rigid by using adequate number of ties and braces, screw jacks or hard board wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete.

Form shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections, care shall be taken to see that no piece is keyed into the concrete.

Material for Form Work
(a) Propping and Centering: All propping and centering should be either of steel tubes with extension pieces or built up sections of rolled steel. Staging should be as designed with required extension pieces as approved by Engineer-in-Charge to ensure proper slopes, as per design for slabs/ beams etc. and as per levels as shown in drawing. All the staging to be either of Tubular steel structure with adequate bracings as approved or made of built up structural sections made form rolled structural steel sections.

(b) In case of structures with two or more floors, the weight of concrete, centering and shuttering of any upper floor being cast shall be suitably supported on one floor below the top most floor already cast.

(c) Form work and concreting of upper floor shall not be done until concrete of lower floor has set at least for 14 days.

**Shuttering:** Shuttering used shall be of sufficient stiffness to avoid excessive deflection and joints shall be tightly butted to avoid leakage of slurry. If required, rubberized lining of material as approved by the Engineer-in-Charge shall be provided in the joints. Steel shuttering used or concreting should be sufficiently stiffened. The steel shuttering should also be properly repaired before use and properly cleaned to avoid stains, honey combing, seepage of slurry through joints etc.

(a) Runner Joists: RSJ, MS Channel or any other suitable section of the required size shall be used as runners.

(b) Assembly of beam head over props. Beam head is an adopter that fits snugly on the head plates of props to provide wider support under beam bottoms.

(c) Only steel shuttering shall be used, except for unavoidable portions and very small works for which 12 mm thick water proofing ply of approved quality may be used.

Form work shall be properly designed for self weight, weight of reinforcement, weight of fresh concrete, and in addition, the various live loads likely to be imposed during the construction process (such as workmen, materials and equipment). In case the height of centering exceeds 3.50 metres, the prop may be provided in multi-stages.

**Camber:** Suitable camber shall be provided in horizontal members of structure, especially in cantilever spans to counteract the effect of deflection. The form work shall be so assembled as to provide for camber. The camber for beams and slabs shall be 4 mm per metre (1 to 250 ) or as directed by the Engineer-in-Charge, so as to offset the subsequent deflection, For cantilevers the camber at free end shall be 1/50th of the projected length or as directed by the Engineer-in-Charge.
**Removal of Form work (Stripping Time)**: In normal circumstance and where various types of cements are used, forms, may generally be removed after the expiry of the following periods:

<table>
<thead>
<tr>
<th>Type of Form work</th>
<th>Minimum period Before Striking Form work for OPC 33 grade</th>
<th>Minimum period Before Striking Form work for OPC 43 grade</th>
<th>Minimum period Before Striking Form work for PPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Vertical form work to columns, walls, beams</td>
<td>16-24 h</td>
<td>16-24 h</td>
<td>24-36 h</td>
</tr>
<tr>
<td>(b) Soffit form work to slabs (Props to be refixed immediately after removal of formwork)</td>
<td>3 days</td>
<td>3 days</td>
<td>4 days</td>
</tr>
<tr>
<td>(c) Soffit form work to beams (Props to be refixed immediately after removal of formwork)</td>
<td>7 days</td>
<td>7 days</td>
<td>10 days</td>
</tr>
<tr>
<td>(d) Props to slabs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Spanning upto 4.5m</td>
<td>7 days</td>
<td>7 days</td>
<td>10 days</td>
</tr>
<tr>
<td>(2) Spanning over 4.5m</td>
<td>14 days</td>
<td>14 days</td>
<td>20 days</td>
</tr>
<tr>
<td>(e) Props to beams and arches:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Spanning upto 6m</td>
<td>14 days</td>
<td>14 days</td>
<td>20 days</td>
</tr>
<tr>
<td>(2) Spanning over 6m</td>
<td>21 days</td>
<td>21 days</td>
<td>30 days</td>
</tr>
</tbody>
</table>

**Note 1**: For other types of cement, the stripping time recommended for ordinary Portland cement may be suitably modified. Generally, if Portland pozzolana or low heat cement or OPC with direct addition of fly ash has been used for concrete, the stripping time will be 10/7 of the period stated for OPC with 43 grade cement above.

**Note 2**: The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slabs, beam or arch as the case may be together with any live load likely to occur during curing or further construction.

**Note 3**: For rapid hardening cement, 3/7 of above periods for OPC 33 grade will be sufficient in all cases except for vertical side of slabs, beams and columns which should be retained for at least 24 hours.

**Note 4**: In case of cantilever slabs and beams, the centering shall remain till structures for counteracting or bearing down have been erected and have attained sufficient strength.

**Note 5**: Proper precautions should be taken to allow for the decrease in the rate of hardening that occurs with all types of cement in cold weather and accordingly stripping time shall be increased.

**Note 6**: Work damaged through premature or careless removal of forms shall be reconstructed within 24 hrs.

**Surface Treatment**
**Oiling the Surface:** Shuttering gives much longer service life if the surfaces are coated with suitable mould oil which acts both as a parting agent and also gives surface protections. A typical mould oil is heavy mineral oil or purified cylinder oil containing not less than 5% pentachlorophenol conforming to IS 716 well mixed to a viscosity of 70-80 centipoises. After 3-4 uses and also in cases when shuttering has been stored for a long time, it should be recoated with mould oil before the next use.

The second categories of shuttering oils / leavening agents are Polymer based water soluble Compounds. They are available as concentrates and when used diluted with water in the ratio of 1:20 or as per manufacturer specifications. The diluted solution is applied by brush applications on the shuttering both of steel as well as ply wood. The solution is applied after every use.

The design of form work shall conform to sound Engineering practices and relevant IS codes.

**Inspection of Form Work**

The completed form work shall be inspected and approved by the Engineer-in-Charge before the reinforcement bars are placed in position. Proper form work should be adopted for concreting so as to avoid honey combed, blow holes, grout loss, stains or discoloration of concrete etc. Proper and accurate alignment and profile of finished concrete surface will be ensured by proper designing and erection of form work which will be approved by Engineer-in-Charge.

Shuttering surface before concreting should be free from any defect/ deposits and full cleaned so as to give perfectly straight smooth concrete surface. Shuttering surface should be therefore checked for any damage to its surface and excessive roughness before use.

**Erection of Form Work (Centering and shuttering):** Following points shall be borne in mind while checking during erection.

(a) Any member which is to remain in position after the general dismantling is done, should be clearly marked.

(b) Material used should be checked to ensure that, wrong items/ rejects are not used.

(c) If there are any excavations nearby which may influence the safety of form works, corrective and strengthening action must be taken.

(d) (i) The bearing soil must be sound and well prepared and the sole plates shall bear well on the ground.

   (ii) Sole plates shall be properly seated on their bearing pads or sleepers.
(iii) The bearing plates of steel props shall not be distorted.

(iv) The steel parts on the bearing members shall have adequate bearing areas.

(e) Safety measures to prevent impact of traffic, scour due to water etc. should be taken. Adequate precautionary measures shall be taken to prevent accidental impacts etc.

(f) Bracing, struts and ties shall be installed along with the progress of form work to ensure strength and stability of form work at intermediate stage. Steel sections (especially deep sections) shall be adequately restrained against tilting, over turning and form work should be restrained against horizontal loads. All the securing devices and bracing shall be tightened.

(g) The stacked materials shall be placed as catered for, in the design.

(h) When adjustable steel props are used. They should:
   1. be undamaged and not visibly bent.
   2. have the steel pins provided by the manufacturers for use.
   3. be restrained laterally near each end.
   4. have means for centralizing beams placed in the forkheads.

(i) Screw adjustment of adjustable props shall not be over extended.

(j) Double wedges shall be provided for adjustment of the form to the required position wherever any settlement/ elastic shorting of props occurs. Wedges should be used only at the bottom end of single prop. Wedges should not be too steep and one of the pair should be tightened/ clamped down after adjustment to prevent shifting.

(k) No member shall be eccentric upon vertical member.

(l) The number of nuts and bolts shall be adequate.

(m) All provisions of the design and/or drawings shall be complied with.

(n) Cantilever supports shall be adequate.

(o) Props shall be directly under one another in multistage constructions as far as possible.

(p) Guy ropes or stays shall be tensioned properly.
(q) There shall be adequate provision for the movements and operation of vibrators and other construction plant and equipment.

(r) Required camber shall be provided over long spans.

(s) Supports shall be adequate, and in plumb within the specified tolerances.

**Measurements**

**General**: The form work shall include the following:

(a) Splayed edges, notching, allowance for overlaps and passing at angles, sheathing battens, strutting, bolting, nailing, wedging, easing, striking and removal.

(b) All supports, struts, braces, wedges as well as mud sills, piles or other suitable arrangements to support the form work.

(c) Bolts, wire, ties, clamps, spreaders, nails or any other items to hold the sheathing together.

(d) Working scaffolds, ladders, gangways, and similar items.

(e) Filleting to form stop chamfered edges of splayed external angles not exceeding 20mm wide to beams, columns and the like.

(f) Where required, the temporary openings provided in the forms for pouring concrete, inserting vibrators, and cleaning holes for removing rubbish from the interior of the sheathing before pouring concrete.

(g) Dressing with oil to prevent adhesion and

(h) Raking or circular cutting

**Classification of Measurements**: Where it is stipulated that the form work shall be paid for separately, measurements shall be taken of the area of shuttering in contact with the concrete surface. Dimensions of the form work shall be measured correct to a cm. The measurements shall be taken separately for the following.

(a) Foundations, footings, bases of columns etc. and for mass concrete

(b) Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc.

(c) Suspended floors, roofs, landings, shelves and their supports and balconies.

(d) Lintels, beams, plinth beams, girders, bressummers and cantilevers.
(e) Columns, pillars, piers, abutments posts and struts.

(f) Stairs (excluding landings) except spiral staircase.

(g) Spiral staircases (including landings).

(h) Arches, Domes, vaults, shells roofs, arch ribs, curvilinear shaped folded plates

(i) Extra for arches, domes, vaults exceeding 6 m span other than curvilinear shaped

(j) Chimneys and shafts.

(k) Well steining.

(l) Vertical and horizontal fins individually or forming box, louvers and bands, facias and eaves board

(m) Waffle or ribbed slabs.

(n) Edges of slabs and breaks in floors and walls (to be measured in running metres where below

200 mm in width or thickness).

(o) Cornices and mouldings.

(p) Small surfaces, such as cantilevers ends, brackets and ends of steps, caps and boxes to

pilasters and columns and the like.

(q) Chullah hoods, weather shades, chajjas, corbels etc. including edges and

(r) Elevated water reservoirs.

Centering, and shuttering where exceeding 3.5 metre height in one floor shall be measured and paid for separately.

Where it is not specifically stated in the description of the item that form work shall be paid for separately, the rate of the RCC item shall be deemed to include the cost of form work.

No deductions from the shuttering due to the openings/ obstructions shall be made if the area of each openings/ obstructions does not exceed 0.4 square metre. Nothing extra shall be paid for forming such openings.
Form work of elements measured under categories of arches, arch ribs, domes, spiral staircases, well steining, shell roofs, curvilinear folded plates & curvilinear eaves board, circular shafts & chimneys shall not qualify for extra rate for circular work.

Extra for circular work shall be admissible for surfaces circular or curvilinear in plan or in elevation beyond the straight edge of supporting beam in respective mode of measurement. However, there may be many different types of such structures. In such cases, extra payment shall be made judiciously after deducting areas where shuttering for circular form work is not involved.

**Rate**

The rate of the form work includes the cost of labour and materials required for all the operations described above.

3.2.9.3 **REINFORCEMENT**

**General Requirements**

Steel for reinforcement shall be clear and free from loose mill scales, dust, loose rust, coats of paints, oil or other coating which may destroy or reduce bond. It shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. Prior to assembly of reinforcement on no account any oily substance shall be used for removing the rust.

**Assembly of Reinforcement** : Bars shall be bent correctly and accurately to the size and shape as shown in the detailed drawing or as directed by Engineer-in-Charge. Preferably bars of full length shall be used. Necessary cutting and straightening is also included. Overlapping of bars, where necessary shall be done as directed by the Engineer-in-Charge. The overlapping bars shall not touch each other and these shall be kept apart with concrete between them by 25mm or 11/4 times the maximum size of the coarse aggregate whichever is greater. But where this is not possible, the overlapping bars shall be bound together at intervals not exceeding twice the dia. of such bars with two strands annealed steel wire of 0.90 mm to 1.6 mm twisted tight. The overlaps/ splices shall be staggered as per directions of the Engineer-in-Charge. But in no case the overlapping shall be provided in more than 50% of cross sectional area at one section.

**Bonds and Hooks Forming End Anchorages**: Reinforcement shall be bent and fixed in accordance with procedure specified in IS 2502, code of practice of bending and fixing of bars for concrete reinforcement. The details of bends and hooks are given below for guidance.
(a) *U-Type Hook*

In case of mild steel plain bars standard U type hook shall be provided by bending ends of rod into semicircular hooks having clear diameter equal to four times the diameter of the bar.

**Note:** In case of work in seismic zone, the size of hooks at the end of the rod shall be eight times the diameter of bar or as given in the structural drawings.

(b) *Bends*

Bend forming anchorage to a M.S. plain bar shall be bent with and internal radius equal to two times the diameter of the bar with a minimum length beyond the bend equal to four times the diameter of the bar.

---

**Anchoring Bars in Tension** : Deformed bars may be used without end anchorages provided, development length equipment is satisfied. Hooks should normally be provided for plain bars in tension. Development length of bars will be determined as per IS: 456.

**Anchoring Bars in Compression** : The anchorage length of straight bar in compression shall be equal to the ‘Development length’ of bars in compression as specified in IS: 456. The projected length of hooks, bend and straight lengths beyond bend, if provided for a bar in compression, shall be considered for development length.

**Binders, stirrups, links etc.** : In case of binders, stirrups, links etc. the straight portion beyond the curve at the end shall be not less than eight times and nominal size of bar.

**Welding of Bars**

Wherever facility for electric **arc welding** or **gas pressure welding** is available, welding of bars shall be done in lieu of overlap. The location and type of welding shall be got approved by the Engineer-in-Charge. Welding shall be as per IS 2751 and 9417.

**Placing in Position**

Fabricated reinforcement bars shall be placed in position as shown in the drawings or as directed by the Engineer-in-charge. The bars crossing one another shall be tied together at every intersection with two strands of annealed steel wire 0.9 to 1.6 mm thickness twisted tight to make the skeleton of the steel work rigid so that the reinforcement does not get displaced during deposition of concrete. Tack welding in crossing bars shall also be permitted in lieu of binding with steel wire if approved by Engineer-in-Charge.

The bars shall be kept in correct position by the following methods:
(a) In case of beam and slab construction pre-cast cover blocks in cement mortar 1:2 (1 cement : 2 coarse sand) about 4x4 cm section and of thickness equal to the specified cover shall be placed between the bars and shuttering, so as to secure and maintain the requisite cover of concrete over reinforcements.

(b) In case of cantilevered and doubly reinforced beams of slabs, the vertical distance between the horizontal bars shall be maintained by introducing chairs, spacers or support bars of steel at 1.0 metre or at shorter spacing to avoid sagging.

(c) In case of columns and walls, the vertical bars shall be kept in position by means of timber templates with slots accurately cut in them: or with clock of cement mortar 1:2 (1 cement: 2 coarse sand) of required size suitable tied to the reinforcement to ensure that they are in correct position during concreting.

(d) In case of other R.C.C. structure such as arches, domes, shells, storage tanks etc. a combination of cover blocks, spacers and templates shall be used as directed by Engineer-in-Charge.

**Tolerance on Placing of Reinforcement:** Unless otherwise specified by the Engineer-in-Charge, reinforcement shall be placed within the following tolerances:

**Tolerance in spacing**

(a) For effective depth, 200 mm or less +10 mm

(b) For effective depth, more than 200 mm + 15 mm

**Bending at Construction Joints:** Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position care should be taken to ensure that at no time the radius of the bend is less than 4 bar diameters for plain mild steel or 6 bar diameter for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bar is not damaged.

**Cover:** The minimum nominal cover to meet durability requirements shall be as under:-

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Nominal Concrete cover in mm not less than</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>20</td>
</tr>
<tr>
<td>Moderate</td>
<td>30</td>
</tr>
<tr>
<td>Severe</td>
<td>45</td>
</tr>
<tr>
<td>Very severe</td>
<td>50</td>
</tr>
<tr>
<td>Extreme</td>
<td>75</td>
</tr>
</tbody>
</table>

**Notes:** 1. For main reinforcement upto 12 mm diameter bar for mild exposure the nominal cover may be reduced by 5 mm.
2. Unless specified otherwise, actual concrete cover should not deviate from the required nominal cover by + 10 mm.

3. For exposure condition ‘severe’ and ‘very severe’ reduction of 5 mm may be made, where concrete grade is M35 and above.

4. Nominal cover to meet specified period of fire resistance shall not be less than as given in Table 16A of IS 456.

Measurement

Reinforcement including authorized spacer bars and lappages shall be measured in length of different diameter, as actually (not more than as specified in the drgs.) used in the work nearest to a centimetre and their weight calculated on the basis of standard weight given in Table below. In case actual unit weight of the bars is less than standard unit weight, but within variation, in such cases weight of reinforcement shall be calculated on the basis of actual unit weight. Wastage and unauthorized overlaps shall not be paid for. Annealed steel wire required for binding or tack welding shall not be measured, its cost being included in the rate of reinforcement.

Where tack welding is used in lieu of binding, such welds shall not be measured. Chairs separators etc. shall be provided as directed by the Engineer-in-Charge and measured separately and paid for.

<table>
<thead>
<tr>
<th>Nominal Size mm</th>
<th>Cross sectional Area Sq.mm</th>
<th>Mass per metre Run Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>28.3</td>
<td>0.222</td>
</tr>
<tr>
<td>8</td>
<td>50.3</td>
<td>0.395</td>
</tr>
<tr>
<td>10</td>
<td>78.6</td>
<td>0.617</td>
</tr>
<tr>
<td>12</td>
<td>113.1</td>
<td>0.888</td>
</tr>
<tr>
<td>16</td>
<td>201.2</td>
<td>1.58</td>
</tr>
<tr>
<td>20</td>
<td>314.3</td>
<td>2.47</td>
</tr>
<tr>
<td>25</td>
<td>491.1</td>
<td>3.85</td>
</tr>
<tr>
<td>28</td>
<td>615.8</td>
<td>4.83</td>
</tr>
<tr>
<td>32</td>
<td>804.6</td>
<td>6.31</td>
</tr>
<tr>
<td>36</td>
<td>1018.3</td>
<td>7.99</td>
</tr>
<tr>
<td>40</td>
<td>1257.2</td>
<td>9.86</td>
</tr>
</tbody>
</table>

These are as per clause 6.2 of IS 1786.

Rate

The rate for reinforcement shall include the cost of labour and materials required for all operations described above such as cleaning of reinforcement bars, straightening, cutting, hooking bending, binding, placing in position etc. as required or directed including tack welding on crossing of bars in lieu of binding with wires.

3.2.9.4 CONCRETING
The concrete shall be as specified under Cement concrete work. The proportion by volume or by the weight of ingredients shall be as specified.

**Consistency**

The concrete which will flow sluggishly into the forms and around the reinforcement without any segregation of coarse aggregate from the mortar shall be used. The consistency shall depend on whether the concrete is vibrated on or hand tamped, it shall be determined by slump test as prescribed in sub-head “concrete” under workability – requirement.

**Placing of Concrete**

Concreting shall be commenced only after Engineer-in-Charge has inspected the centering, shuttering and reinforcement as placed and passed the same. Shuttering shall be clean and free from all shavings, saw dust, pieces of wood, or other foreign material and surfaces shall be treated as prescribed earlier.

In case of concreting of slab and beams, wooden plank or cat walks of chequerred MS plated or bamboo chalies or any other suitable material supported directly on the centering by means of wooden blocks or lugs shall be provided to convey the concrete to the place of deposition without disturbing the reinforcement in any way. Labour shall not be allowed to walk over the reinforcement. In case of columns and wall, it is desirable to place concrete without construction joints. The progress of concreting in the vertical direction, shall be restricted to one metre per hour.

The concrete shall be deposited in its final position in a manner to preclude segregation of ingredients. In deep trenches and footings concrete shall be placed through chutes or as directed by the Engineer-in-Charge. In case of columns and walls, the shuttering shall be so adjusted that the vertical drop of concrete is not more than 1.5 metres at a time.

During cold weather, concreting shall not be done when the temperature falls below 4.50°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone.

During hot weather precaution shall be taken to see that the temperature of wet concrete does not exceed 38°C. No concrete shall be laid within half an hour of the closing time of the day, unless permitted by the Engineer-in-Charge.

It is necessary that the time between mixing and placing of concrete shall not exceed 30 minutes so that the initial setting process is not interfered with.

**Compaction**

It shall be as specified in sub-head of Cement Concrete Work.
Concrete shall be compacted into dense mass immediately after placing by means of mechanical vibrators designed for continuous operations complying with IS 2505, IS 2506, IS 2514 and IS 4656. The Engineer-in-Charge may however relax this condition at his discretion for certain items depending on the thickness of the members and feasibility of vibrating the same and permit hand compaction instead. Hand compaction shall be done with the help of tamping rods so that concrete is thoroughly compacted and completely worked around the reinforcement, embedded fixtures, and into corners of the form. The layers of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed. The vibrators shall maintain the whole of concrete under treatment in an adequate state of agitation; such that de-aeration and effective compaction is attained at a rate commensurate with the supply of concrete from the mixers. The vibration shall continue during the whole period occupied by placing of concrete, the vibrators being adjusted so that the centre of vibrations approximates to the centre of the mass being compacted at the time of placing. Concrete shall be judged to be properly compacted, when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface. When this condition has been attained, the vibrator shall be stopped in case of vibrating tables and external vibrators. Needle vibrators shall be withdrawn slowly so as to prevent formation of loose pockets in case of internal vibration. In case both internal and external vibrators are being used, the internal vibrator shall be first withdrawn slowly after which the external vibrators shall be stopped so that no loose pocket is left in the body of the concrete. The specific instructions of the makers of the particular type of vibrator used shall be strictly complied with. Shaking of reinforcement for the purpose of compaction should be avoided. Compaction shall be completed before the initial setting starts, i.e. with 30 minutes of addition of water to the dry mixture.

Construction joints

Concreting shall be carried out continuously upto the construction joints, the position and details of which shall be as shown in structural drawing or as directed by Engineer-in-Charge. Number of such joints shall be kept to minimum. The joints shall be kept at places where the shear force is the minimum. These shall be straight and shall be at right angles to the direction of main reinforcement. Construction joints should comply with IS 11817.

In case of columns the joints shall be horizontal and 10 to 15 cm below the bottom of the beam running into the column head. The portion of the column between the stepping off level and the top of the slab shall be concreted with the beam.

When stopping the concrete on a vertical plane in slabs and beams, and approved stop board shall be placed with necessary slots for reinforcement bars or any other obstruction to pass the bars freely without bending. The construction joints shall be keyed by
providing a triangular or trapezoidal fillet nailed on the stopboard. Inclined or feather joints shall not be permitted. Any concrete flowing through the joints of stopboard shall be removed soon after the initial set. When concrete is stopped on a horizontal plane, the surface shall be roughened and cleaned after the initial set.

When the work has to be resumed, the joint shall be thoroughly cleaned with wire brush and loose particles removed. A coat of neat cement slurry at the rate of 2.75 kg of cement per square metre shall then be applied on the roughened surface before fresh concrete is laid.

**Expansion Joints**

Expansion joints shall be provided as shown in the structural drawings or as directed by Engineer-in-Charge, for the purpose of general guidance. However it is recommended that structures exceeding 45 m in length shall be divided by one or more expansion joints. The filling of these joints with bitumen filler, bitumen felt or any such material and provision of copper plate, etc. shall be paid for separately in running metre. The measurement shall be taken two places of decimal stating the depth and width of joint.

**Curing**

After the concrete has begun to harden i.e. about 1 to 2 hours after its laying, it shall be protected from quick drying by covering with moist gunny bags, sand, canvass Hessian or any other material approved by the Engineer-in-Charge. After 24 hours of laying of concrete, the surface shall be cured by ponding with water for a minimum period of 10 days where mineral admixtures or blended cements are used. The period of curing shall not be less than 10 days for concrete exposed to dry and hot weather condition.

**Finishing**

In case of roof slabs the top surface shall be finished even and smooth with wooden trowel, before the concrete begins to set. **Sprinkling of dry cement while finishing shall not be resorted to.**

Immediately on removal of forms, the R.C.C. work shall be examined by the Engineer-in-Charge, before any defects are made good.

(a) The work that has sagged or contains honey combing to an extent detrimental to structural safety or architectural concept shall be rejected as given in para 5.4.9.4 for visual inspection test.

(b) Surface defects of minor nature may be accepted. On acceptance of such a work by the Engineer-in-Charge, the same shall be rectified as follows:
1. Surface defects which require repair when forms are removed, usually consist of bulged due to movement of forms, ridges at form joints, honey-combed areas, damage resulting from the stripping of forms and bolt holes, bulges and ridges are removed by careful chipping or tooling and the surface is then rubbed with a grinding stone. Honey-combed and other defective areas must be chipped out, the edges being cut as straight as possible and perpendicularly to the surface, or preferably slightly under cut to provide a key at the edge of the patch.

2. Shallow patches are first treated with a coat of thin grout composed of one part of cement and one part of fine sand and then filled with mortar similar to that used in the concrete. The mortar is placed in layers not more than 10mm thick and each layer is given a scratch finish to secure bond with the succeeding layer. The last layer is finished to match the surrounding concrete by floating, rubbing or tooling on formed surfaces by pressing the form material against the patch while the mortar is still plastic.

3. Large and deep patches require filling up with concrete held in place by forms. Such patches are reinforced and carefully dowelled to the hardened concrete.

4. Holes left by bolts are filled with mortar carefully packed into places in small amounts. The mortar is mixed as dry as possible, with just enough water so that it will be tightly compacted when forced into place.

5. Tiered holes extending right through the concrete may be filled with mortar with a pressure gun similar to the gun used for greasing motor cars.

6. Normally, patches appear darker than the surrounding concrete, possibly owing to the presence on their surface of less cement laitance. Where uniform surface colour is important, this defect shall be remedied by adding 10 to 20 percent of white Portland cement to the patching mortar, the exact quantity being determined by trial.

7. The same amount of care to cure the materials in the patches should be taken as with the whole structure. Curing must be started as soon as possible, after the patch is finished to prevent early drying. Damp Hessian may be used but in some locations it may be difficult to hold it in place. A membrane curing compound in these cases will be most convenient.

(c) The exposed surface of R.C.C. work shall be plastered with cement mortar 1:3 (1 cement : 3 fine sand) of thickness not exceeding 6 mm to give smooth and even surface true to line and form. Any RCC surface which remains permanently exposed
to view in the completed structure, shall be considered exposed surfaced for the purpose of this specification. Where such exposed surface exceeding 0.5 sqm in each location is not plastered with cement mortar 1:3 (1 cement : 3 fine sand) 6 mm thick, necessary deduction shall be made for plastering not done.

(d) The surface which is to receive plaster or where it is to be joined with brick masonry wall, shall be properly roughened immediately after the shuttering is removed, taking care to remove the laitance completely without disturbing the concrete. The roughening shall be done by hacking. Before the surface is plastered, it shall be cleaned and wetted so as to give bond between concrete and plaster. RCC work shall be done carefully so that the thickness of plaster required for finishing the surface is not more than 6 mm.

(e) The surface of RCC slab on which the cement concrete or mosaic floor is to be laid shall be roughened with brushes while the concrete is green. This shall be done without disturbing the concrete.

**Strength of Concrete**

The compressive strength on the work tests for different mixed shall be as given below:

<table>
<thead>
<tr>
<th>Concrete Mix (Nominal Mix on Volume basis)</th>
<th>Compressive Strength in (Kg/sq cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 days’</td>
</tr>
<tr>
<td>1:1:2</td>
<td>210</td>
</tr>
<tr>
<td>1:1:5:3</td>
<td>175</td>
</tr>
<tr>
<td>1:2:4</td>
<td>140</td>
</tr>
</tbody>
</table>
3.2.9.5 Tests for Cement Concrete - Cement concrete and components thereof should satisfy the following tests and codes:

<table>
<thead>
<tr>
<th>Material</th>
<th>Clause</th>
<th>Test</th>
<th>Field/Laboratory test</th>
<th>Test procedure</th>
<th>Min. quantity of material for carrying out the test</th>
<th>Frequency of testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced cement concrete (Nominal Mix)</td>
<td>5.4.1</td>
<td>(a) Slump test</td>
<td>Field/Lab</td>
<td>Appendix 'D' of Chapter 4</td>
<td>(i) 5 cum in case of column</td>
<td>(i) Every 5 cum of part thereof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(ii) 20 cum for slabs, beams and connected columns</td>
<td></td>
<td>(ii) Every 20 cum or part thereof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(iii) 20 cum for other R.C.C. work for all other small items and where R.C.C. done in a day is less than 5 cum test may be carried out as required by Engineer-in-Charge</td>
<td></td>
<td>(iii) -Do-</td>
</tr>
<tr>
<td></td>
<td>5.4.9.1</td>
<td>(b) Cube Test</td>
<td>Lab</td>
<td>Appendix 'A'</td>
<td>(i) 5 cum in case of column</td>
<td>(i) Every 5 cum or part thereof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(ii) 20 cum for slabs, beams and connected columns</td>
<td></td>
<td>(ii) Every 20 cum or part thereof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(iii) 20 cum for other R.C.C. work for all other small items and where R.C.C. done in a day is less than 5 cum test may be carried out as required by Engineer-in-Charge</td>
<td></td>
<td>(iii) -Do-</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Reinforced Cement Concrete (Design Mix)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 cum or part thereof &amp; also on each change of source</td>
<td></td>
</tr>
<tr>
<td>Coarse Aggregates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Aggregates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 cum or part thereof &amp; also on each change of source</td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 MT or on each change of source</td>
<td></td>
</tr>
<tr>
<td>Fresh Concrete</td>
<td>(a) Slump test</td>
<td>Field</td>
<td>Appendix ‘D’ of Chapter 4</td>
<td></td>
<td>10 cum</td>
<td>50 cum for R.C.C. work including in all other small location. R.C.C. done in a day is less than 50 cum test may be carried out as required by Engineer-in-Charge</td>
</tr>
<tr>
<td>Fresh Concrete</td>
<td>(b) Cube Test</td>
<td>Lab</td>
<td>Appendix ‘A’</td>
<td></td>
<td>10 cum or part thereof</td>
<td>50 cum or 10 batches of 5-7 cum each for R.C.C. work in all location taken together. R.C.C. done in a day is less than 50 cum test may be carried out as required by Engineer-in-Charge</td>
</tr>
<tr>
<td><strong>Reinforced Cement Concrete (Ready Mix)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 cum or part thereof &amp; also on each change of source</td>
<td></td>
</tr>
<tr>
<td>Coarse Aggregates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Aggregates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 cum or part thereof &amp; also on each change of source</td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 MT or on each change of source</td>
<td></td>
</tr>
<tr>
<td>Fresh Concrete</td>
<td>(a) Slump test</td>
<td>Field/Lab</td>
<td>Appendix ‘D’ of Chapter 4</td>
<td></td>
<td>10 cum</td>
<td>50 cum for R.C.C. work including in all other small location. R.C.C. done in a day is less than 50 cum test may be carried out as required by Engineer-in-Charge</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------</td>
<td>--------------------------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Fresh Concrete</td>
<td>(b) Cube Test</td>
<td>Lab</td>
<td>Appendix 'A'</td>
<td>10 cum or part thereof</td>
<td>50 cum or 10 batches of 5-7 cum each for R.C.C. work in all location - taken together. R.C.C. done in a day is less than 50 cum test may be carried out as required by Engineer-in-Charge</td>
</tr>
<tr>
<td>2</td>
<td>Steel for Reinforced concrete</td>
<td>5.1.3</td>
<td>(A) Physical Test and chemical tests</td>
<td></td>
<td>(a) For consignment below 100 tonnes</td>
<td>(b) For consignment over 100 tonnes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(i) Under 10 mm dia, one sample for each 25 tonnes or part thereof</td>
<td>(i) Under 10 mm dia, one sample for each 40 tonnes or part thereof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(ii) 10 mm to 16 mm dia one sample for each 35 tonnes or part thereof</td>
<td>(ii) 10 mm to 16 mm, one sample for each 45 tonnes or part thereof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(iii) over 16 mm dia one sample for each 45 tonnes or part thereof</td>
<td>(iii) over 16 mm dia, one sample for each 50 tonnes or part thereof</td>
</tr>
</tbody>
</table>
## LIST OF BUREAU OF INDIAN STANDARDS CODES

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>I.S. No.</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IS 226</td>
<td>Structural Steel</td>
</tr>
<tr>
<td>2.</td>
<td>IS 432 (Part I)</td>
<td>Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement part-I mild steel and medium tensile steel bars.</td>
</tr>
<tr>
<td>3.</td>
<td>IS 432 (Part II)</td>
<td>Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement – Part-II hard drawn steel wire.</td>
</tr>
<tr>
<td>5.</td>
<td>IS 516</td>
<td>Method of test for strength of concrete.</td>
</tr>
<tr>
<td>6.</td>
<td>IS 716</td>
<td>Specification for pentachlorophenol</td>
</tr>
<tr>
<td>7.</td>
<td>IS 1199</td>
<td>Method of sampling and analysis of concrete.</td>
</tr>
<tr>
<td>8.</td>
<td>IS 1200 (Part II)</td>
<td>Method of measurement of building and civil engineering work – concrete work</td>
</tr>
<tr>
<td>9.</td>
<td>IS 1200 (Part V)</td>
<td>Method of measurement of building and civil engineering work – concrete work (Part 5- Form work)</td>
</tr>
<tr>
<td>11.</td>
<td>IS 1599</td>
<td>Method for bend test</td>
</tr>
<tr>
<td>12.</td>
<td>IS 1343</td>
<td>Code of Practice for Prestressed Concrete</td>
</tr>
<tr>
<td>13.</td>
<td>IS 1608</td>
<td>Method for tensile testing of steel products</td>
</tr>
<tr>
<td>14.</td>
<td>IS 1786</td>
<td>Specification for high strength deformed steel and wires for concrete reinforcement.</td>
</tr>
<tr>
<td>15.</td>
<td>IS 1791</td>
<td>Specification for batch type concrete mixes</td>
</tr>
<tr>
<td>17.</td>
<td>IS 2751</td>
<td>Recommended practice for welding of mild steel plain and deformed bars for reinforced construction.</td>
</tr>
<tr>
<td>18.</td>
<td>IS 4925</td>
<td>Batch plants specification for concrete batching and mixing plant</td>
</tr>
<tr>
<td>19.</td>
<td>IS 4926</td>
<td>Ready – Mixed Concrete</td>
</tr>
<tr>
<td>20.</td>
<td>IS 6523</td>
<td>Specification for precast reinforced concrete door, window frames</td>
</tr>
<tr>
<td>21.</td>
<td>IS 10262</td>
<td>Recommended guidelines for concrete mix design</td>
</tr>
<tr>
<td>22.</td>
<td>IS 13311 (Part I)</td>
<td>Indian standard for non-destructive testing of concrete. Method of test for ultrasonic pulse velocity</td>
</tr>
<tr>
<td>23.</td>
<td>IS 13311 (Part II)</td>
<td>Indian standard for non-destructive testing of concrete. Method of testing by rebound hammer.</td>
</tr>
</tbody>
</table>
3.3 READY MIXED CONCRETE

3.3.1 Materials

Selection and Approval of Materials: Materials used should satisfy the requirements for the safety, structural performance durability and appearance of the finished structure, taking full account of the environment to which it will be subjected. The selection and use of materials shall be in accordance with IS 456. Materials used shall conform to the relevant Indian Standards applicable. Where materials are used which are not covered by the provisions of the relevant Indian Standard, there should be satisfactory data on their suitability and assurance of quality control. Records and details of performance of such materials should be maintained. Account should be taken of possible interactions and compatibility between IS 4926 and materials used. Also, prior permission of the purchaser shall be obtained before use of such materials.

Cement: Cement used for concrete shall be in accordance with the requirements of IS 456.

Mineral Admixtures: Use of mineral admixtures shall be permitted in accordance with the provisions of IS 456.

Aggregates: Aggregates used for concrete shall be in accordance with the requirement of IS 456. Unless otherwise agreed testing frequencies for aggregates in plant shall be as given IS 4926.

Chemical Admixtures

(i) Use of chemical admixtures shall be permitted in accordance, with the provisions of IS 456 and IS 9103.

(ii) It shall be the responsibility of the producer to establish compatibility and suitability of any admixture with the other ingredients of the mix and the determine the dosage required to give the desired effect.

(iii) Admixtures should be stored in a manner that prevents degradation of the product and consumed within the time period indicated by the admixture supplier. Any vessel containing an admixture in the plant or taken to site by the producer shall be clearly marked as to its content.

(iv) When offering or delivering a mix to a purchaser it should be indicated if such a mix contains an admixture or combination of admixtures or not. The admixtures may be identified generically and should be declared on the delivery ticket.
(v) The amount of admixture added to mix shall be recorded in the production record. In special circumstances, if necessary, additional dose of admixture may be added at project site to regain the workability of concrete with the mutual agreement between the producer and the purchaser.

**Water :** Water used shall be in accordance with the requirement of IS 456. Unless otherwise agreed, the testing frequencies for water shall be as given in code. The use of re-cycled water is encouraged as long as concrete of satisfactory performance can be produced and steps are taken to monitor the build up of chlorides in any recirculated water and that any subsequent adjustments to the mix design are made to ensure that any overall limit on chloride contents is satisfied. The addition of any recycled water shall be monitored and controlled to meet these requirements.

The total amount of water added to the mix shall be recorded in the production record. The water content of concrete shall be regulated by controlling its workability or by measuring and adjusting the moisture contents of its constituent materials. The producer’s production staff and truck-mixer, drivers shall be made aware of the appropriate responses to variations in concrete consistency of a particular mix caused by normal variations in aggregate moisture content or grading.

**General Requirements**

**Basis of Supply :** Ready-mixed concrete shall be supplied having the quality and the quantity in accordance with the requirement agreed with the purchaser or his agent. Notwithstanding this, the concrete supplied shall generally comply with requirements of IS 456.

All concrete will be supplied and invoiced in terms of cubic metres (full or part) of compacted fresh concrete. All proportioning is to be carried out by mass except water and admixture, which may be measured by volume.

**Transport of Concrete :** Ready-mixed concrete shall be transported from the mixer to the point of placing as rapidly as practicable by methods that will maintain the required workability and will prevent segregation, loss of any constituents or ingress of foreign matter or water. The concrete shall be placed as soon as possible after delivery, as close as is practicable to its final position to avoid re-handling or moving the concrete horizontally by vibration. If required by the purchaser the producer can utilize. A figure of the steel structure to be fabricated shall be drawn on a level platform to full scale. This may be done in full or in parts, as shown on drawings or as directed by the Engineer-in-Charge. Steel tape shall be used for measurements.
**Time in Transport** : The general requirement is that concrete shall be discharged from the truck-mixer within 2 h of the time of loading. However, a longer period may be permitted if retarding admixtures are used or in cool humid weather or when chilled concrete is produced. The time of loading shall start from adding the mixing water to the dry mix of cement and aggregate or of adding the cement to the wet aggregate whichever is applicable.

Ready-mixed concrete plant shall have test facilities at its premises to carry out routine tests as per the requirement of the standard.

**Sampling and Testing of Ready-Mixed Concrete**

**Point and Time of Sampling** : For the assessment of compliance of ready-mixed concrete, the point and time of sampling shall be at discharge from the producer’s delivery vehicle or from the mixer to the site or when delivered into the purchaser’s vehicle. It is critical that the sampling procedure and equipment used enables as representative a sample as possible to be taken of the quantity of concrete delivered.

The sampling may be carried out jointly by the purchaser and the supplier with its frequency mutually agreed upon. However, it will not absolve the supplier of his responsibility from supplying in concrete as per the requirement given in this standard or otherwise agreed to where so permitted in the standard.

**Workability** : The test for acceptance is to be performed upon the producer’s delivery vehicle discharge on site or upon discharge into the purchaser’s vehicle. If discharge from the producers’ vehicle is delayed on site due to lack of preparedness on behalf of the purchaser then the responsibility passes to the purchaser after a delay of more than 30 min.

The workability shall be within the following limits on the specified value as appropriate:

- **Slump**  
  ± 25 mm or 1/3 of the specified value, whichever is less.

- **Compacting factor**  
  ± 0.03, where the specified value is 0.90 or greater,  
  ± 0.04, where the specified value is less than 0.90 but more than 0.80,  
  ± 0.05, where the specified value is 0.80 or less.

Flow table test may be specified for concrete, for very high workability (see IS 9103) Acceptance criteria for spread (flow) are to be established between the supplier and the purchaser.
In order to get a relatively quicker idea of the quality of concrete, optional test on beams for modulus of rupture at 72 ± 2 h or at 7 days or compressive strength test at 7 days may be carried out in addition to 28 days compressive strength test. For this purpose the value should be arrived at based on actual testing. In all cases 28 days compressive strength shall alone be the criteria for acceptance or rejection of the concrete. The purchaser shall inform the producer if his requirements for sampling and testing are higher than one sample every 50 m3 or 50 batches, whichever is the greater frequency.

**Additional Compliance Criteria** : Any additional compliance criteria shall be declared to the producer by the purchaser prior to supply and shall be mutually agreed upon in terms of definition, tolerance frequency of assessment, method of test and significance result.

**Non-Compliance** : The action to be taken in case of non-compliance shall be declared and mutually agreed upon.

**Information to be Supplied by the Purchaser**

The purchaser shall provide to the producer the details of the concrete mix or mixes required by him and all pertinent information on the use of the concrete and the specified requirements. Prior to supply taking place, it is recommended that a meeting is held between the purchaser and the producer. Its objective to clarify operational matters such as notice to be given prior to delivery, delivery rate, the name of the purchasers authorized representative who will coordinate deliveries, any requirements for additional services such as pumping, on site testing or training, etc.

**Designed Mixes** : Where the purchaser specifies a designed mix to be supplied it is essential that all relevant information is conveyed to the producer.

**5.9.4.3 Prescribed Mixes** : The concrete mix shall be specified by its constituent materials and the properties or quantities of those constituents to produce a concrete with the required performance. The assessment of the mix proportions shall form an essential part of the compliance requirements. The purchaser shall provide the producer with all pertinent information on the use of the concrete and the specified requirements.

**Information to be Supplied by the Producer**

When requested, the producer shall provide the purchaser with the following information before any concretes is supplied:

(a) Nature and source of each constituent material,

(b) Source of supply of cement,

(c) Proposed proportions or quantity of each constituent/ m3 of fresh concrete.
(d) Generic type(s) of the main active constituent(s) in the admixture;

(e) Whether or not the admixture contains chlorides and if so, the chloride content of the admixture expressed as a percentage of chloride ion by mass of admixture;

(f) Where more than one admixture is used, confirmation of their compatibility and

(g) Initial and final setting time of concrete when admixture is used at adopted dosage (tested as per IS 8142).

**Production and Delivery**

**Materials Storage and Handling**

(i) **Cement**: Separate storage for Different types and grades of cement shall be provided. Containers may be used to store cement of different types provided these are emptied before loading new cement. Bins or silos shall be weatherproof and permit free flow and efficient discharge of the cement. Each silo or compartment of a silo shall be completely separate and fitted with a filter or alternative method of dust control. Each filter or dust control system shall be of sufficient size to allow delivery of cement to be maintained at a specified pressure, and shall be properly maintained and prevent undue emission of cement dust and prevent interference with weighing accuracy by build up of pressure. Cement shall be stored and stacked in bags and shall be kept free from the possibility of any dampness or moisture coming in contact with them and where cement can be stored and retrieved without undue damage to the bags. The bags are to be protected from becoming damp either from the ground or the weather. The cement is to be used in the order it is delivered (see also IS 4082).

In case, the cement remains in storage for more than 3 months, the cement shall be retested before use and shall be rejected, if it fails to conform to any of the requirements given in the relevant Indian Standard.

(ii) **Dry Pulverized Fuel Ash and Other Mineral Admixtures**: Suitable separate arrangement for storage of pulverized fuel ash, silica fume, metakeolin, rice husk ash, ground granulated blast furnace slag such as for cement, shall be provided, in the plants utilizing these materials.

(iii) **Aggregates (Coarse and Fine)**: Stockpiles shall be free draining and arranged to avoid contamination and to prevent intermingling with adjustment material. Handling procedures for loading and unloading aggregates shall be such as to reduce segregation to a minimum.

Provision shall be made for separate storage for each nominal size and type of aggregate and the method of loading of storage bins shall be such as to prevent intermingling of
different sizes and types. Fine aggregates shall be stacked in a place where loss due to the effect of wind is minimum (see also IS 4082 and IS 456).

(iv) Water: An adequate supply shall be provided and when stored on the plant such storage facilities shall be designed to minimize the risk of contamination.

(v) Chemical Admixtures: Tanks or drums containing liquid admixtures shall be clearly labeled for identification purposes and stored in such a way to avoid damage, contamination or the effects of prolonged exposure to sunlight (if applicable). Agitation shall be provided for liquid admixture, which are not stable solutions.

**Batching Plants and Batching Equipment:** Hoppers for weighing cement, mineral admixtures, aggregates and water and chemical admixture (if measured by mass) shall consist of suitable container freely suspended from a scale or other suitable load-measuring device and equipped with a suitable discharging mechanism. The method of control of the loading mechanism shall be such that, as the quantity required in the weighing hopper is approached the material may be added at controllable rate and shut off precisely within the weighing tolerances. The weighing hoppers for cement, mineral admixtures aggregate shall be capable of receiving their rated load, without the weighed material coming into contact with the loading mechanism. Where the rated capacity of a batching plant mixing cycle is less than 2.0 m³, additional precautions shall be taken to ensure that the correct number of batches are loaded into the truck mixer. The weighing hoppers shall be constructed so as to discharge efficiently and prevent the build up of materials. A tare adjustment, up to 10 percent of the nominal capacity of the weigh scale, shall be provided on the weighing mechanism so that the scale can be adjusted to zero at least once each day. Dust seals shall be provided on cement hoppers between the loading mechanism and the weigh hopper, and shall be fitted so as to prevent the emission of cement dust and not affect weighing accuracy. The hopper shall be vented to permit escape of air without emission of cement dust. Vibrator or other attachment, where fitted, shall not affect the accuracy of weighing. There shall be sufficient protection to cement and aggregate weigh hoppers and weighing mechanisms to prevent interference with weighing accuracy by weather conditions or external build-up of materials.

Where chemical admixture dispensers are used, they shall be capable of measurement within the tolerance specified and calibrated container or weigh scales shall be provided to check the accuracy of measurement at least once a month. Where a continuous mixer with ribbon loading is used, the batching procedure specified by the manufacture of the plant shall be followed. Each control on the batching console and weigh-dial or display shall be clearly labeled with its function and where concerned with the batching of materials, the materials type.
When more than one type or grade of cement is being used, the weighing device and discharge screw or other parts of the transfer system shall be empty before changing from one type of cement to another. When more than one type or grade of cement is being used, the weighing device and discharge screw or other parts of the transfer system shall be empty before changing from one type of cement to another. When pulverized fuel ash and other mineral admixtures are batched through the cement weigh system, the weighing device and discharge screw or other parts of the transfer system shall be empty when the weighing system has returned to zero reading or completed the batch. Where a back weigh system is utilized to weigh materials a system shall be in place so as to prevent materials being loaded during the process of weighing.

**Measurement of Materials**: Cement and mineral admixture materials shall be measured by mass in a hopper or compartment separate from those used for other materials and on a scale of appropriate sensitivity, measurement being taken from a zero reading. Aggregates shall be measured by mass, allowance being made for the free moisture content of the aggregates. The added water shall be measured by volume or by mass. Any liquid chemical admixture (or paste) shall be measured by volume or by mass and any solid admixture by mass. When weighing materials any build up in the hopper during the day must be tared out or allowed for in the batch weights. After measurement all materials shall be discharged into the mixer without loss.

The accuracy of the measuring equipment shall be within + 2 percent of the quantity of cement and mineral admixtures being measured and within + 3 percent of the quantity of aggregate, chemical admixture and water being measured. The plant operator shall be provided with a clear display of then quantities of materials to be batched for each mix and batch size with information identifying the display to be selected for each designed and prescribed mix to be produced. Analogue scale displays for the weighing of cement, mineral admixtures, aggregates and water shall be readily discernable from the operating position. For digital readouts the numerals shall be readily discernable from the operating position.

Fully automatic production systems shall be fitted with control equipment to allow the correct operation of the plant to be monitored during weighing and batching. Automatic control systems on batching plants shall not commence batching until all hoppers have been emptied and/or tared and the scales zeroed unless such systems are designed to take account of build up in their programming.

All scales shall be tested and calibrated.

**Mixing**
(i) **Washing Out Water**: Before loading concrete materials or mixed concrete into either a stationary mixer or truck mixer any water retained in the mixing drum for washing out purposes shall be completely discharged.

(ii) **Stationary or Central Mixers**: Stationary mixers shall not be loaded in excess of the manufacturer’s rated capacity. The mixing time shall be measured from the time all the materials required for the batch, including water, are in the drum of the mixer. The mixing time shall not be less than that recommended by the manufacturer. Where a continuous mixing plant is used, the complete mixing time shall be sufficient to ensure that the concrete is of the required uniformity.

(iii) **Truck Mixers**: When a truck mixer is used for the partial or complete mixing of concrete, mixing shall be considered to commence from the moment when all the materials required for the batch, including water, are in the rotating drum of the mixer.

Truck or agitators shall not be loaded in excess of the manufacturer’s rated capacity. In order to produce a satisfactory mix, and where there is no data available to establish different period and speed of revolutions, mixing shall continue for not less than 60 revolutions of the truck mixer drum at a rate of not less than 7 revolutions/min. All completely truck mixed concrete shall be visually inspected for uniformity prior to leaving the plant.

When a truck mixer or agitator is used for transporting concrete which has been mixed before leaving the plant, the concrete shall be agitated during transit and remixed at the site for at least 2 min so that the concrete is of the required uniformity.

Where water is added to the concrete in the truck mixer through the truck mixer water meter and when such water is being accounted for in the total water within the mix, it shall be ensured that the truck mixer water meter is in operational condition and properly calibrated. Where a water meter is not available, water must be measured in a suitable container before being added to the truck mixer.

(iv) **Condition of Mixers**: Stationary and truck mixers shall be maintained in an efficient and clean condition with no appreciable build up of hardened concrete or cement in the mixing drum, on the mixing blades, or on the loading hopper or discharge chutes.

**Delivery Ticket**: Immediately before discharging the concrete at the point of delivery, the producer or his representative shall provide the purchaser with a preprinted delivery ticket for each delivery of concrete on which is printed, stamped or written the minimum information detailed invoicing.

**Quality Control**
Quality control of ready-mixed concrete may be divided into three components, forward control, immediate control and retrospective control.

**Forward control:** Forward control and consequent corrective action are essential aspects of quality control. Forward control includes the following.

(i) Control of purchased material Quality 

(ii) Control of Materials storage 

(iii) Mix design and mix design modification 

(iv) *Transfer and Weighing Equipment:* The producer shall be able to demonstrate that a documented calibration procedure is in place. The use of electro-mechanical weighing and metering systems, that is, load cells, flow meters, magmeters, etc, is preferable over purely mechanical system, that is, knife edge and lever systems.

(v) Plant mixers where present and truck mixers used shall be in an operational condition.

**Immediate Control:** Immediate control is concerned with instant action to control the quality of the concrete being produced or that of deliveries closely following. It includes the production control and product control.

(i) *Production Control:* The production of concrete at each plant shall be systematically controlled. This is to ensure that all the concrete supplied shall be in accordance with these requirements and with the specifications that has formed the basis of the agreement between the producer and purchaser.

Each load of mixed concrete shall be inspected before dispatch and prior to discharge.

The workability of the concrete shall be controlled on a continuous basis during production and any corrective action necessary taken.

For each load, written, printed or graphical records shall be made of the mass of the materials batched, the estimated slump, the total amount of water added to the load, the delivery ticket number for that load, and the time the concrete was loaded into the truck.

Regular routine inspections shall be carried out on the condition of plant and equipment including delivery vehicles.

(ii) *Product Control:* Concrete mixes shall be randomly sampled and tested for workability and where appropriate, plastic density, temperature and air content. Where significant variations from target values are detected, corrective action shall be taken.
It is important to maintain the water cement ratio constant at its correct value. The amount of added water shall be adjusted to compensate for any observed variations in the moisture contents in the aggregates. Suitable adjustments should also be made in masses of the aggregates due to this variation (see IS 456). Any change in water content due to change in aggregate grading shall be taken care of by forward control by suitable modifications to mix design.

**Retrospective Control :** Retrospective control is concerned with those factors that influence the control of production. Retrospective control may cover any property of materials or concrete, such as aggregate grading, slump, or air content, but is particularly associated with 28-day cube strength because by its very nature it is not a property which can be measured ahead of, or at the time of, manufacture.

**Mix Performance :** The producer shall be responsible for ensuring that suitable control procedures are in place ensure the following.

(i) **Design Mixes :** A quality control system shall be operated to control the strength of design mixes to the levels required as per IS 456 and shall be based on random tests of mixes which form the major proportion of production. The system shall include continuous analysis of results from cube tests to compare actual with target values together with procedures for modifying mix proportions to correct for observed differences. Compressive strength testing shall be carried out using a machine that meets the requirements of IS 14858.

(ii) **Prescribed Mixes :** Periodic and systematic checks shall be made to ensure that the cementitious material contents of prescribed mixes comply with their mix descriptions.

**Stock Control of Materials :** The producer shall operate a materials stock control procedure to enable verification of total quantities used and to confirm that only approved materials have been received.

**Complaints :** The producer shall have a procedure in place to enable the diagnosis and correction of faults identified from complaints.

**Records**

Records shall be maintained by the producer to provide confirmation of the quality and quantity and quantity of concrete produced. The records shall be retained for the purposes of these requirements for a period of at least one year. They shall cover the following aspect:
(a) Production and delivery:
   (i) Batching instruction
   (ii) Batching Records,
   (iii) Delivery tickets, and
   (iv) Equipment calibration and plant maintenance.

(b) Materials and production control:
   (i) Concrete production and materials purchase, usage and stocks, and
   (ii) Certificates or test results for materials.

(c) Production quality Control: Control test results.

PLACING CONCRETE BY PUMPING

General

Concrete conveyed by pressure through either rigid pipes or flexible hoses and discharged directly into the desired area is termed as pumped concrete. Method of applying pressure to concrete is by pumps. Pumps to be used shall be either of the two types as mentioned below:

   (A) Piston type pumps
   (B) Squeeze pressure type pumps.

Compressed air pressure pumps shall not be used in the works.

GUIDELINES FOR FIELD PRACTICE

General Precautions

(i) Proper planning of concrete supply, pump locations, line layout, placing sequence and the entire pumping operation will result in savings of time and expense.

(ii) The pump shall be placed as near the placement area as practicable. The surrounding area of the pump shall be free of obstructions to allow for movement of concrete delivery trucks. The surface must be strong enough to withstand the loaded trucks operating on it. If the surface is a suspended slab, the truck route shall be adequately supported in consultation with the Engineer-in-Charge.
(iii) Pipe lines from the pump to the placing area shall be laid with minimum number of bend. For large placement areas, alternate lines shall be installed for rapid connection when required. A flexible pipe at the discharge end will permit placing over a large area directly without re-handling of pipelines. The pipeline shall be firmly supported.

(iv) If more than one size of pipe must be used, the smaller diameter pipe shall be placed at the pump end and the larger diameter at the discharge end.

(v) When pumping downwards, an air release valve shall be provided at the middle of the top bend to prevent vacuum or air build up. Similarly, while pumping upwards, a no-return valve shall be provided near the pump to prevent the reverse flow of concrete.

(vi) It is essential that direct radio/telecommunication be maintained between the pump operator and the concrete placing crew. Good communication between the pump operator and the batching plant is also essential. The placing rate shall be estimated by the pump operator so that concrete can be ordered at an appropriate delivery rate.

(vii) The pump shall be started for a check run and operated without concrete to ensure that all moving parts are in operation properly. Before placing concrete, the pump shall be run with some grout/mortar for lubricating the line.

(viii) When concrete is received in the hopper, the pump shall be run slowly until the lines are completely full and the concrete is steadily moving. A continuous pumping must be ensured, because, if the pump is stopped, concrete in the line may be difficult to move again.

(ix) When a delay occurs because of concrete delivery or some form repair works or for any other reason, the pump shall be slowed down to maintain some movement of concrete in the pipe line. For longer delays, concrete in the receiving hopper shall be made to last as long as possible by moving the concrete in the lines occasionally with intermittent strokes of the pump. It is sometimes essential to run a return line back to the pump so that concrete can be re-circulated during long delays.

(x) If after a long delay, concrete cannot be moved in the line, it may be necessary to clean out the entire line. However, quite often only a small section of pipe line may be plugged and requires cleaning. The pump operator who know such details as the length of line, age of concrete in the line etc., should be depended upon to aid in deciding the appropriate section to be cleaned.

(xi) When the form is nearly full, and there is enough concrete in the line to complete the placement, the pump shall be stopped and a “go devil” inserted at the appropriate time so that concrete ahead of the go-devil shall be forced completion of the work. The go-devil shall be forced through the pipeline to clean it out. Use of water pressure is a safer
method. The go-devil shall be stopped at the discharge end to ensure that water does not spill on the placement area, if air pressure is used, extreme care shall be taken and the pressure must be carefully regulated. A trap shall be installed at the end of the line to prevent the go-devil being ejected as a dangerous projectile. An air release valve shall also be installed in the line to prevent air pressure build up.

(xii) It is essential to clean the line after concrete placing operation is complete. Cleaning shall be done in the reverse direction from the form work end to the pump-end where the concrete in the line can be dumped in bucket. After removal of all concrete, all pipe lines and other equipments shall be cleaned thoroughly and made ready for the next use.

3.4 STRUCTURAL STEEL

The steel work in built up sections (welded) such as in trusses, form work etc. is specified in this clause.

Laying out

A figure of the steel structure to be fabricated shall be drawn on a level platform to full scale. This may be done in full or in parts, as shown on drawings or as directed by the Engineer-in-Charge. Steel tape shall be used for measurements.

Fabrication

Straightening, shaping to form, cutting and assembling, shall be as below as far as applicable, except that the words “riveted or bolted” shall be read as “welded” and holes shall only be used for the bolts used for temporary fastening as shown in drawings. Fabrication shall generally be done as specified in IS 800. In major works or where so specified, shop drawings giving complete information for the fabrication of the component parts of the structure including the location, type, size, length and details or rivets, bolts or welds, shall be prepared in advance of the actual fabrication and approved by the Engineer-in-charge. The drawings shall indicate the shop and field rivets, bolts and welds. The steel members shall be distinctly marked or stenciled with paint with the identification marks as given in the shop drawings.

Great accuracy shall be observed in the fabrication of various members, so that these can be assembled without being unduly packed, strained or forced into position and when built up, shall be true and free from twist, kinks, buckles or open joints.
Wooden or metal sheet templates shall be made to correspond to each member, and position of rivet holes shall be marked accurately on them and holes drilled. The templates shall then be laid on the steel members, and holes for riveting and bolting marked on them. The ends of the steel members shall also be marked for cutting as per required dimensions. The base of steel columns and the positions of anchor bolts shall be carefully set out at the required location. Before making holes in individual members, for fabrication and steel work intended to be riveted or bolted together shall be assembled and clamped properly and tightly so as to ensure close abutting, or lapping of the surfaces of the different members. All stiffeners shall be fixed (or placed) tightly both at top and bottom without being drawn or caulked. The abutting joints shall be cut or dressed true and straight, and fitted close together.

Web plates of girders, which have no cover flange plates, shall have their ends flush with the tops of angles unless otherwise required. The web plate when spliced, shall have clearance of not more than 5mm. The erection clearance of cleated ends of members connecting steel to steel shall preferably be not greater than 1.5 mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm at each end but where for practical reasons, greater clearance is necessary, seating designed suitably shall be provided.

Column splices and butt joints of struts and compression members requiring contact for stress transmission shall be accurately, machined and close butted over the whole section. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc. after riveting together shall be accurately machined so that the parts connected, butt against each other over the entire surfaces of contact. Connecting angles or channels shall be fabricated and placed in position with great accuracy so that they are not unduly reduced in thickness by machining.

The ends of all bearing stiffeners shall be machined or grounded to fit tightly both at top and bottom.

The steel section shall be straight or to be straightened or flattened by pressure unless required to be of curvilinear form and shall free from twists. These shall be cut square either by shearing or sawing to correct length and measured by steel tape. No two pieces shall be welded or joined to make up for the required length of member.

**Welding** : Welding shall generally be done by electric arc process as per IS 816 and IS 823. The electric arc method is usually adopted and is economical. Where electricity for public is not available generators shall be arranged by the contractor at his own cost unless otherwise specified. Gas welding shall only by resorted to using oxyacetylene flame with specific approval of the Engineer-in-charge. Gas welding shall not be permitted for structural steel work. Gas welding required heating of the members to be
welded along with the welding rod and is likely to create temperature stresses in the welded members. Precautions shall therefore be taken to avoid distortion of the members due to these temperature stresses.

The work shall be done as shown in the shop drawings which should clearly indicate various details of the joint to be welded, type of welds, shop and site welds as well as the types of electrodes to be used. Symbol for welding on plans and shops drawings shall be according to IS 813.

As far as possible every efforts shall be made to limit the welding that must be done after the structure is erected so as to avoid the improper welding that is likely to be done due to heights and difficult positions on scaffolding etc. apart from the aspect of economy. The maximum dia of electrodes for welding work shall be as per IS 814. Joint surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter, which adversely affect the quality of weld and workmanship.

**Precautions**: All operation connected with welding and cutting equipment shall conform to the safety requirements given in IS 818 for safety requirements and Health provision in Electric and gas welding and cutting operations.

Inspection and testing of welds shall be as per IS 822.

**Assembly**: Before welding is commenced, the members to be welded shall first be brought together and firmly clamped or tack welded to be held in position. This temporary connection has to be strong enough to hold the parts accurately in place without any disturbance. Tack welds located in places where final welds will be made later shall conform to the final weld in quality and shall be cleaned off slag before final weld is made.

**Erection**: While erecting a welded structure adequate means shall be employed for temporary fastening the members together and bracing the frame work until the joints are welded. Such means shall consists of applying of erection bolts, tack welding or other positive devices imparting sufficient strength and stiffness to resist all temporary loads and lateral forces including wind. Owing to the small number of bolts ordinarily employed for joints which are to be welded, the temporary support of heavy girders carrying columns shall be specially attended.

Different members which shall be fillet welded, shall be brought into as close contact as possible. The gap due to faulty workmanship or incorrect fit if any shall not exceed 1.5 mm if gap exceeds 1.5 mm or more occurs locally the size of fillet weld shall be increased at such position by an amount equal to the width of the gap.
**Painting**: Before the member of the steel structures are placed in position or taken out of the workshop these shall be painted as specified below. All surfaces which are to be painted, oiled or otherwise treated shall be dry and thoroughly cleaned to remove all loose scale and loose rust. Surfaces not in contact but inaccessible after shop assembly, shall receive the full specified protective treatment before assembly. This does not apply to the interior of sealed hollow sections. Part to be encased in concrete shall not be painted or oiled. A priming coat of approved steel primer such as Red Oxide/Zinc Chromate primer conforming to IS 2074 shall be applied before any member of steel structure are placed in position or taken out of workshop.

**Rate**

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

3.4.1 **Structural Steel Work and all components thereof should satisfy the following tests and codes:**

<table>
<thead>
<tr>
<th>Material</th>
<th>Clause</th>
<th>Test</th>
<th>Field/ laboratory test</th>
<th>Test procedure</th>
<th>Min. quantity of material for carrying out the test</th>
<th>Frequency of testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel if arranged by the contractor</td>
<td>10.1.1</td>
<td>(a) Tensile strength (b) Bend test</td>
<td>Laboratory</td>
<td>IS 1599</td>
<td>20 tonne</td>
<td>Every 20 tonne or part thereof</td>
</tr>
<tr>
<td>Steel tubular pipes</td>
<td>10.13</td>
<td>(a) Tensile Test (b) Bend Test (c) Flattening Test</td>
<td>Laboratory</td>
<td>IS 1608 IS 2329 IS 2328</td>
<td>Every 8 tonne or part thereof</td>
<td>Every 8 tonne or part thereof</td>
</tr>
</tbody>
</table>
### 3.5 BRICK WORK

Bricks used in the masonry may be of the following type.

(a) The **Common Burnt Clay Bricks** shall conform to IS:1077 and shall be hand moulded or machine moulded. They shall be free from nodules of free lime, visible cracks, flaws, warpage and organic matter, have a frog 100 mm in length 40 mm in width and 10 mm to 20 mm deep on one of its flat sides. Bricks made by extrusion process and brick tiles may not be provided with frogs. Each brick shall be marked (in the frog where provided) with the manufacturer’s identification mark or initials.

(b) **Fly Ash Lime Bricks (FALG Bricks)**: The Fly Ash Lime Bricks (FALG Bricks) shall conform to IS 12894. Visually the bricks shall be sound, compact and uniform in shape.
free from visible cracks, warpage, flaws and organic matter. The bricks shall be solid and with or without frog on one of its flat side.

**Fly Ash:** Fly ash shall conform to IS 3812.

**Note:** This item will be operated only for load bearing structure upto 2 storeys and for non-load bearing walls 23 cm thick for multi-storeyed buildings. Bottom ash used as replacement of sand shall not have more than 12% loss on ignition when tested.

**Sand:** Deleterious materials, such as clay and silt in the sand shall preferably be less than 5%.

**Lime:** Lime shall conform to class ‘C’ hydrated lime of IS 712.

**Additives:** Any suitable additive considered not detrimental to the durability of bricks may be used.

(c) **Clay Fly Ash Bricks:** The clay fly ash bricks shall conform to IS 13757. The bricks shall be sound, compact and uniform in shape and colour. Bricks shall have smooth rectangular faces with sharp and square corners. The bricks shall be free from visible cracks, flaws, warpage, nodules of free lime and organic matter, the bricks shall be hand or machine moulded. The bricks shall have frog of 100 mm in length 40 mm width and 10 to 20 mm deep on one of its flat sides. If made by extrusion process may not be provided with frogs. Fly Ash shall conform to grade I or grade II of IS 3812.

(d) **Calcium Silicate Bricks:** The bricks shall conform to IS 4139. The Calcium silicate bricks shall be sound, compact and uniform in shape. Bricks shall be free from visible cracks, warpage, organic matter, large pebbles and nodules of free lime. Bricks shall be solid and with or without frog. The bricks shall be made of finely grounded sand siliceous rock and lime. In addition limited quantity of fly ash conforming to IS 3812 may be used in the mix. These bricks are also known as Fly Ash Sand Lime bricks in the construction industry.

(e) **Tile Brick:** The bricks of 4 cm height shall be moulded without frogs. Where modular tiles are not freely available in the market, the tile bricks of F.P.S. thickness 44 mm (1-3/4”) shall be used unless otherwise specified.

(f) **Brick Bats:** Brick bats shall be obtained from well burnt bricks.

(g) **Mechanized Autoclave Fly Ash Lime Brick:** These bricks shall be machine moulded and prepared in plant by appropriate proportion of fly ash and lime. The autoclave fly ash bricks shall conform to IS 12894. Visually, the bricks shall be sound, compact and uniform shape, free from
visible cracks, warpage and organic matters. The brick shall be solid with or without frog, and of
100/80 mm in length, 40 mm width and 10 to 20 mm deep one of its flat side as per IS 12894. The
brick shall have smooth rectangular faces with sharp corners and shall be uniform in shape and
colour. Fly ash shall conform to IS 3812 and lime shall conform to class ‘C’ hydrated lime of IS 712.

Classification

Bricks/Brick tiles shall be classified on the basis of their minimum compressive strength as given below:

<table>
<thead>
<tr>
<th>Class Designation</th>
<th>Average compressive strength</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not less than</td>
</tr>
<tr>
<td></td>
<td>N/mm$^2$</td>
</tr>
<tr>
<td>12.5 (125)</td>
<td>12.5</td>
</tr>
<tr>
<td>10 (100)</td>
<td>10</td>
</tr>
<tr>
<td>7.5 (75)</td>
<td>7.5</td>
</tr>
<tr>
<td>5 (50)</td>
<td>5</td>
</tr>
<tr>
<td>3.5 (35)</td>
<td>3.5</td>
</tr>
</tbody>
</table>

The bricks shall have smooth rectangular faces with sharp corner and shall be uniform in colour and emit clear ringing sound when struck.

Samples of bricks shall be subjected to the following tests:
(a) Dimensional tolerance.
(b) Water absorption.
(c) Efflorescence.
(d) Compressive strength

**Water Absorption:** The average water absorption of bricks when tested in accordance with the procedure laid down in Appendix C of Chapter 6 shall be not more than 20% by weight.

**Efflorescence:** The rating of efflorescence of bricks when tested shall be not more than moderate.
Bricks shall be soaked in water before use for a period for the water to just penetrate the whole depth of the bricks. Alternatively bricks may be adequately soaked in stacks by profusely spraying with clean water at regular intervals for a period not less than six hours. The bricks required for masonry work using mud mortar shall not be soaked. When the bricks are soaked they shall be removed from the tank sufficiently early so that at the time of laying they are skin-dry. Such soaked bricks shall be stacked on a clean place where they are not again spoiled by dirt earth etc.

**Note I:** The period of soaking may be easily found at site by a field test in which the bricks are soaked in water for different periods and then broken to find the extent of water penetration. The least period that corresponds to complete soaking will be the one to be allowed for in construction work.

**Note II:** If the bricks are soaked for the required time in water that is frequently changed the soluble salt in the bricks will be leached out, and subsequently efflorescence will be reduced.

Bricks shall be laid in English Bond (Fig. 6.2, 6.3, 6.4) unless otherwise specified. For brick work in half brick wall, bricks shall be laid in stretcher bond. Half or cut bricks shall not be used, except as closer where necessary to complete the bond. Closers in such cases, shall be cut to the required size and used near the ends of the wall. Header bond shall be used preferably in all courses in curved plan for ensuring better alignment.

All loose materials, dirt and set lumps of mortar which may be lying over the surface on which brick work is to be freshly started, shall be removed with a wire brush and surface wetted. Bricks shall be laid on a full bed of mortar, when laying, each brick shall, be properly bedded and set in position by gently pressing with the handle of a trowel. Its inside face shall be buttered with mortar before the next brick is laid and pressed against it. Joints shall be fully filled and packed with mortar such that no hollow space are left inside the joints.

The walls shall be taken up truly in plumb or true to the required batter where specified. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in the alternate course shall come directly one over the other. Quoin, Jambs and other angles shall be properly plumbed as the work proceeds. Care shall be taken to keep the perpends properly aligned within following maximum permissible tolerances:

(a) Deviation from vertical within a storey shall not exceed 6 mm per 3 m height.
(b) Deviation in verticality in total height of any wall of building more than one storey in height shall not exceed 12.5 mm.

(c) Deviation from position shown on plan of any brick work shall not exceed 12.5 mm.

(d) Relative displacement between load bearing wall in adjacent storeys intended to be vertical alignments shall not exceed 6 mm.

(e) A set of tools comprising of wooden straight edge, masonic spirit levels, square, 1 metre rule line and plumb shall be kept on the site of work for every 3 masons for proper check during the progress of work.

All quoins shall be accurately constructed and the height of brick courses shall be kept uniform. This will be checked using graduated wooden straight edge or storey rod indicating height of each course including thickness of joints. The position of damp proof course, window sills, bottom of lintels, top of the wall etc. along the height of the wall shall be marked on the graduated straight edge or storey rod. Acute and obtuse quoins shall be bonded, where practicable in the same way as square quoins. Obtuse quoins shall be formed with squint showing three quarters brick on one face and quarter brick on the other.

The brick work shall be built in uniform layers. No part of the wall during its construction shall rise more than one metre above the general construction level. Parts of wall left at different levels shall be raked back at an angle of 45 degrees or less with the horizontal. Tooothing shall not be permitted as an alternative to raking back. For half brick partition to be keyed into main walls, indents shall be left in the main walls.

All pipe fittings and specials, spouts, hold fasts and other fixtures which are required to be built into the walls shall be embedded, as specified, in their correct position as the work proceeds unless otherwise directed by the Engineer-in-Charge.

Top courses of all plinths, parapets, steps and top of walls below floor and roof slabs shall be laid with brick on edge, unless specified otherwise. Brick on edge laid in the top courses at corner of walls shall be properly radiated and keyed into position to form cut (maru) corners as shown in Fig 6.4. Where bricks cannot be cut to the required shape to form cut (maru) corners, cement concrete 1:2:4 (1cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) equal to thickness of course shall be provided in lieu of cut bricks.

To facilitate taking service lines later without excessive cutting of completed work, sleeves (to be paid separately) shall be provided, where specified, while raising the brick work. Such sleeves in external walls shall be sloped down outward so as to avoid passage of water inside.
Top of the brickwork in coping and sills in external walls shall be slightly tilted. Where brick coping and sills are projecting beyond the face of the wall, drip course/throating (to be paid separately) shall be provided where indicated.

Care shall be taken during construction that edges of jambs, sills and projections are not damaged in case of rain. New built work shall be covered with gunny bags or tarpoulin so as to prevent the mortar from being washed away. Damage, if any, shall be made good to the satisfaction of the Engineer-in-Charge.

In retaining walls and the like, where water is likely to accumulate, weep holes, 50 to 75 mm square shall be provided at 2 m vertically and horizontally unless otherwise specified. The lowest weep hole shall be at about 30 cm above the ground level. All weep holes shall be surrounded by loose stones and shall have sufficient fall to drain out the water quickly.

3.5.1 Foamed Cement Concrete Masonry blocks shall be used where specified. These blocks of Durovert CLC make or similar shall have dimensions 2’-0” X 8” and thickness of 4” or 6” or 8” as specified, with density not less than 800 kg/m3. The masonry shall satisfy all specifications set for brickwork and inability to do so must be brought to the attention of the engineer-in-charge. The application of these shall be as specified by Engineer-in-Charge.

3.5.2 Brickwork and all components thereof shall satisfy the following tests and codes:
3.1. **Autoclave Aerated Solid Cement concrete blocks Masonry**: Providing and laying solid cement blocks Masonry with cement blocks of size 400x200x200mm with compressive strength of 50Kgs/Sqcm in foundation and super structure up to all floor level with cement mortar of 1:6 (1 cement:6 coarse sand)

3.1.1. **General**: The work shall be carried out for all external walls and wherever required internal also. The Contractor shall submit a detailed proposal
enclosing test reports and details confirming technical requirements for source approval from Engineer In charge.

3.1.2. **Material**: The material shall confirm to the requirements as per IS code 2185 (Part-I). The average compressive strength shall be 50Kgs/Sqcm.

3.1.3. **Construction**: The Masonry construction shall be in accordance to IS code 2572. The thickness of the mortar layer shall be minimum 12mm.

3.1.4. **FQP**: Cement concrete blocks shall be tested for Dimensional tolerance, compressive strength and water absorption for every lot of 5000 Nos. or part thereof. The test results shall confirm to:

- 3.1.4.1. Dimensional tolerance = Length for each block +/- 5mm
  = Breadth and height +/- 3mm

- 3.1.4.2. Average Compressive strength = Not less than 50Kgs/Sqcm

- 3.1.4.3. Water absorption = Not more than 10%

- 3.1.4.4. Block density = Not less than 1800Kgs/Cum

3.1.5. The method of testing and sampling shall be as per IS 2185.

3.1.6. **Measurement**:

- 3.1.6.1. The Solid concrete block masonry shall be measured in Cum with length, Breadth and Height measured to nearest 0.01M.

- 3.1.6.2. No deduction shall be made for opening up to 0.01Sqm area

- 3.1.6.3. Cement concrete blocks as hold fasts

3.1.7. **Rate**: The rate shall include the cost of all materials and labour required for all the operations of Solid cement concrete blocks masonry for foundations and upto floor V level.

3.2. **Autoclave Aerated Solid Cement concrete blocks Masonry**: Providing and laying solid cement blocks masonry with cement blocks of size 400x100x200mm with compressive strength of 50Kgs/Sqcm in foundation and super structure up to floor V level with cement mortar of 1:4 (1 cement :4 coarse sand).

3.2.1. **General**: The work shall be carried out internal walls. The Contractor shall submit a detailed proposal enclosing test reports and details
confirming technical requirements for source approval from Engineer In charge.

3.2.2. **Material:** The material shall confirm to the requirements as per IS code 2185 (Part-I). The average compressive strength shall be 50Kgs/Sqcm.

3.2.3. **Construction:** The Masonry construction shall be in accordance to IS code 2572. The thickness of the mortar layer shall be minimum 12mm. 2 Nos. of 6mm dia steel shall be provided in every third layer of the masonry.

3.2.4. **FQP:** Cement concrete blocks shall be tested for Dimensional tolerance, compressive strength and water absorption for every lot of 5000 Nos or part thereof. The test results shall confirm to:

3.2.4.1. Dimensional tolerance = Length for each block +/- 5mm

= Breadth and height +/- 3mm

3.2.4.2. Average Compressive strength = Not less than 50Kgs/Sqcm

3.2.4.3. Water absorption = Not more than 10%.

3.2.4.4. Block density = Not less than 1800Kgs/Cum

3.2.5. The method of testing and sampling shall be as per IS 2185

3.2.6. **Measurement:**

3.2.6.1. The Solid concrete block masonry shall be measured in Sqm with length and Height measured to nearest 0.01M.

3.2.6.2. No deduction shall be made for opening up to 0.01Sqm area

3.2.6.3. Cement concrete blocks as hold fasts.

3.2.7. **Rate:** The rate shall include the cost of all materials and labour required for all the operations of Solid cement concrete blocks masonry for foundations and up to all floor levels. Reinforcement in every third layer shall be paid separately in relevant item.

3.6 **STONE WORK**
3.6.1 Material:

Stone- The stone shall be of the type specified such as granite, trap, limestone, sandstone, quartzite, etc. and shall be obtained from the quarries, approved by the Engineer-in-Charge. Stone shall be hard, sound, durable and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and other similar defects that may adversely affect its strength and appearance. As far as possible, stones shall be of uniform colour, quality or texture. Generally stone shall not contain crypt crystalline silica or chart, mica and other deleterious materials like iron-oxide organic impurities etc.

Stones with round surface shall not be used.

The compressive strength of common types of stones shall be as per following table and the percentage of water absorption shall generally not exceed 5% for stones other than specified in following table. For laterite this percentage is 12%.

<table>
<thead>
<tr>
<th>Type of stone</th>
<th>Maximum Water Absorption Percentage by weight</th>
<th>Minimum Compressive Strength kg./sq.cm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granite</td>
<td>0.5</td>
<td>1000</td>
</tr>
<tr>
<td>Basalt</td>
<td>0.5</td>
<td>400</td>
</tr>
<tr>
<td>Lime stone (Slab &amp; Tiles)</td>
<td>0.15</td>
<td>200</td>
</tr>
<tr>
<td>Sand stone (Slab &amp; Tiles)</td>
<td>2.5</td>
<td>300</td>
</tr>
<tr>
<td>Marble</td>
<td>0.40</td>
<td>500</td>
</tr>
<tr>
<td>Quartzite</td>
<td>0.40</td>
<td>800</td>
</tr>
<tr>
<td>Laterite (Block)</td>
<td>12</td>
<td>35</td>
</tr>
</tbody>
</table>

Note 1: Test for compressive strength shall be carried out as laid down in IS 1121 (Part I).

Note 2: Test for water absorption shall be carried out as laid down in IS 1124.

Size of Stones

Normally stones used should be small enough to be lifted and placed by hand. Unless otherwise indicated, the length of stones for stone masonry shall not exceed three times the height and the breadth on base shall not be greater than three-fourth of the thickness of wall, or not less than 150 mm. The height of stone for rubble masonry may be up to 300 mm. The selection and grading of stones for rubble masonry is largely done at site and the smaller stones are used in the hearting of wall.

Random Rubble Masonry shall be uncoursed or brought to courses as specified. Random rubble masonry brought to the course is similar to uncoursed random rubble masonry except that the courses are roughly levelled at intervals varying from 300 mm to 900 mm in height according to the size of stones used.
Dressing

Each stone shall be hammer dressed on the face, the sides and the beds. Hammer dressing shall enable the stones to be laid close to neighbouring stones such that the bushing in the face shall not project more than 40 mm on the exposed face.

(i) **Face stone:** At least 25% stones shall be headers tailing into the work at least 2/3rd the thickness of wall in super structure masonry. Such stones shall not be less than 200 sq. cm in cross sections.

(ii) **Hearting Stones:** The hearting or interior filling of a wall face shall consist of rubble stones not less than 150 mm in any direction, carefully laid, hammered down with a wooden mallet into position and solidly bedded in mortar. The hearting should be laid nearly level with facing and backing.

(iii) **Quoin Stone:** Quoin stone shall be less than 0.03 cum in volume.

(iv) **Jamb stones:** The jambs shall not be made with stones specified for quoins except that the stones which were required to be provided at 1 metrecentre to centre on both the exposed faces shall here be provided only on the jamb and the length shall be equal to the thickness of the wall for wall upto 60 cm and a line of headers shall be provided for walls thicker than 60 cm as specified for bond.

**Courses**- The masonry shall be carried out in regular courses of height not exceeding 50 cm and masonry on any day will not be raised more than 60 cm in height when using mortars having compressive strength less than 20 kg./sq. cm at 28 days and 100 cm when using mortars exceeding this strength.

**Thickness of Joints**- The joint thickness shall not exceed 30 mm at any point on the face. Chips of the stone and spalls shall be wedged into seating bed of face stones to avoid excessive bed thickness. No pinning shall be allowed to avoid excessive joint thickness.

**Mortar**

The mortar used for joining shall be as specified.

3.6.2 Laying

Stone shall be laid on their natural bed and shall be solidly bedded full in mortar with close joints, chips of stone spalls be wedged into the work wherever necessary. No dry work or hollow spaces shall be allowed and every stone whether large or small shall be carefully selected to fit snugly the interstices between the large stones. Masonry shall be built breaking joints in all the three directions. Bond stone and headers shall be properly
laid into the work and shall be marked by the contractor with white lead paint. The bond stones shall be provided as specified.

The masonry work in wall shall be carried up true to plumb or to specified batter.

Random rubble masonry shall be brought to the level courses at plinth, window sills, lintel and roof levels. Levelling shall be done with concrete comprising of one part of the mortar as used for masonry and two parts of graded stone aggregate of 20 mm nominal size. The masonry in structure shall be carried uniformly. Where the masonry of one part is to be delayed, the work shall be raked back at an angle not steeper than 45°.

**Raking out joints** - All the joints on the faces to be pointed or plastered shall be racked out with racking tool to a depth of 20mm while the mortar is still green

**Bond Stones** - Though bond stones shall be provided in walls upto 600 mm thickness, a set of two or more bond stones overlapping each other by at least 150 mm shall be provided in a line from face to back. In case of highly absorbent types of stones (porous lime stone and sand stone etc.) the bond stone shall extend about two-third into the wall, as through stones in such walls a set of two or more bond stones overlapping each other by at least 150 mm shall be provided. Each bond stone or a set of bond stones shall be provided for every 0.5 m² of the wall surface and shall be provided at 1.5 m to 1.8 m apart clear in every course. In case of highly absorbent types of stones (porous lime stone and sand stone etc.) single piece bond stones may give rise to dampness. For all thicknesses of such walls a set of two or more bond stones overlapping each other by at least 15 cm shall be provided. Length of each such bond stone shall not be less than two-third of the thickness of the wall. Where bond stones of suitable lengths are not available pre-cast cement concrete block of 1:3:6 mix (1 cement : 3 coarse sand: 6 graded stone aggregate 20 mm nominal size) of cross section not less than 225 square centimeters and length equal to the thickness.

At least one bond stone or a set of bond stones shall be provided at 1.5 m to 1.8 m apart clear in every course. (Bond stones shall be marked suitably with paint as directed by the Engineer-in-Charge).

**Quoin and Jamb Stones** - The quoin and jamb stones shall be of selected stones neatly dressed with hammer or chisel to form the required angle. Quoin stones shall not be less than 0.01 cum in volume. Height of quoins and jamb stones shall not be less than 15 cm. Quoins shall be laid header and stretcher alternatively.

**Joints**
Stones shall be so laid that all joints are fully packed with mortar and chips. Face joints shall not be more than 20 mm thick. The joints shall be struck flush and finished at the time of laying when plastering or pointing is not to be done. For the surfaces to be plastered or pointed, the joints shall be raked to a minimum depth of 20 mm when the mortar is still green.

3.6.3 Scaffolding

Single scaffolding having one set of vertical support shall be allowed. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of the horizontal scaffolding member may rest in a hole provided in the masonry. Such holes, however, shall not be allowed in pillars under one metre in width or near the skew back of arches. The holes left in masonry work for supporting scaffolding shall be filled and made good with cement concrete 1 : 3 : 6 (1 cement : 3 coarse sand : 6 stone aggregate 20 mm nominal size).

3.6.4 Curing

Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. In case of masonry with fat lime mortar curing shall commence two days after laying of masonry and shall continue for at least seven days thereafter.

3.6.5 Protection

Green work shall be protected from rain by suitable covering. The work shall also be suitably protected from damage, mortar dropping and rain during construction.

3.6.6 Measurements

The length, height and thickness shall be measured correct to a cm. The thickness of wall shall be measured at joints excluding the bushing. Only specified dimensions shall be allowed; anything extra shall be ignored. The quantity shall be calculated in cubic metre nearest to two places of decimal.

The work under the following categories shall be measured separately.

(i) From foundation to plinth level (level one):
   (a) work in or under water and or liquid mud,
   (b) work in or under foul positions.

(i) Above plinth level and upto floor five level.
(ii) Above floor five level to every floor/floors or part thereof.

(iii) Stone masonry in parapet shall be measured together with the corresponding item in the wall of

thestorey next below.

No deduction shall be made nor extra payment made for the following:

(i) Ends of dissimilar materials (that is joists, beams, lintels, posts, girders, rafters purlins, trusses, corbels, steps etc.) upto 0.1 sqm in section.

(ii) Openings each upto 0.1 sqm in area. In calculating the area of openings, any separate lintels or sills shall be included alongwith the size of opening but the end portions of the lintels shall be excluded and the extra width of rebated reveals, if any, shall also be excluded.

(iii) Wall plates and bed plates, and bearing of chajjas and the like, where the thickness does not exceed 10 cm and the bearing does not extend over the full thickness of the wall. Note: The bearing of floor and roof shall be deducted from wall masonry.

(iv) Drain holes and recesses for cement concrete blocks to embed hold fasts for doors, windows etc.

(v) Building in masonry, iron fixture, pipes upto 300 mm dia, hold fasts of doors and windows etc.

(vi) Forming chases in masonry each upto section of 350 sq cm.

3.6.7 Rate

The rate shall include the cost of materials and labour required for all the operations described above

and shall include the following:

(a) Raking out joints for plastering or pointing done as a separate item, or finishing flush as the work proceeds.

(b) Preparing tops and sides of existing walls for raising and extending.

(c) Rough cutting and waste for forming gables cores, skew backs or spandrels of arches, splays at eaves and all rough cutting in the body of walling unless otherwise specified.
(d) Bond stones or cement concrete bond blocks.

(e) Leading and making holes for pipes etc.

(f) Bedding and pointing wall plates, lintels, sills etc. in or on walls, bedding roof tiles and corrugated sheets in or on walls.

(g) Building in ends of joists, beams, lintels etc.

3.6.8 COURSED RUBBLE MASONRY - FIRST SORT

**Stone:** Shall be as specified above.

**Dressing:** Face stones shall be hammer dressed on all beds, and joints so as to give them approximately rectangular block shape. These shall be squared on all joints and beds. The bed joint shall be rough chisel dressed for at least 80 mm back from the face, and side joints for at least 40 mm such that no portion of the dressed surface is more than 6 mm from a straight edge placed on it. The remaining unexposed portion of the stone shall not project beyond the surface of bed and side joint. The bushing on the face shall not project more than 40 mm as an exposed face and 10 mm on a face to be plastered. The hammer dressed stone shall also have a rough tooling for minimum width of 25 mm along the four edges of the face of the stone, when stone work is exposed.

**Mortar:** The mortar for jointing shall be as specified.

**Laying:** All stones shall be wetted before use. The walls shall be carried up truly plumb or to specified batter. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. The height of each course shall not be less than 15 cm nor more than 30 cm.

Face stones shall be laid alternate headers and stretchers. No pinning shall be allowed on the face. No face stone shall be less in breadth than its height and at least one third of the stones shall tail into the work for length not less than twice their height.

The hearting or the interior filling of the wall shall consist of stones carefully laid on their proper beds in mortar; chips and spalls of stone being used where necessary to avoid thick beds of joints of mortar and at the same time ensuring that no hollow spaces are left anywhere in the masonry. The chips shall not be used below the hearting stone to bring these up to the level of face stones. The use of chips shall be restricted to the filling of interstices between the adjacent stones in hearting and these shall not exceed 10% of the quantity of stone masonry.

The masonry in a structure shall be carried up uniformly but where breaks are unavoidable, the joints shall be raked back at angle not steeper than 45°. Tooothing shall not be allowed.
**Bond Stones:** Shall be as specified earlier except that a bond stone or a set of bond stones shall be inserted 1.5 to 1.8 metres apart, in every course.

**Quoins:** The quoins shall be of the same height as the course in which these occur. These shall be at least 450 mm long and shall be laid stretchers and headers alternatively. These shall be laid square on the beds, which shall be rough-chisel dressed to a depth of at least 100 mm. In case of exposed work, these stones shall have a minimum of 25 mm wide chisel drafts at four edges, all the edges being in the same plane.

**Joints:** All bed joints shall be horizontal and all side joints vertical. All joints shall be fully packed with mortar, face joints shall not be more than one cm thick. When plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. Otherwise, joints shall be raked to a minimum depth of 20 mm by raking tool during the progress of work, when the mortar is still green.

**Curing, Scaffolding, Measurements and Rates:** Shall be as specified earlier.

### 3.6.9 COURSED RUBBLE MASONRY - SECOND SORT

**Dressing:** Shall be as specified above except that no portion of dressed surface of joints shall show a depth of gap more than 10 mm from a straight edge placed on it and use of chips shall not exceed 15 per cent of the quantity of stone masonry.

**Mortar:** The mortar for jointing shall be as specified.

**Laying:** Shall be as specified above except that the use of chips shall not exceed 15% of the quantity of stone masonry and stone, in each course need not be of the same height but not more than two stones shall be used in the height of a course.

**Bond Stone, Quoins:** Shall be as specified above respectively.

**Joints:** All bed joints shall be horizontal and all side vertical. All joints shall be fully packed with mortar, face joints shall not be more than 20 mm thick. When plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. Otherwise, the joints shall be raked to a minimum depth of 20 mm by raking tool during progress of work, where the mortar is still green.

**Curing, Scaffolding, Measurement and Rates:** Shall be as specified earlier.

### 3.6.10 Stone works and all components thereof should satisfy the following tests and codes:
<table>
<thead>
<tr>
<th>Material</th>
<th>Clause</th>
<th>Test</th>
<th>Requirement</th>
<th>Field/ laboratory Test</th>
<th>Test Procedure</th>
<th>Minimum Qty. of material for carrying out test</th>
<th>Frequency of Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stone</td>
<td>7.1.1 4</td>
<td>(i) Water absorption</td>
<td>Not more than 2.5% by mass for sandstone and as specified in IS 1123 for other stones.</td>
<td>Laboratory</td>
<td>IS 1124</td>
<td>50 sqm. for slabs and 10 cum in stone masonry</td>
<td>100 sqm/20 cum or part thereof or change of source as per direction of Engineer-in-Charge</td>
</tr>
<tr>
<td></td>
<td>7.8 7.9</td>
<td>(ii) Transverse strength</td>
<td>Not less than 7 N/mm² (70 Kgf/cm²) for sandstone and as specified in IS 1123 for other stones.</td>
<td>Laboratory</td>
<td>IS 1121 Part II</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iii) Resistance to wear</td>
<td>Not greater than 2 mm on the average and 2.5 mm for any individual specimen for sandstone and as specified in IS 1123 for other stones.</td>
<td>Laboratory</td>
<td>IS 1706</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iv) Durability</td>
<td>Shall not develop signs of spalling, disintegration or cracks for sandstone and as specified in IS 1123 for other stones.</td>
<td>Laboratory</td>
<td>IS 1126</td>
<td>-do-</td>
<td>-do-</td>
</tr>
</tbody>
</table>
4.0. **NON SCHEDULE ITEMS**: The items considered based on market rates of materials & works are termed as Non Schedule Items.

4.1. **Providing and Fixing 12mm thick toughened glass**: Providing & fixing 12mm thick toughened clear glass for Balcony Hand railing including all necessary Stainless steel hardware as per detailed specifications etc., complete.

4.1.1. **General**: The toughened glass work shall be carried out for staircases, balcony railings etc.

4.1.2. **Material**: 12mm thick toughened glass of approved make shall be fixed to the hand railing portion as per the construction drawings.
4.1.3. **Erection:** The glass shall be fixed to the SS hand railing in panels. The panels shall be rigidly fixed to the SS lugs and connected to the hand rail. All glass edges shall be polished with nominal radius in the corners.

4.1.4. **Measurement:** The work shall be measured in Sqm with length and height

4.1.5. **Rate:** The rate includes the cost of Glass, necessary SS hardware for fixing arrangement to the glass and hand rail and labour for erection purpose complete.

4.2. **Cinder filling:** Providing and placing cinder filling to the sunk floors in toilets well compacted carefully by hand beating to required slopes including consolidation, curing, (mix shall be one part of cement mortar 4 parts of Cinder finishing the same with the cement mortar 1:4 (1 cement:4 coarse sand) by adding water proofing compound as per manufacturers recommendations including providing 25mm dia PVC drain pipe of required length. For toilet and Kitchen sunken portions

4.2.1. **General:** The work shall be carried out for sunken slabs of toilets.

4.2.2. **Material:** The materials consist of Cinder mixed with cement mortar with top plastered with cement mortar.

4.2.3. **Laying:** The Cinder and cement mortar mix shall be mixed in a mechanical mixer in the proportions mentioned in the BOQ. The mix shall be laid in the sunkun slabs and compacted with hand beating. The top surface of the cinder filling shall be plastered to a thickness of 12mm. Water proofing compound shall be mixed as per manufacturer’s recommendations. The surface shall be cured for a minimum period of seven days.

4.2.4. **Measurement:** Quantity shall be calculated in Cum.

4.3. **Rate:** The rate includes the material cost, all taxes, labour, tools, machinery etc complete.

4.4. **G.I. Wire mesh:** Providing & fixing G.I. Plaster mesh made out of galvanized iron of nominal thickness 0.35 mm with a Zinc coating of 120 gm per sqm along the junctions of masonry & concrete works including fixing, scaffolding, lead & lifts etc.

4.4.1. **General:** The GI wire mesh shall be used at the junctions of masonry walls with Columns and beams.
4.4.2. **Material:** GI wire mesh of 0.35mm thickness with a zinc costing of 120 grams shall be provided.

4.4.3. **Fixing:** The mesh shall be fixed to different surfaces before plaster with the help of screws and nails at Masonry and column/beam junctions. If required drilling can be done. A min of 75mm width shall be provided on either side of the joint. A min of 15cm shall be overlapped wherever mesh is joined. The mesh shall be fixed in such away that it should be concealed in the plaster.

4.4.4. **Measurement:** Length x breadth shall be measured and computed to Sqm.

4.4.5. **Rate:** The rate includes the material cost, all taxes, labour, tools, machinery etc complete. Included in plastering.

4.5. **Self leveling epoxy floor finish:**

4.5.1. **General:** The treatment shall be carried out for stilt floor/parking area flooring. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups confirming the technical requirements for approval of Engineer-In-charge before placement of order.

4.5.2. **Material:** The materials shall be self leveling water based epoxy with primer as approved by Engineer-in-charge.

4.5.3. **Laying:** Concrete floor surface shall be clean to remove dirt, curing compounds, existing coatings or laitance to provide a clean, sound bonding surface. Prime the surface with Floor Sealer prior to placement of the topping. The prime coat is mixed to water at required ratio. Apply topping material while primer floor Sealer is tacky. If the prime coat dries prior to the placement of top coat, apply a second coat of primer. The topping material shall be mixed with water if required as per the manufacturer’s recommendations. The mixing shall be done using drill type mixer. Pour mixed material on to primed substrate and spread with squeegee or trowel and allow to self-level. Any high spots can be pared off with the edge of a trowel after initial set. The required thickness must be achieved in one application. For best results, pouring and leveling should be continuous until area is completely leveled.

4.5.4. **Measurement:** Length x breadth shall be measured and computed to Sqm.

4.5.5. **Rate:** The rate includes the material cost, all Taxes, adhesives cost, application etc complete.
4.6. **90 to 45mm metal filling**: Supplying, stacking, laying and spreading in layers under floor in plinth, graded stone aggregate of size ranging 90 mm to 45 mm to required thickness, filling voids with 13.2 mm nominal size (Type A) stone screenings/chippings and moorum, consolidation with hand roller of 0.50 tonne capacity, ramming etc. complete (compacted thickness shall be measured for payment).

4.6.1. **General**: The Metal filling work shall be carried out below floors, at stilt level.

4.6.2. **Material**: The material shall be clean crushed stone aggregate of 90 to 45mm and 13.2mm stone screenings and Murram as binding material. The material shall be of good quality and from approved sources as per the Instructions of Engineer-in-Charge. The materials quantities of material requirement for 100 mm compacted thicknesses shall be as per Table 16.12 of CPWD specification-2009 and the grading requirement of stone aggregate shall be as per Table 16.2 and 16.9 of CPWD specification-2009.

4.6.3. **Preparation of surface and laying**: The surface below the metalling shall be neatly dressed to the required levels and slopes as per the drawings and rolled with Half Tonne hand roller. The coarse aggregate of 90 to 45mm shall be spread uniformly and evenly up on prepared surface in required quantities with twisting motion to avoid segregation. In no case these shall be dumped in heaps on the area. The aggregate shall be spread uniformly to required profile. The surface of the aggregate spread shall be carefully trued up and all high or low spots remedied by removing or adding aggregate as may be required. Each layer shall be to a compacted thickness of 100mm. Immediately following at spreading of the coarse aggregate, it shall be compacted by rolling with half tonne hand roller and the rolling shall be discontinued when the aggregate is partially compacted with sufficient void space in them to permit application of screenings. Stone screening of 13.2mm shall be laid over the rolled metal surface in the voids and rolled until the screenings are thoroughly keyed. After the application of screenings and rolling a binding material of Murram shall be applied at a uniform slow rate in two or more successive thin layers. After each application of binding material the surface shall be sprinkled with water resulting in slurry swept in with hand brooms and rolled with half tonne hand roller.
4.6.4. **Measurement**: The length and breadth shall be measured to the nearest centimeter. The depth of the consolidated layer shall be computed to the nearest half centimeter. The quantity shall be calculated in Cum.

4.6.5. **Rate**: The rate shall include the cost of all labour and materials involved in all the operations described above including stone aggregate Murram etc. complete.

4.7. **Providing and fixing hermatically sealed double glazing** for UPVC windows as per Architecture drawing and the directions of Engineer-in-Charge with glass made of 6mm+12mm air gap+6mm thickness for windows of Air-conditioned areas.

4.7.1. **General**: The Double Glazing shall be provided for door and windows located in Air conditioned areas. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups confirming the technical requirements for approval of Engineer-In-charge before placement of order.

4.7.2. **Material**: The glass shall be 6mm thick (Model SKN 144/154 of Saint Gobain Glass or equivalent) on outer side and 6mm thick plain glass inside with 12mm air gap in between (6mm+12mm+6mm). Modifications, if called for, to the above glass model number based on recommendations for GRIHA will be incorporated as per requisite VLT and SHGC required for thermal comfort in the modeled spaces. The glass shall be procured from approved vendors. The double glazing unit shall be manufactured by thoroughly drying the air gap between two glass panes and sealing it Air tight. Spacers shall be provided to keep the glass panes apart. The drying agents shall absorb the moisture from the hermetically sealed space. The Secondary sealant to be filled should be appropriate for the size of the insulated glass unit.

4.7.3. **Erection**: Glass shall be fixed to the door panels with teak wood beading of required size and to the windows with EPDM Gasket and glazing beading.

4.7.4. **Measurement**: The actual size of the glass area shall be measured in sqm.

4.7.5. **Rate**: The rate shall include the cost of all Materials, wastage, taxes complete. excluding fixing charges, Glazing clips and Gasket which are already included in the Basic item of UPVC windows.

4.8. **Supply of 6mm thick float glass for windows.**
4.8.1. **General:** The Glazing shall be provided for UPVC windows.

4.8.2. **Material:** The glass shall be 6mm thick procured from approved vendor.

4.8.3. **Erection:** Glass shall be fixed to the windows with EPDM Gasket and glazing beading.

4.8.4. **Measurement:** The actual size of the glass area shall be measured in sqm.

4.8.5. **Rate:** The rate shall include the cost of all Materials, wastage, taxes complete excluding fixing charges, Glazing clips and Gasket which are already included in the Basic item of UPVC windows.

4.9. **Supply of frosted glass for ventilators and louvers**

4.9.1. **General:** The Glazing shall be provided for UPVC Ventilators/Louvers.

4.9.2. **Material:** The pin headed glass shall be 6mm thick (ST 136/ST167) of Saint Gobain procured from approved vendor.

4.9.3. **Erection:** Glass shall be fixed to the windows with EPDM Gasket and glazing beading.

4.9.4. **Measurement:** The actual size of the glass area shall be measured in sqm.

4.9.5. **Rate:** The rate shall include the cost of all Materials, wastage, taxes complete excluding fixing charges, Glazing clips and Gasket which are already included in the Basic item of UPVC windows.

4.10. **Supply and fixing of PVC water stopper:** Providing and fixing PVC water stopper of 225mm wide with centre bulb for construction joints of water tanks, Retaining walls of basement.

4.10.1. **General:** The water stopper shall be provided for construction joints of basement walls and water tank walls.

4.10.2. **Material:** The material shall be PVC water stopper of 225mm width with bulb

4.10.3. **Erection:** The water stopper shall be fixed in the concrete portion vertically and shall be rigidly fixed in position.

4.10.4. **Measurement:** The item shall be measured in Meter.

4.10.5. **Rate:** The rate shall include the cost of all Materials, taxes, fixing charges complete.
4.11. **Providing and Laying in position sealing compounds for expansion joints:**

4.11.1. **General:** The work shall be carried out for expansion joints of pavements.

4.11.2. **Material:** The material shall be from the approved vendors.

4.11.3. **Erection:** The erection shall be taken up as per the manufacturer’s recommendations.

4.11.4. **Measurement:** The item shall be measured in Per M length, per CM depth and 1 CM depth.

4.11.5. **Rate:** The rate shall include the cost of all Materials, taxes, fixing charges complete.

4.12. **Anti-termite treatment by Chemical Injection Method:**

4.12.1. **General:** The anti-termite treatment is a pre construction method of reticulate piping laid insite with post construction injection method of treatment carried out for Basement, Ground floor and Upper floor areas. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups confirming the technical requirements for approval of Engineer-In-charge before placement of order.

4.12.2. **Material:**

4.12.2.1. Linear Low Density Polythene (LLDP) pipes of outer Dia 8.0mm and Inner Dia 6.4mm.

4.12.2.2. The tube shall have dippers at a spacing of 300mm Max. Every dripper shall have a pressure valve which open when the chemical is injected.

4.12.2.3. Junction boxes.

4.12.2.4. Chemical for injection with disbursement of Solution of “Imidaclorprid” @ 2.5Ltr. /Sq. Mtr. at plinth level

4.12.3. **Laying and application:** 8mm joint less tube shall be laid along all the walls inside and out side below the floorings at Ground floor level. Necessary junction boxes are to be installed. Necessary testing is to be carried out to ensure the piping loop is secure and in order. Injection of chemical through the tubes with injecting pump as per the recommendations of the manufacturer.
4.12.4. **Measurement:** Outer wall to outer wall area at Ground floor shall be measured in sqm nearest to two decimals.

4.12.5. **Rate:** The rates shall be paid as per BOQ items of Pipe, Chemical and junction boxes based on the actual measurements of Meter, Sqm and Each respectively which include the cost of all Materials, chemicals, taxes, labour, laying charges etc complete.

### 3.9 Aluminium work

Aluminium sections used for fixed/openable windows, ventilators, partitions, frame work & doors etc. shall be suitable for use to meet architectural designs to relevant works and shall be subject to approval of the Engineer-in-Charge for technical, structural, functional and visual considerations. The aluminium extruded sections shall conform to IS 733 and IS 1285 for chemical composition and mechanical properties. The stainless steel screws shall be of grade AISI 304. The permissible dimensional tolerances of the extruded sections shall be as per IS 6477 and shall be such as not to impair the proper and smooth functioning/operation and appearance of door and windows.

Aluminium glazed doors, windows etc. shall be of sizes, sections and details as shown in the drawings. The details shown in the drawings may be varied slightly to suit the standards adopted by the manufacturers of the aluminium work, with the approval of Engineer-in-Charge. Before proceeding with any fabrication work, the contractor shall prepare and submit, complete fabrication and installation drawings for each type of glazing doors, windows, ventilators and partition etc. for the approval of the Engineer-in-Charge. If the sections are varied, the contractor shall obtain prior approval of Engineer-in-Charge and nothing extra shall be paid on this account.

The powder used for powder coating shall be Epoxy/polyester powder of make approved by the Engineer-in-Charge. The contractor shall give detailed programme for powder coating in advance, to facilitate the inspection by Engineer-in-Charge or his authorized representative. The polyester powder shall be applied by electrostatic powder spray method. Before start of powder coating the contractor shall submit detail specification for application of polyester powder from manufacturer of the polyester powder for approval of Engineer-in-Charge. The powder coating shall be applied as per the specification approved by Engineer-in-Charge. The thickness of the finished polyester powder coating measured by micron meter shall not be less than 50 micron nor more than 120 micron at any point. It is mandatory that all aluminium members shall be wrapped with self adhesive non-staining PVC tape, approved by Engineer-in-Charge.

Shop drawings for each type of doors/windows/ventilators etc. shall be prepared by using suitable sections based on architectural drawings, adequate to meet the requirement/specifications and by taking into consideration varying profiles of aluminium sections being extruded by approved manufacturers. The shop drawings shall show full size sections of glazed doors, windows, ventilators etc. The shop drawings shall also show the details of fittings and
joints. Before start of the work, all the shop drawings shall be got approved from the Engineer-in-Charge. Actual measurement of openings left at site for different type of door/window etc. shall be taken. The fabrication of the individual door/windows/ventilators etc. shall be done as per the actual sizes of the opening left at site. The frames shall be truly rectangular and flat with regular shape corners fabricated to true right angles. The frames shall be fabricated out of section which have been cut to length, mitered and jointed mechanically using appropriate machines. All aluminium work shall provide for replacing damaged/broken glass panes without having to remove or damage any member of exterior finishing material.

The holes in concrete/masonry/wood/any other members for fixing anchor bolts/fasteners/screws shall be drilled with an appropriate electric drill. Windows/doors/ventilators etc. shall be placed in correct final position in the opening and fixed to Sal wood backing using stainless steel screws of star headed, counter sunk and matching size groove of required size at spacing not more than 250 mm c/c or dash fastener. All joints shall be sealed with approved silicone sealants. Where aluminum comes into contact with stone masonry, brick work, concrete, plaster or dissimilar metal, it shall be coated with an approved insulation lacquer, paint or plastic tape to ensure that electrochemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion.

All the aluminium sections including snap beading fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimeter. The weight calculated on the basis of actual average (average of five samples) weight of composite section in kilogram correct to the second place of decimal shall be taken for payment. The rate shall include the cost of all the materials, labours involved in all the operations as described in nomenclature of item and particular specification.

Material, fabrication and dimensions of aluminium doors, windows and ventilators manufactured from extruded aluminium alloy sections of standard sizes and designs complete with fittings, ready for being fixed into the building shall be as per IS 1948. Aluminium alloy extruded sections used in the manufacture of extruded window sections shall conform to IS 733. Hollow aluminium alloy sections used shall conform to IS 1285. Screws threads of machine screws used in the fabrication of aluminium doors, windows and ventilators shall conform to IS 1362. Glass panes shall weigh at least 7.5 kg/m2 and shall be free from flaws, specks or bubbles. All panes shall have properly squared corners and straight edges.

**HERMETICALLY SEALED UNIT**

Insulating glass shall be a double glazed unit comprising two sheets of float glass panes separated by a spacer, hermetically sealed using primary and secondary sealants. The design of insulating glass system shall consist of:
(a) Hollow Spacer Bar- The hollow aluminium spacer bar shall be of required size and shape and shall be colour anodized. The spacer bar shall have two lines of perforations in the inner surface.

(b) Desiccant- The desiccant shall be Neftomol 3 AChemetall or equivalent. The desiccant filled in the aluminium spacer bar shall be synthesized crystalline compounds of Aluminium Hydroxide, Caustic Soda and Sodium Silicate which absorbs water molecules. The desiccant shall be of 3 A size (A means Angstrom). The quantity of desiccant used shall not be less than 35 gm/m length of spacer bar. Filled spacer bar frame shall not be stored for more than 6 hours before assembly and sealing of the unit to ensure proper functioning of the desiccant. The contractor shall submit documentary proof of using the above material in the work.

(c) Primary Sealant- The primary sealant shall be single component approved by the Engineer in Charge, thermo plastic solvent free sealing compound based on polysosutylene. The sealant surface shall be free from cavities, depression and other defects. The contractor shall submit documentary proof of using the above material in this work.

(d) Secondary Sealant- The secondary sealant in double glazed unit shall be silicone sealant approved by the Engineer in Charge. The contractor shall submit documentary proof of using the above material in this work to the entire satisfaction of Engineer-in-Charge. Before application of silicone/ polysulphide, the surface must be cleaned and free from oil, grease, dust and other loose matter. The surfaces shall be cleaned with alcohol or other suitable solvents, not detergent or soap. The polysulphide shall be mixed and applied mechanically using automatic mixing machine in the manner approved by Engineer-in-Charge.

The height and width of double glazed/single glazed unit (the area of glass unit outside the snap beading shall only be measured) as fixed in place shall be measured correct to one centimeter and area calculated in sqm. correct to second place of decimal shall be taken for payment.

The rate shall include the cost of all the materials, labours involved in all the operations as described in nomenclature of item and particular specification.

**Pervious Concrete with Recharge Bed**

Providing & laying Controlled Pervious cement concrete using stone aggregates, cement with no fines with admixtures, additives of BASF/ Equivalent as per mix design at places including providing recharge bed on soil with 40 % air voids, fabricating and erecting form work, preparation and placing wherever needed/ specified as per drawing including striking/ de-shuttering. Air Voids should be in range of 15 to 20% or more.

The rate includes woven/non woven geo textile on the soil below the recharge bed.

The quantity measured will be in terms of pervious concrete.
3.10 Wood work

Material:

Teakwood: Individual hard and sound knot shall not be more than 12 mm in diameter and the aggregate area of all the knots shall not exceed 0.5% of the area of the piece. It shall be close grained. Moisture content shall not exceed 10%.

Sal wood: sapwood is very perishable and should not be used. No individual hard and sound knot shall exceed 25 mm in diameter and the aggregate area of all the knots shall not exceed 1% of the area of the piece. Moisture content shall not exceed 10%.

Timber shall be either air seasoned or kiln seasoned and in both cases moisture content of the seasoned timber shall be as specified. Unless otherwise specified, air seasoned timber shall be used. Kiln seasoning of timber, where specified, shall be done as per IS 1141 in a plant approved by Engineer-in-Charge. Preservative treatment, where specified, shall be done using Oil type, Organic solvent type or Water-soluble type preservative. Oil type preservatives shall be used if the timber is not required to be polished or painted. Before preservative treatment, the timber shall be sawn and seasoned. All surfaces exposed after treatment, except due to planing, shall be thoroughly brushed with the preservation before jointing. Preservative treatment of timber shall be done as per IS 401 in a plant approved by the Engineer-in-Charge.

Door & Window frames:

Timber for door, window and ventilators frames shall be as specified. Timber shall be sawn in the direction of the grains. All members of a frame shall be of the same species of timber and shall be straight without any warp or bow. Frames shall have smooth, well-planed (wrought) surfaces except the surfaces touching the walls, lintels, sill etc., which may be left clean sawn. Rebates, rounding or moulding shall be done before the members are jointed into frames. The depth of the rebate for housing the shutters shall be 15 mm, and the width of the rebates shall be equal to the thickness of the shutters. A tolerance of ± 2 mm shall be permitted in the specified finished dimensions of timber sections in frames.

Joints: The Jamb posts shall be through tenoned in to the mortise of the transoms to the full thickness of the transoms and the thickness of the tenon shall be not less than 2.5 cm. The tenons shall closely fit into the mortise without any wedging or filling. The contact surface of tenon and mortise before putting together shall be glued with polyvinyl acetate dispersion based adhesive conforming to IS 4835 or adhesive conforming IS 851 and pinned with 10 mm dia hard wood dowels, or bamboo pins or star shaped metal pins. The joints shall be at right angles when checked from the inside surfaces of the respective members. The joints shall be pressed in
position. Each assembled door frame shall be fitted with a temporary stretcher and a temporary diagonal brace on the rebated faces.

**Frames:** The frames shall be got approved by the Engineer-in-Charge before being painted, oiled or otherwise treated and before fixing in position. The surface of the frames abutting masonry or concrete and the portions of the frames embedded in floors shall be given a coating of coal tar. Frames shall be fixed to the abutting masonry or concrete with holdfasts or metallic fasteners as specified. After fixing, the jamb posts of the frames shall be plugged suitably and finished neat. Vertical members of the door frames shall be embedded in the floor for the full thickness of the floor finish and shall be suitably strutted and wedged in order to prevent warping during construction. A minimum of three hold fasts shall be fixed on each side of door and window frames one at centre point and other two at 30 cm from the top and bottom of the frames. In case of window and ventilator frames of less than 1 m in height two hold fasts shall be fixed on each side at quarter point of the frames. Hold fasts and metallic fasteners shall be measured and paid for separately.

**Measurement:** Wood work wrought, framed and fixed shall be measured for finished dimension without any allowance for the wastage or for dimensions beyond specified dimension. However, in case of members having mouldings, roundings or rebates and members of circular or varying sections, finished dimensions shall be taken as the sides of the smallest square or rectangle from which such a section can be cut. Length of each member shall be measured over all to the nearest cm so as to include projection for tenons. Width and thickness shall be measured to the nearest mm and the quantity shall be worked out in unit of upto three places of decimal.

**Rate:** The rate shall include the cost of material and labour involved in all the operations described above except the hold fasts or metallic fasteners which will be paid for separately.

**List of Mandatory Tests:**

<table>
<thead>
<tr>
<th>Material</th>
<th>Clause</th>
<th>Test</th>
<th>Field/Laboratory Test</th>
<th>Test Procedure</th>
<th>Min., Quantity of Material for carrying out the test</th>
<th>Frequency of Testing</th>
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</thead>
<tbody>
<tr>
<td>Timber</td>
<td>9.1.6</td>
<td>Moisture content</td>
<td>Field (by moisture meter laboratory test as required by Engineer-in-Charge)</td>
<td>Appendix ‘C’</td>
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<td>Every one cu m or part thereof.</td>
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<td>Flush door</td>
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<td>End immersion Test knife test Adhesion Test</td>
<td>Laboratory</td>
<td>IS 2202 Appendix ‘F’</td>
<td>26 shutters</td>
<td>As per sampling and testing specified in clause 9.7.11</td>
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<tr>
<td>Mortice Locks</td>
<td>9.15.13</td>
<td>Testing spring of Laboratory</td>
<td>IS 2209-Appendix ‘G’</td>
<td>50 Nos</td>
<td>100 or part thereof.</td>
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</table>
PROJECT OFFICE SPECIFICATION

4.27 Containerized Unit

Prefabricated Containerized Unit shall be installed to serve as Site Office, and removed post-construction, conforming to the following specifications:

**Size:** approximately 30sq.metre minimum area, of layout as per drawings issued or instruction of Engineer-in-Charge.

**Material:**
Foundation shall be cast in PCC.
External and internal partition walls shall be constructed with Sandwiched panel 50mm(+/-5mm) thick, made of 6mm(+2) thick Cement Fibre board on both sides of thermocole layer of 38mm(+/-5mm) thickness.

Roof structure shall be made of MS hollow pipes, in a grid of 2ftx4ft. Roof panel shall be composed of pre-painted galvanized steel sheets on top, with insulating layer of thermocole in the middle, covered by 6mm thick Boiling-Water-Proof (BWP) plywood underneath.

Floor : Modular Floor shall be constructed of MS pipe sections resting on ISMB/C, mounted with 18mm BWP plywood to provide sturdy portable floor 15cm-20cm above ground level. Above plywood, 1.5 mm thick layer of PVC flooring shall be provided (LG Make/equivalent).

Finishing : Exterior surface shall be painted with textured, waterproof and fire resistant polymer coatings. Interior walls shall be painted with Oil Bound Acrylic distemper. The paints are to be of approved colour and texture.

False Ceiling : False ceiling shall be provided with aluminium suspension members and grid of aluminium channels, with panels of gypsum, cement fiber board or insulated panels.

Plumbing provision is to be provided and sewerage connection to be given to pit/ as per direction by EIC. Post construction, the connection shall be dismantled and pit covered to the specification of the Engineer-in-charge.

Waterproofing in toilet and mounting PVC on walls up to 1.524m(5ft.) height.

Proper electrical connections shall be provided with adequate light, fan and power points as per detail, with modifications as suggested/approved by EIC.

**Fittings and furniture** shall be provided as per the following list:
- Flush doors with aluminium handle L-drop for locking arrangements (D1=0.9mx2.1m)
• Flush door with aluminium handle L-drop for locking arrangements (D2=0.65mx1.98m)
• Plain aluminium sliding 4mm glass window with locking arrangements. (S/W=0.9mx0.9m)
• Toilet Fittings and Accessories like WC with Cistern (Standard Make White), Wash Basin (Standard Make White), towel rail, mirror, taps, soap case including internal plumbing (ISI make) with plumbing connections outside.
• Working counters (Panel topped with GI plain sheet resting on MS frame) with stainless steel sink with internal plumbing- 0.5mX1.8m.
• AC of reputed make of 1Ton Capacity
• Conference room table 1.8mX0.9m topped with matte finish laminate
• Storage unit of size 0.6mX0.2mX2.1m
• Standard table 1.5mX0.75m- 1 no and 1.2 m x .6 m – 1 no topped with matte finish laminate
• High back/low back chairs for the office

EXTERNAL CLADDING

4.23 Ventilated façade shall be provided using PRODEMA Prodex panels or similar, of 8 mm thickness. There shall be an aluminium framework used to support the façade to the wall. This may have only vertical members and should maintain a constant gap from the wall not less than 20mm. Panels are fixed to the framework using the exposed-fastening system with rivets bearing the same finishing and colour as the panels. Behind the facade panels there should be a minimum 20mm wide uninterrupted ventilated air chamber. Only vertical battens should be used.

Joints between panels should observe the following:

• The panels should have freedom of movement of 1.8mm per linear metre of panel, both lengthways and widthways;
• A minimum joint of 8mm is recommended;
• Joints should guarantee adequate ventilation and drainage. The maximum distance between fastenings shall be 450mm if there are only two fastenings in one direction, and 600mm if there are three or more fastenings in one direction.
• The fastenings located near the panel edge shall be at a minimum distance of 20 mm and at a maximum distance of 40 mm from the panel edge.

The installation of this façade shall be as per detailed shop drawings and the instructions of the engineer-in-charge.

4.24 Ventilated façade shall be provided using Fundermax - Max Exterior or similar lap sliding elements of profile 4100 x 250 mm, using mounting clips fixed to vertical aluminium sections of minimum 75 mm width in the corner joints and 50 mm width otherwise. Only vertical slats should be used. The vertical slats are to be spaced maximum 500 mm with panels installed starting from the bottom. Provision of mesh has
to be made at the bottom and the top of the cladding system. The bottom of the structure to be minimum 20 mm higher than the finished floor level to facilitate air movement.

The installation of this façade shall be as per detailed shop drawings and the instructions of the engineer-in-charge.

4.25 **Structural glazing** shall be provided and fixed as per the detailed drawing, using double glazed unit (DGU) with 6mm+12mm (air gap) +6mm thick reflective toughened glass of approved color manufactured by reputed manufacturer such as Glaverbell, Modiguard, St.Gobain etc., using structural sealant of Dow Corning D995/GE/Wacker Germany etc., complete as per detailed drawing. The entire structural glazing be carried with structural sealant DC-995 or GE/Wacker. While the weather proofing/water proofing be done with weather sealant DC789/793 or GE/Wacker. The entire façade will be designed to safely carry dead load, wind load etc. the wind load may be calculated based on recommendation of IS 875 (Part III). The entire façade should be water proof. The façade be fixed to the structure through Hot dip galvanized with epoxy coating MS brackets and anchor fasteners. The entire façade shall be composed of double-glazed units.

4.26 **Double glazed unit with spider glazing** shall be provided and installed as per detailed drawings. Hardwares such as Arm spider, point bracket etc., and 8mm + 12mm + 13.5mm laminate glass of approved colour manufactured by reputed manufacturer such as Glaverbell, Modiguard, St.Gobain etc., using structural sealant of Dow Corning D995/GE/Wacker Germany etc., shall be used, as specified as per detailed drawing. The entire structural glazing be carried with structural sealant DC-995 or GE/Wacker. The entire façade will be designed to safely carry dead load, wind load etc. the wind load may be calculated based on recommendation of IS 875 (Part III). Vendor is to provide structural details for approval before commencing works.

4.27 **FLUSH DOORS:**

All flush doors shall be sold core unless otherwise specified. It shall conform to the relevant specifications of I.S.2202 and shall be obtained from approved manufacturers. The finished thickness of the shutter shall be as mentioned in the item. Face veneers shall be of the pattern and colour approved by the EIC / Architects and an approved sample shall be deposited with the EIC / Architects for reference.

The solid core shall be of Wood Laminate prepared from battens of well-seasoned and treated good quality wood having straight grains. The battens shall be of uniform size of about 2.5 cm width. These shall be properly glued and machine pressed together with grains of each piece reversed from that of adjoining one. The longitudinal joints of the battens shall be staggered and no piece shall be less than 50 cm in length. Alternatively, the core shall be of solid teak particle
board. Edges of the core shall be lipped with first class teakwood battens of 4 cm. (1 ½”) minimum depth, glued and machine pressed along the core.

The core surface shall then have two or three veneers firmly glued on each face. The first veneer (called cross Bond) shall be laid with its grains at right angles to those of the core and the second the third veneer with their grains parallel to these of the core. The under veneers shall be of good quality, durable and well-seasoned wood. The face veneer shall be of minimum one mm thickness and of well-matched and seasoned first class teak, laid along with grains of the core battens. The combined thickness of all the veneers on each face shall not be less than 4 mm. Thermo setting synthetic resin conforming to IS 303 for moisture proof plywood grade M.P.F.I. shall be used in manufacture. In addition all doors shall have external lipping all round 8 mm thick.

Providing and fixing approved quality factory made solid core flush door in single leaf total avg. 42 mm thick BWP grade anti-termite treated type plywood with polished natural veneer surface on both sides, flush door 35 thk. ply board shutter to be ready factory made with both-side hardwood ply board faced Pine-wood core in continuous gapless section with butt joints tightly factory bonded with phenol formaldehyde adhesive of brand as approved. TW lipping on all edges of the door shutter 4mm thick, with 25mm thick ply panel core, BWR and anti termite treated. The TW frame top rail (at lintel level) to have avg. 100 mm horn projection on either side to anchor firmly as per the drawing inclusive of all walling holdfasts & horns, fixing implements, accessories installed finished and lift up to 20 mts etc. complete. Item to be completed in all respects as per drawings & instructions from Project-in-charge/Architect.

Hardware Double bearing butt hinges size 4" x 3" x 3mm, - 3 Nos

Lever handle , escutcheon and spindle in satin stainless steel. Complete set including sash lock and EPC with both sides Key operation & fixing accessories.- 1 No

Cam action door closer with G-N slide channel arm for pull side fixing, Silver finish.- 1 No

Floor stop half dome with 45mm dia with fixing accessories, in satin stainless steel- 1 No

5.0. GENERAL

5.1. Double pipe scaffolding shall be used for all the works and as per industry best practices.

5.2. Where equivalent is indicated, it shall mean material with equivalent quality with the vendors indicated. In case it is not possible to identify similar materials with other vendors, the material shall be selected based on equivalent cost with in identified Vendors as per manufacturers price catalogs.
5.3. **Drawings**

5.3.1. Tender drawings developed by the consultant / owner are enclosed with the tender documents. These are indicative. Upon placement of award, 2 sets of the drawings, with a “RELEASED FOR CONSTRUCTION” stamp, shall be issued by the Owner to the Contractor matching with the requirement at Site. The Contractor shall execute the work at Site as per these drawings only.

5.3.2. The Drawings shall be made available to the Contractor sequentially as per the agreed work schedule.

5.4. **Approved Vendors:** List of approved vendors is enclosed to the specification.

5.5. **Field Quality Program:**

5.5.1. The work shall be executed as per the HPCL Standard Field Quality Document No. ______________________ pertaining to building civil works along with the other quality plans indicated in the Technical specifications. All tests on materials and finished products as required in field quality plan shall be carried out by the Contractor at his own cost. The following guidelines shall govern for carrying various lab tests:

5.5.2. The material testing shall be carried out in any of the following NABL accredited laboratories or any approved lab in Lucknow as following:

5.5.2.1. Civil Aid Technoclinic Pvt Ltd, Bangalore.

5.5.2.2. Indian Institute of Technology Delhi/ Kanpur

5.5.2.3. StructGeotech Research Laboratory, Bangalore.

5.5.3. In case Testing facilities are not available for any specified test given in FQP/Tech Spec/BOQ item Description in these laboratories, the same shall be carried out in any other laboratory where such facilities are available with the specific approval of Engineer-in-Charge.

5.5.4. The contractor shall arrange at his own cost, packing, forwarding and other incidentals for conducting the tests.

5.5.5. All test reports shall be submitted to HPCL within 7 days from the date of dispatch of test specimens to the laboratory.
5.6. The Contractor shall bring samples of all materials; finished or raw to the site and shall get them approved from the Engineer-in-Charge before using them in the work. Any material not conforming to approved samples shall be removed within 48 hours of the Engineer-in-Charge’s instruction to the Contractor to do so, failing which it shall be removed by the Engineer-in-Charge or his representative from the site at the risk and cost of the Contractor.

5.7. Samples of materials to be used with original/colour catalogue with specification shall be brought by contractor well in advance and shall be displayed and kept in separate sample room in site. Samples of all kinds of materials to be used shall require approval of the Owner.

5.8. Materials shall be of approved quality and the best of their kind available and shall generally conform to I.S. Specifications. The Contractor shall order all the materials required for the execution of work as early as necessary and ensure that such materials are on site well ahead of requirement for use in the work. The work involved calls for high standard of workmanship combined with speed and to the entire satisfaction of the Engineer-in-Charge.

**LIST OF APPROVED VENDORS**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of Item</th>
<th>Standard make / brand names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chlorpyriphos (For anti-termite treatment)</td>
<td>Sahakar of M/s.Karnataka Co-op. Marketing Fed. Ltd., Termisac of M/s.Bayer India Ltd, Bhagiradha Chemicals Ltd, Hyderabad</td>
</tr>
<tr>
<td>2</td>
<td>Reticulate Antitermite with Imidaclorpid</td>
<td>Itemsecure – Ivory terrace, Alkapuri Baroda, Gujarat</td>
</tr>
<tr>
<td>3</td>
<td>Water proofing compound</td>
<td>Pidilite Industries, CICO No. 1, SCOTT No.1, Accoproof, Fosroc chemicals; Sika</td>
</tr>
<tr>
<td>4</td>
<td>Cement</td>
<td>ACC, Birla cements, L&amp;T, Ultra Tech Cement, Ambuja</td>
</tr>
<tr>
<td>5</td>
<td>Ready Mix Cement Concrete (RMC)</td>
<td>Ultra Tech Concrete, ACC Concrete, L&amp;T Concrete /approved equivalent</td>
</tr>
<tr>
<td>6</td>
<td>Reinforcement Steel</td>
<td>TISCO, SAIL, RINL</td>
</tr>
<tr>
<td>6</td>
<td>Flush door shutter</td>
<td>Kutty Flush doors, Chennai / KSFIC, Bangalore / Anand Wood Crafts, Hyderabad /Anchor flush doors</td>
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<tr>
<td>7</td>
<td>Hydraulic door closers</td>
<td>Dorma, Hafle/approved equivalent</td>
</tr>
<tr>
<td>8</td>
<td>Structural Steel, MS pipes</td>
<td>TISCO, SAIL, RINL (For Misc requirement like railings, grills etc procurement can be made from local market if the materials are not available with main producers as decided by the Engineer in Charge)</td>
</tr>
<tr>
<td>11</td>
<td>Aluminium sections</td>
<td>Hindalco, Jindal/approved equivalent</td>
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<tr>
<td>12</td>
<td>Glazing</td>
<td>Modi glass, AIS glass, Saint Gobain</td>
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<tr>
<td>13</td>
<td>Floor springs</td>
<td>Dorma, Hafle</td>
</tr>
<tr>
<td>14</td>
<td>Silicon sealants</td>
<td>Dow corning. Other Brand if any shall be as per advice of the consultant.</td>
</tr>
<tr>
<td>15</td>
<td>Wall putty</td>
<td>Birla putty, JK putty, Asian putty</td>
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<td>16</td>
<td>Spider fittings</td>
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<td>17</td>
<td>UPVC Windows</td>
<td>Fenesta, Sintex, Wintech</td>
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<td>GI plaster mesh</td>
<td>Arpitha Building products, Bangalore , National Wire Products, Pune</td>
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<tr>
<td>19</td>
<td>Automatic sliding door</td>
<td>Dorma, Gandhi Automation Pvt Ltd, Mumbai</td>
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<tr>
<td>20</td>
<td>Laminated glass</td>
<td>AIS Glass/saint goban /approved equivaI nt. Other Brand if any shall be as per advice of the consultant.</td>
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<tr>
<td>21</td>
<td>Frosted film</td>
<td>Garware films, 3 M films</td>
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<td>Epoxy leveling topping</td>
<td>Epoxy.com, Arcoy Industries, MRF</td>
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<td>23</td>
<td>LOW VOC paints</td>
<td>Asian Paints, Nerolac paints, Alconoble(ICI)</td>
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<td>24</td>
<td>Adhesives</td>
<td>Pidilite Industries, Fosroc chemicals, Sika India Ltd</td>
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<tr>
<td>25</td>
<td>Water proofing agency</td>
<td>Nina industries/Oversees water proofing/BASF approved applicator/approved equivalent agency</td>
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</tbody>
</table>
1.0 Introduction:

5.9. The intent of this technical specification covers all construction related to Public health Engineering works (Plumbing & Sanitary) as covered in the scope of contract as per drawings supplied by Owner.

5.10. All works shall be carried out as per design/drawings standardized by the Consultant / Owner and these specification provided by the Consultant / Owner. All standard drawings are enclosed with the tender documents. In case any item is not covered under specification then the same shall be carried out as per CPWD specification and applicable Standards and Codes. Any item for which specification is not provided herein and is not covered under CPWD specification shall be executed as per manufacturer guidelines. All materials shall be of best quality conforming to relevant Indian Standards and Codes. In case of any conflict between Standards/ Code and Technical Specification, the provisions of Technical Specification shall prevail.

5.11. The Contractor shall furnish all labor, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with drawings, specifications and direction of Owner.

5.12. All materials including cement, reinforcement steel and structural steel etc. shall be arranged by the Contractor. All testing required shall be arranged by the Contractor at his own cost. The contractor shall execute the work as per the Field Quality Plan (FQP) attached with this document.

5.13. The bidder shall fully apprise himself of the prevailing conditions at the proposed site. Climatic conditions including monsoon patterns, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically brought out in the specifications.

6.0. SCHEDULE ITEMS
6.1. The Items of works considered based on Delhi Schedule of Rates are termed as Schedule Items.

6.2. The work shall be executed in accordance with the specification stipulated in the Bill of Quantity and other bidding documents read along with CPWD (Central Public Works Department) specifications-2009 for civil works and IS codes with up to date corrections For non-schedule items specification as given along with tender document and similar items of CPWD shall be applicable.

6.3. The work shall be executed in accordance with the specification stipulated in the Bill of Quantity and other bidding documents read along with CPWD (Central Public Works Department) specifications-2009 for civil works and IS codes with up to date corrections.

6.4. The list of references for civil works are CPWD specifications, relevant IS codes and best practices.

7.0. NON SCHEDULE ITEMS: The items considered based on market rates of materials & works are termed as Non Schedule Items. For non-schedule items, specification as given in BOQ, Similar items of CPWD and this specification shall be applicable.

7.1. Construction of Masonry chamber: Constructing masonry chamber 60X60X75 cm, inside with aerated fly ash bricks of n cement mortar 1:4 (1 cement : 4 coarse sand) for valves, with C.l surface box 100 mm. Top diameter 160 mm bottom diameter and 180 mm deep (inside) with chained lid and Pre cast RCC top slab 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) necessary excavation foundation concrete 1:5:10 (1 cement: 5 fine sand : 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12 mm thick finished with a floating coat of neat cement complete as per drawing

7.1.1. General: The work shall be carried out for Valve chambers of water supply system.

7.1.2. Materials: All the materials required for the work shall be as per item description and approved by Engineer in Charge.

7.1.3. Construction: The construction of chamber shall be with fly ash bricksw ith cement mortar of 1:6. C I surface box shall be fixed in the RCC slab as per the CPWD specification, item no 18.17

7.1.4. Measurement: The chambers shall be enumerated under relevant item.

7.1.5. Rate: The rate includes the cost of materials and labour involved in the operations described above.

7.2. Construction of masonry Manhole: Constructing Masonry manhole with in fly ash bricks cement mortar 1:4 (1 cement : 4 coarse sand) RCC top slab with 1:
2 : 4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) foundation concrete 1 : 4 : 8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size) inside plastering 12 mm thick with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with floating coat of neat cement complete as per standard design. Inside size 90 x 80 cm and 45 cm deep including CI cover with frame (light duty) 455 x 610 mm internal dimensions total weight of cover and frame to be not less than 38 kg. (weight of the cover 23 kg and weight of the frame 15 kg).

7.2.1. The work shall be executed in line with CPWD specification No 19.4

7.3. Construction of masonry Manhole: Constructing circular manhole 1.22 m internal dia at bottom and 0.56 m dia at top with fly ash bricks in cement mortar 1:4 (1 cement : 4 sand) inside cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 sand) finished with a floating coat of neat cement, foundation concrete 1:3:6 (1 cement : 3 sand : 6 graded stone aggregate 40 mm nominal size) and making necessary channel in cement concrete 1:2:4 (1 cement : 2 sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement all complete as per standard design, 1.68 m deep with SFRC cover and frame (heavy duty HD-20 grade designation) 560 mm internal diameter conforming to I.S. 12592, total weight of cover and frame to be not less than 182 kg. fixed in cement concrete 1:2:4 (1 cement : 2 sand : 4 graded stone aggregate 20 mm nominal size) including centering shuttering all complete. (Excavation, foot rests and 12 mm thick cement plaster at the external surface shall be paid for separately).

7.3.1. The work shall be executed in line with CPWD specification No 19.4.

7.4. Gully Trap: Providing and fixing square-mouth Square gully trap Grade-A complete with C.I grating masonry chamber with water tight C.I. Cover with frame of 300X300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be less than 2.70 kg 100x100 mm size P type With masonry as per drawing.

7.4.1. The work shall be executed in line with CPWD specification No 19.2.1.3.

7.5. Oval Wash Basin (White): Supplying, installing, testing and commissioning approved make oval wash basin white colour fixed under counter with single hole 15 mm Long body Sensor Tap unit, 32 mm dia CP waste coupling, 32 mm dia C.P. bottle trap with C.P. extension pipe, 1 No. 15 mm dia C.P. angle cock 1 No. C.P. flexible inlet connection pipe G.I. expansion bolts etc., complete including silicon sealant. Size 570 x 423 mm. Sensor Tap water flow rate is considered as 2.75 Ltrs/Min. Basin: TOTO Model No 651J or equivalent and Sensor Tap; Jaquar Model 51027 or Equivalent.
7.5.1. **General:** The wash basins shall be installed at locations indicated in construction drawings.

7.5.2. **Material:** Materials like white wash basin, (As per IS 2556 Part-1 and Part-4) CP long body pillar cock, CP bottle trap (Jaquar Model No-769B), CP angle cock (Jaquar Model No-053), Inlet connection pipe fittings etc shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. The aerated pillar cock flow rates shall be as specified in the BOQ.

7.5.3. **Installation:** The wash basin and other fittings shall be installed as per the relevant CPWD specifications of Sanitary installations, under Section-17.

7.5.4. **Measurement:** The wash basins shall be enumerated under relevant item.

7.5.5. **Rate:** The rate includes the cost of all the items mentioned above and for successful commissioning except the granite counter which shall be paid under relevant item and making holes in the granite counter.

7.6. **Oval Wash Basin (Colour)** Supplying, installing, testing and commissioning approved make oval wash basin of light colour fixed under counter with single hole 15mm Long body Sensor Tap unit, 32mm dia CP waste coupling, 32mm dia CP bottle trap with C.P. extension pipe, 1 No. 15mm dia C.P. angle cock 1 No. C.P. flexible inlet connection pipe G.I. expansion bolts etc, complete including silicon sealant. Size 570 x 423 mm. Sensor Tap water flow rate is considered as 2.75Ltrs/Min. Basin: TOTO Model No 651J or equivalent. and Sensor Tap ;Jaquar Model 51027 or Equivalent.

7.6.1. **General:** The wash basins shall be installed at locations indicated in construction drawings.

7.6.2. **Material:** Materials like Colour wash basin, (As per IS 2556 Part-1 and Part-4) CP long body pillar cock, CP bottle trap (Jaquar Model No-769B), CP angle cock (Jaquar Model No-053), Inlet connection pipe fittings etc shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Where ever equivalent brand is considered the base price of the individual items shall be considered as equivalent. The aerated pillar cock flow rates shall be as specified in the BOQ.

7.6.3. **Installation:** The wash basin and other fittings shall be installed as per the relevant CPWD specifications of Sanitary installations, under Section-17.
7.6.4. **Measurement**: The wash basins shall be enumerated under relevant item.

7.6.5. **Rate**: The rate includes the cost of all the items mentioned above and for successful commissioning except the granite counter which shall be paid under relevant item and making holes in the granite counter.

7.7. **Water closet (Colour)**: Supplying, installing, testing and commissioning approved make light colored glazed Orissa Pan type Water closet set in PCC 1:3:6 including 110mm dia UPVC 'P' trap, 15 mm CP angle cock with dual flush porcelain 2/4 Ltrs capacity with all internal fittings etc., complete. Size: 580x440mm. HindwareCeilo model 20042 or equivalent

7.7.1. **General**: The water closets shall be installed at locations indicated in construction drawings.

7.7.2. **Material**: Materials like Coloured water closet( As per IS 2556 Part-1 and Part-3), Dual flush porcelain cistern, CP angle cock (Jaquar Model No-053), Inlet connection pipe fittings etc shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Where ever equivalent brand is considered the base price of the individual items shall be considered as equivalent. The dual flushing cistern flow rates shall be as specified in the BOQ.

7.7.3. **Installation**: The Water closets and other fittings shall be installed as per the relevant CPWD specifications of Sanitary installations, under Section-17.

7.7.4. **Measurement**: The water closets shall be enumerated under relevant item.

7.7.5. **Rate**: The rate includes the cost of all the items mentioned above and for successful commissioning.

7.8. **European Water closet (White)**: Supplying, installing, testing and commissioning approved make white colour European water closet wall mounted pattern type 'P' trap with 4/2 Lts. Capacity Dual Flush porcelain close coupled cistern with all internal fittings of the cistern. The quoted price shall also include 1no. 15mm CP angle cock, CP Inlet connection pipe, CP wall flange, plastic solid seat and cover with rubber buffers and flap, heavy duty plastic hinges, etc., complete. TOTO model CW868J or equivalent

7.8.1. **General**: The water closets shall be installed at locations indicated in construction drawings.
7.8.2. **Material:** Materials like White water closet (As per IS 2556 Part-1 and Part-2), Dual flush porcelain cistern, CP angle cock (Jaquar Model No-5053), Inlet connection pipe fittings etc. shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. The dual flushing cistern flow rates shall be as specified in the BOQ.

7.8.3. **Installation:** The Water closets and other fittings shall be installed as per the relevant CPWD specifications of Sanitary installations, under Section-17.

7.8.4. **Measurement:** The water closets shall be enumerated under relevant item.

7.8.5. **Rate:** The rate includes the cost of all the items mentioned above and for successful commissioning.

7.9. **European Water closet (Colour):** Supplying, installing, testing and commissioning approved make light colour European water closet floor mounted pattern type ‘P’ trap with 4/2 Lts. Capacity Dual Flush porcelain close coupled cistern with all internal fittings of the cistern. The quoted price shall also include 1no. 15mm CP angle cock, CP Inlet connection pipe, CP wall flange, plastic solid seat and cover with rubber buffers and flap, heavy duty plastic hinges, etc., complete. TOTO model CW868J or equivalent.

7.9.1. **General:** The water closets shall be installed at locations indicated in construction drawings.

7.9.2. **Material:** Materials like Colour water closet (As per IS 2556 Part-1 and Part-2), Dual flush porcelain cistern, CP angle cock (Jaquar Model No-053), Inlet connection pipe fittings etc. shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Where ever equivalent brand is considered the base price of the individual items shall be considered as equivalent. The dual flushing cistern flow rates shall be as specified in the BOQ.

7.9.3. **Installation:** The Water closets and other fittings shall be installed as per the relevant CPWD specifications of Sanitary installations, under Section-17.

7.9.4. **Measurement:** The water closets shall be enumerated under relevant item.

7.9.5. **Rate:** The rate includes the cost of all the items mentioned above and for successful commissioning.
7.10. **PCC Pedestals:** Supplying and fixing in position P.C.C. pedestals 400x230x230mm with MS brackets & GI clamps for laying pipes on terrace.

7.10.1. **General:** The PCC pedestal are required for GI pipe supports on top of terrace.

7.10.2. **Material:** The Mix shall be PCC1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20mm nominal size)

7.10.3. **Construction:** The PCC shall be laidas per the relevant CPWD specifications of Plain cement concrete.

7.10.4. **Measurement:** The pedestals shall be enumerated under relevant item.

7.10.5. **Rate:** The rate includes the cost of all the materials, labour, tools etc complete.

7.11. **Health Faucet:** Supplying, installing, testing and commissioning approved make 15mm CP health faucet with CP flexible tube 1.0m long, CP crutch, nozzle & 2 way Bib Cock with wall flange etc complete. The water flow rate is 6 ltrs/Min Jaquar Model No 573 & 041 or equivalent 

7.11.1. **General:** The Health faucets shall be fixed at locations as indicated in drawings.

7.11.2. **Material:** Materials like Health faucet with 2 way bib cock shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Where ever equivalent brand is considered the base price of the individual items shall be considered as equivalent. Water flow rates shall be as specified in the BOQ.

7.11.3. **Installation:** The health faucet shall be fixed to wall tiles nearer to the water closet.

7.11.4. **Measurement:** The health faucet shall be enumerated under relevant item.

7.11.5. **Rate:** The rate includes the cost of all the materials, labour, tools etc complete.

7.12. **Toilet paper holder:** Supplying and fixing approved make C.P. toilet paper holder complete. Jaquar Model No 1151 or equivalent.

7.12.1. **General:** The toilet paper holder are required for Gents and Ladies wash rooms water closets.
7.12.2. **Material**: The paper holder shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge.

7.12.3. **Installation**: The toilet paper holder shall be fixed to wall tiles nearer to the water closet.

7.12.4. **Measurement**: The toilet paper holder shall be enumerated under relevant item.

7.12.5. **Rate**: The rate includes the cost of all the materials, labour, tools etc complete.

7.13. **Towel Rail**: Supplying and fixing of approved make C.P. towel ring including C.P. screws with Fischer plugs etc., complete. (Near Wash Basin) Jaquar Model No 1121 or equivalent.

7.13.1. **General**: The towel rings shall be provided for near Wash basins.

7.13.2. **Material**: The towel ring shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Wherever equivalent brand is considered the base price of the individual items shall be considered as equivalent.

7.13.3. **Installation**: The towel ring shall be fixed to wall tiles nearer to the wash basin.

7.13.4. **Measurement**: The towel ring shall be enumerated under relevant item.

7.13.5. **Rate**: The rate includes the cost of all the materials, labour, tools etc complete.

7.14. **Urinals**: Supplying, installing, testing and commissioning approved make white large flat back urinals of size 370x360x735mm with 40mm C.P. dome type waste coupling 40mm C.P. bottle trap with C.P. extension pipe, 15mm dia solenoid valve unit & Battery operated sensor unit for automatic flushing with necessary electrical etc. C.P spreader unit, GI expansion bolts etc complete. The water flow rate from flush is considered as 1.5 Ltrs/Min. Jaquar Model No 51077 or TOTO Model No VW350HJTI or equivalent.

7.14.1. **General**: The urinals shall be provided at locations indicated in drawings.

7.14.2. **Material**: Urinal (As per IS :2556) set along with the fittings like waste coupling, bottle trap, nipples etc shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Wherever equivalent brand is considered the base price of the
individual items shall be considered as equivalent. Water flow rates shall be as specified in the BOQ.

7.14.3. **Installation:** The Urinals and other fittings shall be installed as per the relevant CPWD specifications of Sanitary installations.

7.14.4. **Measurement:** The Urinals shall be enumerated under relevant item.

7.14.5. **Rate:** The rate includes the cost of all the materials, labour, tools etc complete.

7.15. **Hand Dryer:** Supplying and fixing approved make Automatic Hand drier Sensor operated working on 230V electric supply complete including wiring.

7.15.1. **General:** The hand dryers shall be provided in Gents and ladies wash rooms.

7.15.2. **Material:** Hand dryers (Euronics model No EH07S) shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Wherever equivalent brand is considered the base price of the individual items shall be considered as equivalent.

7.15.3. **Specification:**

(a) Body material: Stainless steel /Fibre

(b) Voltage: 220V/50Hz

(c) RPM: 2500 (Min)

(d) Drying time: 25 Sec (Max)

(e) Time protection: 60Sec (Max)

(f) Sensing range: 20cm (Max)

7.15.4. **Installation:** The dryer shall be installed as per the manufacturers recommendations.

7.15.5. **Measurement:** The Dryer shall be enumerated under relevant item.

7.15.6. **Rate:** The rate includes the cost of all the materials, labour, tools etc complete.

7.16. **Grab Bar:** Fixing of approved make 20 mm dia CP grab bar 1000 mm long with CP end clamps, screws etc., complete.

7.16.1. **General:** The grab bars shall be provided in wash rooms.
7.16.2. **Material:** The material shall be purchased from the approved vendors. The bar shall be solid 20mm dia of 1m length of required shape.

7.16.3. **Installation:** The grab bar shall be installed as per the manufacturers recommendations to the walls.

7.16.4. **Measurement:** The Grab bar shall be enumerated under relevant item.

7.16.5. **Rate:** The rate includes the cost of all the materials, labour, tools etc complete.

7.17. **Sink:** Supplying, installing, testing and commissioning approved make SS kitchen sink with single bowl & drain board made of 18 gauge sheet, 1 No. 40mm dia C.P. waste coupling, 40 mm dia C.P. Bottle trap with C.P. extension pipe, 2 Nos 15mm dia sink pillar cocks. unit wall mounted type, C.I. brackets etc., complete. Size: 900x500. Water flow from pillar cock is considered as 2.75 ltrs/Min. Franke/Future make. pillar cock Jaquar model No 23347 or equivalent.

7.17.1. **General:** The Sink shall be provided in Canteen.

7.17.2. **Material:** The material like SS Sink, pillar cock, bottle traps etc shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Where ever equivalent brand is considered the base price of the individual items shall be considered as equivalent.

7.17.3. **Installation:** The Sink shall be installed as per the relevant CPWD specifications of Sanitary installations.

7.17.4. **Measurement:** The sink shall be enumerated under relevant item.

7.17.5. **Rate:** The rate includes the cost of all the materials, labour, tools etc complete.

7.18. **Bib Cock:** Supplying and Fixing of approved make 15mm long body bib cock with necessary CP wall flanges etc., complete. Jaquar Model No 23107 or equivalent.

7.18.1. **General:** The Bib cocks shall be provided in Wash rooms.

7.18.2. **Material:** The material shall be purchased from the approved vendors as per the Catalogue Nos mentioned and wherever Catalogue Nos are not available, as per the instructions of Engineer in Charge. Where ever equivalent brand is considered the base price of the individual items shall be considered as equivalent.
7.18.3. **Installation**: The bib cock shall be installed as per the relevant CPWD specifications of Sanitary installations.

7.18.4. **Measurement**: The Bib cocks shall be enumerated under relevant item.

7.18.5. **Rate**: The rate includes the cost of all the materials, labour, tools etc complete.

7.19. **Mirror**: Providing and Fixing Mirror with superior glass of approved make with 6mm thick hard board backing with teak wood frame and polished.

7.19.1. **General**: The mirrors shall be provided at Wash Basins.

7.19.2. **Material**: The thickness of the mirror shall be 6mm with hard board backing of 6mm thick. The glass shall be procured from approved Vendors. The size of the mirror shall be as decided by Engineer in Charge.

7.19.3. **Installation**: The mirror shall be installed as per the relevant CPWD specifications of Sanitary installations.

7.19.4. **Measurement**: The mirrors shall be enumerated under relevant item.

7.19.5. **Rate**: The rate includes the cost of all the materials, labour, tools etc complete.

7.20. **UPVC pipes of SWR grade**: Supplying, laying, jointing, testing and commissioning approved make UPVC pipes SWR grade B confirming to IS13592 for kitchen sink, wash basin outlets & anti syphonage pipes. The quoted rate shall include necessary chasing in walls making good the same in C.M. 1:4, necessary fittings viz., elbows, tees etc., including M.S angle with G.I clamps complete.

7.20.1. **General**: The pipes shall be used for drainage purpose.

7.20.2. **Material**: The pipes shall confirm to the IS 13592 type-B

7.20.3. **Installation**: The pipes shall be laid in the walls where ever possible by making chases in the wall. The pipes shall be jointed with rubber ring. The cutting of the walls shall be done by mechanical means.

7.20.4. **Measurement**: The pipes shall be measured in running metres

7.20.5. **Rate**: The rate includes the cost of all the pipes, fittings, clamps, labour etc complete.

7.21. **UPVC pipes of SWR grade**: Supplying, laying, jointing, testing and commissioning approved make UPVC pipes SWR grade B confirming to IS
13592 with rubber ring joints confirming to IS 5382. The quoted rate shall include necessary fittings like Tees, Bends, Offsets etc., including M.S angle with G.I clamps complete.

7.21.1. **General:** The pipes shall be used for drainage purpose.

7.21.2. **Material:** The pipes shall confirm to the IS 13592 type-B.

7.21.3. **Installation:** The pipes shall be laid below the floor and on the walls for drain out lets. The pipes shall be fixed to the walls with necessary clamps fixed to the walls by putting wooden plugs of 50x50x50mm size. The pipes shall be jointed with rubber ring.

7.21.4. **Measurement:** The pipes shall be measured in running metres.

**7.21.5. Rate:** The rate includes the cost of all the pipes, fittings, clamps, labour etc complete.

7.22. **Multi floor traps:** Supplying and fixing approved make UPVC multi inlet floor trap with 75mm dia outlet and C.P. cover on top etc., complete with cement concrete support around the floor trap.

7.22.1. **General:** The floor traps shall be used for drainage purpose.

7.22.2. **Material:** The traps shall confirm to the IS

7.22.3. **Installation:** The traps shall be provided in floors at required levels as the drawing. The traps shall be kept in position by providing PCC all round the trap.

7.22.4. **Measurement:** The traps shall be measured in numbers.

**7.22.5. Rate:** The rate includes the cost of all the materials, fittings, clamps, labour etc complete.

7.23. **UPVC pipes:** Supplying, jointing, testing & Commissioning of approved make UPVC pipe SWR grade “A” confirming to IS: 13592 with rubber ring joints for rain water disposal confirming to IS5382. The quoted rate shall include necessary bends, etc., including M.S angle with G.I clamps complete. 160mm dia

7.23.1. **General:** The pipes shall be used for Rain water down take pipes.

7.23.2. **Material:** The pipes shall confirm to the IS 13592 type-A.

7.23.3. **Installation:** The pipes shall be laid on the walls for draining rain water from roof tops. The pipes shall be fixed to the walls with necessary clamps fixed to the walls by putting wooden plugs of 50x50x50mm size. The pipes shall be jointed with rubber ring.
7.23.4. **Measurement**: The pipes shall be measured in running metres

7.23.5. **Rate**: The rate includes the cost of all the pipes, fittings, clamps, labour etc complete

7.24. **Drilling of Slab**: Providing, Supplying & Drilling/Core Cutting of RCC slabs of thickness up to 200mm, to required dia (up to 150mm) outlets using low vibration mechanical means. Cost to include identification of embedded reinforcement using proformeter, closing of core cut using self sealing non-shrink grouts of approved make either single or double component with necessary form work, staging, tools, etc.

7.24.1. **General**: The drilling shall be carried out for laying pipes through the slab

7.24.2. **Equipment**: Core cutters of low vibrations shall be used for the work.

7.24.3. **Execution**: The drilling work shall be carried out as per the site requirement with low vibration equipment. After laying the pipes the gaps around the pipe shall be filled with self sealing Non shrinkage grouts.

7.24.4. **Measurement**: The Holes shall be measured in Numbers

7.24.5. **Rate**: The rate includes the cost of all the equipment, labour etc complete

7.25. **Over head water tank fittings**: Supplying, fixing and testing inlet, outlet, vent and overflow pipes, fittings with C.I frame with cover to over head tank complete with PVC rungs, etc complete as shown in the drawing. all puddle flanges to be hot dip galvanized. The payment for this item shall be made involving the following items only

7.25.1. **General**: Providing and fixing outlet, inlet, drain out etc fittings for Building over head water tank.

7.25.2. **Material**: The materials shall be as described in the BOQ and other miscellaneous items required for successful commissioning of RCC over head water tank.

7.25.3. **Installation**: The fittings like puddle flanges of various sizes and PVC rings shall be installed in the RCC over head water tank of the building during the concreting period. Man hole covers shall be placed after completion of the works.

7.25.4. **Measurement**: The measurement shall be as indicated in the BOQ.

7.25.5. **Rate**: The rate includes the cost of all the materials, labour, etc complete. The payment shall be made only for the items indicated in BOQ. Any other items which are required for the successful commissioning of the
water tank shall be deemed to be included in the rates. The RCC water
tank shall be measured separately under relevant items.

7.26. **Under ground water tank fittings:** Supplying, fixing and testing inlet, outlet, vent and over flow pipes, fittings with C.I frame with cover to U.G. Sump complete with PVC rungs, etc complete as shown in the drawing. all puddle flanges to be hot dip galvanized. The payment for this item shall be made involving the following items only.

7.26.1. **General:** Providing and fixing out let, inlet, drain out etc fittings for Under Ground water tank.

7.26.2. **Material:** The materials shall be as described in the BOQ and other miscellaneous items required for successful commissioning of Under Ground water tank.

7.26.3. **Installation:** The fittings like puddle flanges of various sizes and PVC rings shall be installed in the RCC Under Ground water tank of the building during the concreting period. Man hole covers shall be placed after completion of the works.

7.26.4. **Measurement:** The measurement shall be as indicated in the BOQ.

7.26.5. **Rate:** The rate includes the cost of all the materials, labour etc complete. The payment shall be made only for the items indicated in BOQ. Any other items which are required for the successful commissioning of the U.G. water tank shall be deemed to be included in the rates. The RCC U.G.water tank shall be measured separately under relevant items.

7.27. Supplying, installing, testing and commissioning approved make Submersible pump made of C.I Construction suitable for building application. The quoted rate shall also include for providing necessary safety devices viz. dry run protection, over load relays etc., complete working on 230V, 50Hz, 1Ph, with starter, The rate includes all the necessary fittings. The procurement shall be taken up on approval by E.I.C. Duty of pump: 2.0LPS @45M head (From sump to Building OHWT).

7.27.1. **General:** These pumps are required for pumping water from Under Ground water tank to RHQ Bldg tank.

7.27.2. **Material:** The pumps shall be procured from the approved Vendors based on the parameters given in the BOQ. Agency shall submit a detailed description of the pumps for the approval of E.I.C before procurement.

7.27.3. **Installation:** The pumps shall be installed as per the manufacturers recommendations.
7.27.4. **Measurement**: The measurement shall be in Nos.

7.27.5. **Rate**: The rate includes the cost of pumps, panel boards, necessary inlet and out piping, connections etc and installation and commissioning.

7.28. Supplying, installing, testing and commissioning approved make Submersible pump made of C.I Construction suitable for building application. The quoted rate shall also include for providing necessary safety devices viz. dry run protection, over load relays etc., complete working on 230V, 50Hz, 1Ph, with starter, The procurement shall be taken, up on approval by E.I.C. Duty of pump: 1.0 LPS @ 15.0M head( From pump room sump to out side drain)

- **General**: These pumps are required for pumping water from pump room sump to out side
- **Material**: The pumps shall be procured from the approved Vendors based on the parameters given in the BOQ. Agency shall submit a detailed description of the pumps for the approval of E.I.C before procurement.
- **Installation**: The pumps shall be installed as per the manufacturers recommendations
- **Measurement**: The measurement shall be in Nos
- **Rate**: The rate includes the cost of pumps, panel boards, necessary inlet and out piping connections etc and installation and commissioning.

7.29. Supplying, installing, testing and commissioning approved make centrifugal monobloc pumps for Filter feed water inside the Pump room. The quoted rate shall include Automatic control panel with level switches, starters, dry run preventer, O/L relays, necessary wiring up to the pumps and control panel, the pumps shall run 415V 50Hz electric supply, foot valve, NRV of Dia 40 mm etc, complete. The procurement shall be taken , up on approval of pumps by E.I.C . Duty of pump: 2 LPS @ 30.0M head.

- **General**: These pumps are required for pumping water to filter beds etc.
- **Material**: The pumps shall be procured from the approved Vendors based on the parameters given in the BOQ. Agency shall submit a detailed description of the pumps for the approval of E.I.C before procurement.
- **Installation**: The pumps shall be installed as per the manufacturers recommendations on the RCC pedestals,
Measurement: The measurement shall be in Nos

Rate: The rate includes the cost of pumps, panel boards, foot values inlet and outlet GI pipe connections, NRV etc. and installation and commissioning excluding the cost of RCC pedestals which shall be paid separately.

7.30. Supplying, installing, testing and commissioning approved make centrifugal monobloc pumps for Filter feed water inside the Pump room. The quoted rate shall include Automatic control panel with level switches, starters, dry run preventor, O/L relays, necessary wiring up to the pumps and control panel, the pumps shall run 415V 50Hz electric supply, foot valve, NRV of Dia 40 mm etc., complete. 1no. working+1no.standby. The procurement shall be taken up on approval of pumps by E.I.C. Duty of Pump = 1.5 LPS @ 30M head.

- General: These pumps are required for pumping water to filter beds etc.
- Material: The pumps shall be procured from the approved Vendors based on the parameters given in the BOQ. Agency shall submit a detailed description of the pumps for the approval of E.I.C. before procurement.
- Installation: The pumps shall be installed as per the manufacturers recommendations on the RCC pedestals,
- Measurement: The measurement shall be in Nos
- Rate: The rate includes the cost of pumps, panel boards, foot values inlet and outlet GI pipe connections, NRV etc. and installation and commissioning excluding the cost of RCC pedestals which shall be paid separately.

7.31. Providing, installing, testing and commissioning of approved make Conductive type level sensor with SS 316 probes MS 2-1/2" table E std flange and weather proof cast aluminium enclosure to sense two levels of the underground sump and the overhead water storage tank.

- General: These water level indicators are required for Under Ground and Over head water tanks. The Contractor shall submit a detailed proposal meeting the technical requirements for approval of Engineer In charge before placement of order.
- Material: The material consists of Level sensor Stainless steel probes, necessary indication panel with electrical fittings.
- Installation: The sensors and electrical panels shall be installed as per the manufacturers recommendations.
7.32. Supply & laying of 4 core 1.5sqmm copper armoured cable from UG sump sensors to level control instruments laid in a 32mm dia. PVC 6Kg/sqcm pipes.

- **General**: The cable is required for sensors.
- **Material**: The cable and PVC casing pipes shall be procured from approved Vendors.
- **Installation**: The cables shall be laid through the PVC pipes below floorings/on the eall.
- **Measurement**: The measurement shall be in Metres
- **Rate**: The rate includes the cost of the cable, PVC pipe and laying charges including terminations.

7.33. Supplying and fixing of digital percentage level indicator for the storage tanks consisting of display unit and level sensor. The display unit should have 2-1/2 digit seven segment LED to display the levels as 0%, 10% to 100%. The unit should be weather proof and wall / panel mounted input to the unit should be 230V AC. The level sensor should consists of float operated magnetic float switch with one PUF float suitable mounting flange and flame proof enclosure. Quoted rate shall include necessary conduits and cabling.

- **General**: level indicators are required for water tanks of RHQ building. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups meeting the technical requirements for approval of Engineer In charge before placement of order.
- **Material**: All the required materials shall be procured from approved Vendors
- **Installation**: The installation shall be carried out as per the manufacturers recommendations.
- **Measurement**: The measurement shall be in Nos
- **Rate**: The rate includes the cost of all the materials, installation and commissioning charges
Supply, Installation and commissioning of water purifier of RO system of 125 Ltrs/Hour capacity, Indion Chemical dosing systems is a state of the art electronic metering pump, which are mounted on a plastic chemical solution tank. The electronic metering pumps are solenoid driven diaphragm type. The diaphragm is made of high quality fabric reinforced EPDM. The liquid side is coated with Teflon. The body is made up of FRP suitable for most applications in water treatment.

**General:** The RO unit has been designed for a product flow rate of 125 LPH. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups meeting the technical requirements for approval of Engineer In charge before placement of order.

- **Specification:** The treated water shall confirm to the following:
  - Dissolved solids less than 100 PPM
  - PH value 7 to 7.5

- **Operating data for RO plant:**
  - No of stream = One
  - Mode of operation = Semi Auto
  - Recovery = 20%
  - Operating hours = 10 Hrs

- **Scope of the supply**
  - Raw water pump make CRI / Kirloskar — 1 No
  - Dual media filter unit with manually operated multiport valves and piping.— 1 No, FRP
  - Micron cartridge filter
  - High pressure pump make CRI / Kirloskar — 1 No (Stainless steel)
  - R.O. System . R.O membranes
  - RO pressure tubes
  - RO skid—1 No, MS powder coatd
  - RO Control panel—1 No, MS powder coated.
  - Pressure gauges—-2 Nos
- Rotameter --------- 2 Nos
- TDS meter --------- 1 No
- Any other requirements as per Manufacturers Catalogues, recommendations.

- **Installation**: The installation shall be carried out as per the manufacturers recommendations.

- **Measurement**: The measurement shall be in Nos.

- **Rate**: The rate includes the cost of all the materials, installation and commissioning charges excluding any concrete works, incoming supply, laboratory tests for water.

3.35 Suppling, installing, testing and commissioning approved make Raw Water Pressure sand filter with necessary Accessories complete with Frontal piping, valves, suitable supports for mounting pressure gauges, orifice plates. The Filter shall be made of FRP with necessary protective coating. The cost of filter shall also include initial charge of under bed & multi-grade filter media to suit the requirement etc., complete as per standards and Drawings.. Max. working Pressure = 3.0kg/sqcm. Max flow rate is 6.0 Cum /Hour.

3.35.1 General: The sand filter beds are considered for a working pressure of 3.0 Kg/Sqcm with a max flow rate of 6 Cum/Hr. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups meeting the technical requirements for approval of Engineer In charge before placement of order.

3.35.2 Specification:

3.35.2.1 Operating flow = 6.0 Cum/Hour
3.35.2.2 Operating pressure = 3.0 Kgs/Sqcm
3.35.2.3 Body material = FRP
3.35.2.4 Filter media = Sand media of different grades.
3.35.2.5 Any other requirements as per Manufacturers Catalogues, recommendations.

3.35.3 **Installation**: The installation shall be carried out as per the manufacturers recommendations.

3.35.4 **Measurement**: The measurement shall be in Nos.
3.35.5 Rate: The rate includes the cost of all the materials, filter media, frontal piping, valves, pressure gauzes etc and installation and commissioning charges.

3.36 Supplying, installing, testing and commissioning approved make activated carbon filter in FRP vessel construction with internals, electrical control system complete with Frontal piping, valves, suitable supports for mounting, pressure gauge, orifice plate etc..., complete as per the detailed specification for the efficient working of system as per standards and drawings. The maximum working Pressure shall be 3.5 Kg/Sqcm. Max flow rate = 6.0cum/hr.

3.36.1 General: The activated carbon filter beds are considered for a working pressure of 3.5 Kg/Sqcm with a max flow rate of 6.0 Cum/Hr. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups meeting the technical requirements for approval of Engineer In charge before placement of order.

3.36.2 Specification:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.36.2.1</td>
<td>Operating flow = 6.0 Cum/Hour</td>
</tr>
<tr>
<td>3.36.2.2</td>
<td>Operating pressure = 3.5 Kgs/Sqcm</td>
</tr>
<tr>
<td>3.36.2.3</td>
<td>Body material = FRP</td>
</tr>
<tr>
<td>3.36.2.4</td>
<td>Filter media = Carbon media.</td>
</tr>
<tr>
<td>3.36.2.5</td>
<td>Any other requirements as per Manufacturers Catelogues, recommendations.</td>
</tr>
</tbody>
</table>

3.36.3 Installation: The installation shall be carried out as per the manufacturers recommendations.

3.36.4 Measurement: The measurement shall be in Nos.

3.36.5 Rate: The rate includes the cost of all the materials, electrical control system filter media, frontal piping, valves, pressure gauzes etc and installation and commissioning charges.

3.37 Supplying, installing, testing and commissioning approved make Raw Water Pressure sand filter with necessary Accessories complete with Frontal piping, valves, suitable supports for mounting pressure gauges, orifice plates. The Filter shall be made of FRP with necessary protective coating. The cost of filter shall also include initial charge of underbed& multi-grade filter media to suit the requirement etc., complete as per standards and drawings. Max. working Pressure = 3.0kg/sqcm. MAx flow rate 6.0 Cum/Hour
3.37.1 **General:** The sand filter beds are considered for a working pressure of 3.0 Kg/Sqcm with a max flow rate of 6.0 Cum/Hr. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups meeting the technical requirements for approval of Engineer In charge before placement of order.

3.37.2 **Specification:**

- **3.37.2.1 Operating flow** = 6.0 Cum/Hour
- **3.37.2.2 Operating pressure** = 3.0 Kgs/Sqcm.
- **3.37.2.3 Body material** = FRP
- **3.37.2.4 Filter media** = Sand media of different grades.
- **3.37.2.5 Any other requirements** as per Manufacturers Catalogues, recommendations.

3.37.3 **Installation:** The installation shall be carried out as per the manufacturers recommendations.

3.37.4 **Measurement:** The measurement shall be in Nos.

3.37.5 **Rate:** The rate includes the cost of all the materials, filter media, frontal piping, valves, pressure gauzes etc and installation and commissioning charges.

3.38 **Supplying, installing, testing and commissioning approved make Water Softener with necessary Accessories complete with Frontal piping, valves, suitable supports for mounting pressure gauges, orifice plates. The Softener shall be made of FRP with necessary protective coating. The cost of Softener shall also include initial charge of Resin media to suit the requirement as per standards and drawings etc., complete as per standards. Working pressure =3.0 Kgs/Sqcm. Max flow rate= 6.0 Cum/Hour

3.38.1 **General:** The water softener is considered for a working pressure of 3.0 Kg/Sqcm with a max flow rate of 6.0 Cum/Hr. The Contractor shall submit a detailed proposal meeting the technical requirements for approval of Engineer In charge before placement of order. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups meeting the technical requirements for approval of Engineer In charge before placement of order.

3.38.2 **Specification:**

- **3.38.2.1 Operating flow** = 6.0 Cum/Hour
- **3.38.2.2 Operating pressure** = 3.0 Kgs/Sqcm.
3.38.2.3 Body material = FRP
3.38.2.4 Filter media = Resin Media
3.38.2.5 Out put hardness = Less than 5 PPM
3.38.2.6 Any other requirements as per Manufacturers Catalogues, recommendations.

3.38.3 Installation: The installation shall be carried out as per the manufacturers recommendations.

3.38.4 Measurement: The measurement shall be in Nos.

3.38.5 Rate: The rate includes the cost of all the materials, Resign filter media, frontal piping, valves, pressure gauzes etc and installation and commissioning charges.

3.39 Supply, installing, testing and commissioning of approved make Electronic dosing system for dosing Chlorine in to the water with pre set dosage based on the quantity of water. The Chlorine dosing shall consist of Electronic dosing pump with positive displacement type with adjustable stroke length and frequency. The quoted rate shall also include FRP chemical solution tank necessary electrical complete to make the operation automatic. Max flow rate = 6.0 Cum/Hour.

3.39.1 General: The Dosing system is considered for a flow rate of 6.0 Cum/Hr. The Contractor shall submit a detailed proposal with drawings, catalogues, write-ups meeting the technical requirements for approval of Engineer In charge before placement of order.

3.39.2 Specification:
   3.39.2.1 Operating flow = 5.0 Cum/Hour
   3.39.2.2 Capacity of tank = 100 Ltrs
   3.39.2.3 Body material = FRP/HDPE
   3.39.2.4 Quantity dosing pump = 1 No (Electronic diaphragm type)
   3.39.2.5 Any other requirements as per Manufacturers Catalogues, recommendations.

3.39.3 Installation: The installation shall be carried out as per the manufacturers recommendations.

3.39.4 Measurement: The measurement shall be in Nos.
3.39.5 Rate: The rate includes the cost of all the materials, frontal piping, valves, pressure gauzes etc and installation and commissioning charges.

Technical Specifications for Solar Lighting System for Common Areas

PV MODULES:
1.1 The PV modules must conform to the latest edition of any of the following IEC / equivalent BIS Standards for PV module design qualification and type approval:
   - Crystalline Silicon Terrestrial PV Modules IEC 61215 / IS14286
   - Thin Film Terrestrial PV Modules IEC 61646 / Equivalent IS(Under Dev.)
   - Concentrator PV Modules & Assemblies IEC 62108

1.2 In addition, the modules must conform to IEC 61730 Part 1 - requirements for construction & Part 2 - requirements for testing, for safety qualification or Equivalent IS (Under Dev.)

1.3 PV modules to be used in a highly corrosive atmosphere (coastal areas, etc.) must qualify Salt Mist Corrosion Testing as per IEC 61701 / IS 61701.

1.4 IDENTIFICATION AND TRACEABILITY
Each PV module must use a RF identification tag (RFID), which must contain the following information:
   (i) Name of the manufacturer of PV Module
   (ii) Name of the Manufacturer of Solar cells
   (iii) Month and year of the manufacture (separately for solar cells and module)
   (iv) Country of origin (separately for solar cells and module)
   (v) I-V curve for the module
   (vi) Peak Wattage, Im, Vm and FF for the module
   (vii) Unique Serial No and Model No of the module
   (viii) Date and year of obtaining IEC PV module qualification certificate
   (ix) Name of the test lab issuing IEC certificate
   (x) Other relevant information on traceability of solar cells and module as per ISO 9000 series.

Until March 2013, the RFID can be inside or outside the module laminate, but must be able to withstand harsh environmental conditions. However from 1st April 2013 onwards; RFID shall be mandatorily placed inside the module laminate

1.5 VALIDITY
The validity of the existing Certificates/Reports in the old format/procedure shall be valid till March 2013 only. Manufactures are advised to get their samples tested as per the new format/procedure before 31st March 2013, whose validity shall be for five years.

1.6 AUTHORIZED TESTING LABORATORIES/ CENTERS
PV modules must qualify (enclose test reports/ certificate from IEC/NABL accredited laboratory) as per relevant IEC standard. Additionally the performance of PV modules at STC conditions must be tested and approved by one of the IEC / NABL Accredited Testing Laboratories including Solar Energy Centre. For small capacity PV modules upto 50Wp capacity STC performance as above will be sufficient. However, qualification certificate from IEC/NABL
accredited laboratory as per relevant standard for any of the higher wattage regular module should be accompanied with the STC report/ certificate.

1.6.1 Details of Test Labs are given in Annexure I.

1.7 DESIGN – Solar PV panel system design shall be submitted, in the form of schematic diagram, shop drawings and installation and maintenance schedule. These shall be approved by Engineer-in Charge before confirmation.

1.8 WARRANTY
PV modules used in solar power plants/ systems must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years.

2. BALANCE OF SYSTEM (BOS) ITEMS/ COMPONENTS:
2.1 The BOS items / components of the SPV power plants/ systems deployed under the Mission must conform to the latest edition of IEC/ E equivalent BIS Standards/ MNRE specifications / as specified below:

<table>
<thead>
<tr>
<th>BOS Item / System</th>
<th>Applicable BIS / Equivalent IEC Standard Or MNRE Specifications</th>
<th>Standard Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV Lighting Systems:</td>
<td>Solar PV Home Lighting System</td>
<td>As per MNRE latest Specifications dated 09.09.2011</td>
</tr>
<tr>
<td></td>
<td>Solar PV street Lighting System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solar PV Lantern</td>
<td></td>
</tr>
<tr>
<td>Charge Controller/MPPT units</td>
<td>Environmental Testing</td>
<td>IEC 60068-2 (1,2,14,30) / Equivalent BIS Std.</td>
</tr>
<tr>
<td>Power Conditioners/ Inverters**</td>
<td>Efficiency Measurements</td>
<td>IEC 61683 / IS 61683</td>
</tr>
<tr>
<td>(including MPPT and Protections)</td>
<td>Environmental Testing</td>
<td>IEC 60068-2 (1, 2, 14, 30) / Equivalent BIS Std.</td>
</tr>
<tr>
<td>Storage Batteries</td>
<td>General Requirements &amp; Methods of Testing Tubular Lead Acid / VRLA / GEL Capacity Test Charge/Discharge Efficiency Self-Discharge</td>
<td>As per relevant BIS Std.</td>
</tr>
<tr>
<td>Cables</td>
<td>General Test and Measuring Method PVC insulated cables for working voltage up to and including 1100 V and UV resistant for outdoor installation</td>
<td>IEC 60227 / IS 694 IEC 60502 / IS 1554 (Pt. I &amp; II)</td>
</tr>
<tr>
<td>Junction Boxes Enclosures for Inverters/Charge</td>
<td>General Requirements</td>
<td>IP 54(for outdoor)/ IP 21(for indoor) as per IEC 529</td>
</tr>
</tbody>
</table>
AUTHORIZED TESTING LABORATORIES/ CENTERS
Test certificates / reports for the BoS items/ components can be from any of the NABL/ IEC Accredited Testing Laboratories or MNRE approved test centers. The list of MNRE approved test centers will be reviewed and updated from time to time.

WARRANTY
The mechanical structures, electrical works including power conditioners /inverters /charge controllers / maximum power point tracker units/distribution boards/digital meters/ switchgear/ storage batteries, etc. and overall workmanship of the SPV power plants/ systems must be warranted against any manufacturing/ design/ installation defects for a minimum period of 5 years.

VENDORS: Only MNRE Approved Vendors will be considered.
### SOLAR WATER HEATER.

#### 3.40.1 Supplying, Installing, Testing and Commissioning of Solar water heater of 500 Lts capacity complete include in solar collector panels, ss Storage drum made of S.S with insulation and cladding and back up electrical heating element, frontal piping, etc.
8.0. GENERAL

8.1. Double pipe scaffolding shall be used for all the works and as per industry best practices.

8.2. Where equivalent is indicated, it shall mean material with equivalent quality with the vendors indicated. In case it is not possible to identify similar materials with other vendors, the material shall be selected based on equivalent cost with in identified Vendors as per manufacturers price catalogs.

8.3. Drawings.

8.3.1. Tender drawings developed by the consultant / owner are enclosed with the tender documents. These are indicative. Upon placement of award, 2 sets of the drawings, with a “RELEASED FOR CONSTRUCTION” stamp, shall be issued by the Owner to the Contractor matching with the requirement at Site. The Contractor shall execute the work at Site as per these drawings only.

8.3.2. The Drawings shall be made available to the Contractor sequentially as per the agreed work schedule.

8.4. Approved Vendors: List of approved vendors is enclosed to the specification.

8.5. Field Quality Program:

8.5.1. The work shall be executed as per the Standard Field Quality Document No. CC/QA/I/SFPQ/SS/04/980622/REV-0 pertaining to building civil works along with the other quality plans indicated in the Technical specifications. All tests on materials and finished products as required in field quality plan shall be carried out by the Contractor at his own cost. The following guide lines shall govern for carrying various lab tests:

8.5.2. The material testing shall be carried out in any of the following NABL accredited laboratories:

8.5.2.1. Civil Aid TechnoclinicPvt Ltd, Bangalore.

8.5.2.2. Karnataka Test House Pvt Ltd, Bangalore

8.5.2.3. StructGeotech Research Laboratory, Bangalore.

8.5.3. In case Testing facilities are not available for any specified test given in FQP/Tech Spec/BOQ item Description in these laboratories, the same shall be carried out in any other laboratory where such facilities are available with the specific approval of Engineer in Charge.

8.5.4. The contractor shall arrange at his own cost, packing, forwarding and other incidentals for conducting the tests.
8.5.5. All test reports shall be submitted to HPCL within 7 days from the date of dispatch of test specimens to the laboratory.

8.6. The Contractor shall bring samples of all materials; finished or raw to the site and shall get them approved from the Engineer-in-Charge before using them in the work. Any material not conforming to approved samples shall be removed within 48 hours of the Engineer-in-Charge’s instruction to the Contractor to do so, failing which it shall be removed by the Engineer-in-Charge or his representative from the site at the risk and cost of the Contractor.

8.7. Samples of materials to be used with original/colour catalogue with specification shall be brought by contractor well in advance and shall be displayed and kept in separate sample room in site. Samples of all kinds of materials to be used shall require approval of the Owner.

8.8. Materials shall be of approved quality and the best of their kind available and shall generally conform to I.S. Specifications. The Contractor shall order all the materials required for the execution of work as early as necessary and ensure that such materials are on site well ahead of requirement for use in the work. The work involved calls for high standard of workmanship combined with speed and to the entire satisfaction of the Engineer in Charge.

8.9. Before placement of award for supply & installation of equipments, materials. the contractor shall submit a proposal furnishing all the catalogs & specifications for approval of the Engineer in charge, well in advance.

****

<p>| LIST OF APPROVED MANUFACTURERS AND BRANDS FOR BOUGHTOUT ITEMS FOR PHE WORKS |
|------------------|------------------|</p>
<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description of Item</th>
<th>Standard make / brand names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wash basin</td>
<td>Hind ware, Parryware, jaquar</td>
</tr>
<tr>
<td>2</td>
<td>Indian type water closets</td>
<td>Hind ware, Parryware, jaquar</td>
</tr>
<tr>
<td>3</td>
<td>European type water closets</td>
<td>Hind ware, Parryware, jaquar</td>
</tr>
<tr>
<td>4</td>
<td>Flushing cisterns</td>
<td>Hind ware, Parryware, Jaquar</td>
</tr>
<tr>
<td></td>
<td>Item Description</td>
<td>Supplier(s)</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Urinals</td>
<td>Hind ware, Parryware, Jaquar</td>
</tr>
<tr>
<td>6</td>
<td>Pillar cock, health faucets, angle cocks, bib cocks, Toilet paper holders, Towel rings and other fixtures</td>
<td>Jaguar, Kohler</td>
</tr>
<tr>
<td>7</td>
<td>Valves</td>
<td>Leader, HAWA, Globe, Zoloto</td>
</tr>
<tr>
<td>8</td>
<td>Stainless Steel kitchen Sink</td>
<td>Franke, Futura</td>
</tr>
<tr>
<td>9</td>
<td>Automatic hand dryer</td>
<td>Euronics Industries, Bangalore, Kimberly clark/approved equivalent</td>
</tr>
<tr>
<td>10</td>
<td>UPVC pipes,</td>
<td>Finolex, Supreme, Prince, Kissan</td>
</tr>
<tr>
<td>11</td>
<td>CPVC pipes</td>
<td>Ashirwad Flow Guard, Prince, Astral</td>
</tr>
<tr>
<td>12</td>
<td>Cast Iron Manhole covers</td>
<td>Bengal Iron Corpn (BIS), NECO, Zenith</td>
</tr>
<tr>
<td>13</td>
<td>Pumps</td>
<td>Kirloskar, Suguna, Texmo/approved equivalent</td>
</tr>
<tr>
<td>14</td>
<td>Water treatment items like Sand filters, Activated carbon filters, RO system, Water softner, Chlorine dosing system etc</td>
<td>ION EXCHANGE , DOSI ION/approved equivalent</td>
</tr>
<tr>
<td>15</td>
<td>Solar Water System</td>
<td>TATA BP Solar, Racold</td>
</tr>
<tr>
<td>16</td>
<td>Solar PV panels</td>
<td>TATA BP Solar, Racold</td>
</tr>
</tbody>
</table>

Note: The Contractor shall submit detailed technical proposals for approval of Engineer in Charge before placement of order.
### TECHNICAL SPECIFICATIONS

**FIRE FIGHTING AND SPRINKLER WORKS**

**General Technical Specifications for Fire Hydrant and Sprinkler Works**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particulars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Technical Specifications for Fire Hydrant System.</td>
</tr>
<tr>
<td>2</td>
<td>Automatic Sprinkler System.</td>
</tr>
<tr>
<td>3</td>
<td>Technical Specifications for 415 Volts Fire Pump Panel.</td>
</tr>
<tr>
<td>4</td>
<td>Technical Specifications for Starters</td>
</tr>
<tr>
<td>5</td>
<td>Technical Specifications for Switchboard</td>
</tr>
<tr>
<td>6</td>
<td>Technical Specifications for Medium Voltage Cables</td>
</tr>
<tr>
<td>7</td>
<td>Extinguishers &amp; Signage.</td>
</tr>
</tbody>
</table>

**Annexure – I**

Technical Data Sheets

**Annexure – II**

Approved Brands of Materials

### TECHNICAL SPECIFICATIONS FOR FIRE HYDRANT SYSTEM

**1.0 Scope of Work:**

Following are the different items of works which have to be designed, supplied, erected, tested and commissioned along with getting entire system approved from Local Fire Authority.

**1.1** Automatic Fire Hydrant System consisting of Diesel Engine (Main pump), Electrical Pump and Jockey Pumps, Sprinkler Pump, G.I. Piping with fittings, M.S Valves, Yard Hydrant Hose Cabinets and Hose Reels, Sprinklers.
1.2 First Aid Fire Extinguishers System consisting of Carbon dioxide, Dry Chemical Powder Extinguisher and Fire Buckets.

2.0 **Regulation and Standards:**

The installation shall conform in all respects to the following broad list of standard in General and in particular the materials used shall bear prevailing ISI marking:

- **a** IS:901-1975 : Specification for coupling, double male female, instantaneous pattern for fire Lighting.
- **c** MSS SP 67 : Butterfly Valves.
- **d** API 609 : Butterfly valves, lug type and wafer type.
- **e** IS:1536-1976 : Centrifugal cast (spun) cast iron pressure pipe for water, gas and sewage.
- **f** IS:1239 : Mild steel tube, tubular and other wrought steel fittings.
- **g** IS 1538-78 : Cast Iron fittings for pressure pipes for water, gas and sewage.
- **h** IS: 8423-1977 : Controls per collating hose for fire fighting
- **i** IS:5290-1983 :
- **k** ADI:610 : Centrifugal pump for general refinery service
- **l** IS:1648-1966 : Code of practice for fire of Building (General), Lighting equipment, its maintenance.
- **n** IS:2871-1983 : Branch pipe, universal for fire fighting proposes.
- **o** IS:884-1969 : First Aid hose reel for fire fighting.
- **p** IS:5132-1968 : Hose reel tubing for fire protection system.
Cast iron and carbon steel butterfly valves for general purpose.

Code of practice for selection, installation and maintenance of portable fire extinguishers.

Specification for coupling branch pipe, nozzle used in hose reel tubing for fire fighting.

Specification for basket strainer for fire fighting purpose.

Specification for automatic sprinkler heads.

Specification for fire hydrant, stand post type.

Specification for first aid hose reel for fire fighting.


**3.0 Drawings:-**

The drawings enclosed herewith are for the general guidance to the Tenderers. The Contractor shall upon the award of the work, furnish detailed shop drawings necessary to carryout the work at site within 15 day. These shall be submitted for approval to the Architects/Employer. The work shall be commenced only after the approval of drawing by the Architects/Employer and obtaining the approval from Local Fire Authority.

**3.1 Drawing/Information Required From Successful Tenderer within 15 Days after Award of Work:-**

b. Performance curve for the pump.
c. Necessary civil scope drawing for the system.
d. Bar chart showing engineering, manufacturing and dispatch of equipment and erection services.
e. Drawing, literature and technical particulars of all bought out items.
f. Control logic diagram for the pump to start.
g. Schedule for valves and piping material.
4.0 **Inspection and Approval:-**

The contractor shall arrange all necessary inspection by the Local Fire Authority/Tariff Advisory Committee. He shall also arrange for all the tests, obtain and deliver to the Employer any approval required as per the local by–laws and Local Fire Authority. It is the sole responsibility of the contractor to prepare and submit the drawings to Local Fire Authority and do all liaisons works with Local Fire Authority in getting the complete installation approved by them.

5.0 **Painting:-**

All piping equipment, furnished under this specification shall be properly painted with two coats of synthetic enamel paint after installation and shall meet the requirements as outlined in Fire Protection Manual. Paint used for this work will be lead free quality. The cost of painting deems to be inclusive in the respective items.

6.0 **Guarantee:-**

The contractor shall guarantee that the material and workmanship of the entire system are of first class quality and shall correspond to standard Engineering Practice. All the equipment/apparatus shall be guaranteed to yield the specified rating and design capacities speeds. Any defective equipment/material/workmanship found short of the specified quality shall be rejected. Contractor shall make good the rejected items at his own cost. Guarantee certificate of equipment from suppliers/manufacturers shall be handed over to the Employer.

7.0 **Defects and Liability:-**

All the equipment/material and the system shall be guaranteed against defective material and workmanship for a period of 12 months from the date of commissioning and handling over the Employer along with all relevant documentation. The contractor shall repair/rectify or replaces all the defective materials, components free of cost. In addition, normal maintenance shall be carried out during Defect Liability period of 12 months.

8.0 **Instruction Manual/Completion Drawings/Training:-**

The contractor shall furnish detailed instruction and operation manual in quadruplicate. The contractor shall also furnish detailed completion drawings on tracing sheet drawn to an approved scale. The drawings shall be inclusive of control schematic, if any. The contractor shall train the Employer’s personnel in the operation and maintenance of the system for one month.

9.0 **Testing:-**
The contractor shall arrange to test the entire system as per the procedure enumerated under Particular specification after the erection is completed. The test shall be carried out to the Satisfaction of Architects/Employer. The results of the tests shall be submitted to the Employer. If the results of the tests are not found to be satisfactory by the Architects/Engineer in-charge, necessary rectification shall be done until the test results are found to be satisfactory. The installation shall be deemed to be completed only after the successful completion of the test.

10.0 **Technical Data:-**
The Tenderers shall furnish data of their equipment as per the proforma under ‘Technical Data’. The tenders without technical data are liable to be rejected.

10.1 **Data :-**

a Type : wet riser system.

b No. of Fire Pumps : 1 Jockey pump, 1 Electrical Pump, 1 Diesel Pump & 1 Sprinkler Pump.

c Static Water Storage : 1,00,000 Ltrs Storage Sump.

11.0 **Piping :-**

Above ground piping and under ground piping shall be mild steel tubes of heavy grade unless and until specified conforming to IS-1239 Part-1. Mild steel pipes shall be provided with welded joints only unless flanges are warranted. All fittings shall be medium grade wrought or mild steel conforming to A 234 Gr. WPB Sch. 40 (IS-1239 Part II). The flanges shall be drilled as per relevant Indian Standards.

Flanges shall be faced and shall have jointing of rubber insertion of Neoprene Gasket. In case of Tyton pipes, using rubber gaskets as per manufacturer specification shall make the joint. The joints shall be supported of withstanding a pressure of 10.5 KSC. All the above ground piping shall be supported by angle iron brackets on walls or suspended by hangers from ceiling or concrete pedestals at some places. Piping over ground shall be painted with two coats of approved enamel over a coat of primer after the installation and testing.

11.1 **Anticorrosive Treatment for Underground Piping :-**
G.I. pipe laid outdoor in trenches/buried in earth shall be wrapped with pipe coat membrane consisting of seven layers of polyethylene polymerized bitumen and polyester mat laid over a suitable primer of fiber and solvent based rubber modified bituminous primer of density 0.9 Gms/cum applied at the rate of approx. 200-250 gam/Smt. Material to be laid strictly as per manufacturer’s specification and laid under technical assistance of manufacturer’s representative.

Pipes passing through masonry walls, foundation, beams shall be taken through embedded pipe sleeve of same material. The pipes sleeve size to be at least 1½ times the diameter of the crossing pipeline. The pipeline running below floor shall be given anticorrosive treatment same as for underground piping.

11.2 Butterfly Valves:-

Butterfly Valves shall conform the following specification:

<table>
<thead>
<tr>
<th>Part</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>High duty cast iron to IS-210 Gr. FG220 and BS 1452 Gr. 220.</td>
</tr>
<tr>
<td>Seating</td>
<td>Mouldedinsitu resilient lining of black nitrite rubber.</td>
</tr>
<tr>
<td>Disk</td>
<td>Nylon coated S.G. Iron to IS 1865/SG 400/12 and BS 2729 Gr. 420/12.</td>
</tr>
<tr>
<td>Shaft</td>
<td>The shafts are made of stainless steel AISI 431.</td>
</tr>
</tbody>
</table>

Only flanged End valves to be used with flanges drilled to BS 10 Table F. Valves shall be capable of being locked in open position. Hand Wheel shall be with vertical gear unit for smooth opening and Closing of the valve. Key rods with M.S. coated extended Spindles to be provided whenever the valves are not approachable from the ground surface.

11.3 Non-return Valves:-

Non-return valve shall be of cast iron with gum metal seat, non-return valves shall be of flanged type. Spring-loaded valves shall not be used. The valves shall be suitable for a test pressure of 21 Kgs/Cm2.

11.4 Hydrant Valves (Landing Valves):-

Landing valves shall be gunmetal 63-mm dia oblique female instantaneous pattern with caps and chains. Landing valves shall conform to IS-5290 in all respects. Double-headed landing valves shall have separate control valves. Landing valves shall be of gum metal
and fitted with instantaneous coupling conforming to IS-901. The coupling shall be fitted with an internal plug secured by a chain. Landing valves shall be installed on hydrant risers at a height of 1.0 to 1.2 Mtrs from the floor level. The landing valves shall be connected to the wet riser standpipes by means of a suitable tee, the cost of which is deemed to be included in the unit rate for piping.

11.5 Hose Pipes :-

All hose shall be of 63 mm diameter made of RRL as per IS-636.

11.6 Branch Piping and Nozzle :-

Branch pipes shall be of gunmetal to fit into the instantaneous coupling. Nozzle shall be of spray or fog type of diameter of not less than 16 mm and not more than 25 mm. Branch pipe and nozzle shall be of instantaneous pattern.

11.7 Sprinklers :-

The automatic sprinklers shall be installed in the basement and parking. The sprinklers shall be quartz bulb type only and operating at 68 deg. C.

The sprinklers shall be connected through a 38mm GI pipe of medium class and feeder pipe shall be of 80 mm dia connected to wet riser/down comer.

The contractor shall give required tools for removing and fixing of different types of sprinklers free of cost as directed by Engineer –in-charge.

11.8 Air Valve

The contractor shall provide 25 mm dia screwed inlet cast iron single acting air valves on all high points in the system.

11.9 Drain Valve

The contractor shall provide 50mm dia M.S pipe to I.S:1239 heavy class with 50mm gunmetal full way valve for draining any water in the system in low pockets as directed by Engineer-In-Charge.

11.10 Hose Cabinet :-
Hose cabinet shall be glass (4 mm thick) fronted with double hinged door and
lock. The cabinet shall be made of 16 SWG M.S sheet and spray painted to
scarlet red colour with word “fire”. The hose cabinet shall be of suitable size to
accommodate the following:

a. Landing valves (Single Headed)

b. 63 mm hose pipe (2 lengths of 15 Mtrs each)

c. Branch pipe and nozzles (one set)

d. Two keys of break glass recess for keys.

11.11 Fire Pump :-

a. Pumping Sets :-

Pumping sets shall be single or multistage horizontal centrifugal multistage multi-outlet
pumps with cast iron body and bronze dynamically balanced. Impeller connecting shaft
shall be stainless steel.

b. Pumps shall be connected to the drive by means of a flexible coupling.

c. Pumps shall be provided with approved type of mechanical seal’ pressure gauge with
isolation cock on the delivery side.

d. The pumps shall be of type approved by TAC or local fire authority.

e. Pumps selected should work under 150% rated flow delivered against 65% of the rated
head so as to meet local statutory requirements/Clients requirements.

11.12 Pump Driven By Diesel Engine :-

a. Diesel Engine shall be 4 (Four)-cylinder type with individual head assemblies. The
engine shall be water-cooled and shall include radiator, water pump and connecting
piping, strainer, isolating and pressure reducing valves, by-pass line complete in all respects.

b. Engine shall be direct injection type with low noise and exhaust omission levels.

c. The speed of the engine shall match the pump speed for direct drive.

d. The engine shall be self starting type and shall be provided with 12 Volts heavy duty batteries, dynamo, starter, cut-out, starter, cutout battery leads complete in all respects. Two additional spare batteries shall be provided.

e. The system shall be provided with an automatic fully connected batterer charger of type and capacity required for the system.

f. System should be designed such a way that both batteries are connected and are individually able to provide automatic pump starting. The battery circuits should be arranged to alternately attempt starting on one circuit first, then the other one battery could be charged by an alternator on the engine with the other one charged by an independent means.

g. The engine shall be provided with an oil bath air cleaner.

h. Engine shall be suitable for running on high-speed diesel oil.

i. The system shall be provided with a control panel with push button starting arrangement and wired to operate the engine on a differential pressure gauge.

J The entire system shall be mounted on a common structural base plate with anti-vibration mounting and flexible connections on the suction and delivery piping.
k. Providing one fully mounted and supported day oil tank fabricated from 5-mm thick MS sheet of capacity (size 1 Mtr x 1 Mtr x 0.7 Mtrs) 500 Ltrs with inlet, outlet with valves, gauge glass, manhole cover. The cost of MS frame work for staging to be included.

l. Provide one exhaust pipe of MS 3 mm thick with suitable muffler to discharge the engine gasses to outside open air as per site conditions duly painted. Exhaust pipes to be insulated and GI sheet cladded from engine outlet up to muffler and located outside the building.

m. Provide all accessories fittings and fixtures necessary and required for a complete operating engine set.

n. Pressure switches/sensing devices to be mounted on its own independent discharge header for all the four pumps to achieve automatic operation.

Air vessel Tank made out of 4 mm MS sheet 300 mm dia x 1000 mm long with dished ends in 5 m thick sheet with provision necessary for inlet, outlet, duly painted inside with two coats of anti-corrosive paint of approved synthetic enamel paint.

12.0 **Pump Driven by Electric Motor**

Fire pump shall be electrically driven centrifugal pump of capacity 2280 LPM. The pump shall be automatic in operation and driven by a totally enclosed fan cooled induction electric motor of 60 HP at 1500 RPM. The construction details of the pumps shall be as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Pump : Horizontal type split casing.</td>
</tr>
<tr>
<td>b.</td>
<td>Casing : Cast Iron</td>
</tr>
<tr>
<td>c.</td>
<td>Impeller : Double inlet enclosed type – bronze.</td>
</tr>
<tr>
<td>d.</td>
<td>Shaft : Stainless steel.</td>
</tr>
</tbody>
</table>
e. Bearings : Heavy-duty ball bearings.

f. Flanges : Faced and drilled as per BSS-10 tables or IS.

g. Drive : Direct drive with flexible coupling.

h. Gland : Horizontal split for each insertor and removal.

i. Motor : Total enclosed fan cooled inducting motor suitable for operation of 430 Volts, 3 Phase, 50 Hz, and a/c. supply. Motors shall confirm to IS: 325. Motors shall be wound for class-B insulation.

j. Starting : Automatic starting device with arrangement of contactor, pressure switch, etc. and suitable hooter.

k. Installation : Pump and motor set shall be mounted on a common base plate and installed on a suitable concrete foundation and curing the same. Suitable anti-vibration springs shall also be installed to minimize the vibration. The pump set shall, however be factory aligned. The bedplate Levels shall be properly fixed at site before the Foundation bolts are grouted.

i. Pump Accessories : Pump set shall be provided with the following accessories:

a. Coupling Guard.

b. Air vent for pump casing.

c. Suction and delivery pressure gauges.

d. Base plate, foundation bolts, nuts, washers.
12.1 **Jockey Pump**

Pump shall be electrically driven centrifugal pump of capacity **180 LPM** at 70 MTRS. The pump shall be automatic in operation and driven by dip proof squirrel cage electric motor of 15 HP at 2860 rpm.

12.2 **Diesel Engine.**

**GENERAL**

The diesel engine shall be of multicylinder type four-stroke cycle with mechanical (airless) injection, cold starting type. The engine shall be manufactured as per IS 10000 and shall be ease of maintenance, repair, cleaning and inspection. This will also provide interchangeability of parts. All parts susceptible to temperature changes shall have tolerance for expansion and contraction without resulting in leakage, misalignment of parts or injury to parts.

**STARTING**

The engine shall be capable of both automatic and manual start. Generally the engine shall start automatically but in case of the auto-start system failure the engine shall be capable of manual start. Engine shall be able to start without any preliminary heating of combustion chamber; cranking mechanism shall also be provided. All controls/mechanism, which has to be operated in the starting process, shall be within easy reach of the operator. A DC motor charged by battery shall initiate automatic start of diesel engine. The battery shall hold adequate retainable charge to provide the starting of the diesel engine. Starting power will be supplied from two sets of storage batteries. One set of battery is for automatic starting of the engine and the other provided for manual starting. A selector switch will be provided at automatic starting control panel to select any of the two sets of battery for manual / auto starting of the engine. The battery capacity shall be adequate for ten consecutive starts without recharging with a cold engine under full compression. The battery banks shall be used for no other purpose other than starting of the engine and shall be fully charged at all times with provision for trickle and boost charges. After start of the engine the charger shall be disconnected, the battery being fed from the engine dynamo. The two-battery charger of air-cooled type shall be
able to charge on battery bank at a time. The D/E starting panel along with the battery chargers should be of reputed approved makes.

GOVERNING SYSTEM

The engine shall have a speed control device which will control the speed under all conditions of load., the governor shall be suitable for operation without external power supply. The Governor shall offer following features: An adjustable governor to regulate engine speed within a range of 10% between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load.

FUEL SYSTEM

The diesel engine is to run on high-speed diesel, the tank provided being enough to hold the volume required for 6 hours (minimum) continuous operation. Fuel tank shall be double wall type, so that overflow of the fuel shall be collected in the secondary tank. Fuel supply and return piping shall be metal with necessary valves. Fuel tank shall be mounted on the fabricated consisting with air vent, overflow, drain, filling and manhole etc.

COOLING WATER SYSTEM

Direct cooling system shall be employed for the diesel engine. Water shall be tapped from the fire pump discharge. This water shall be led through duplex strainer, pressure breakdown orifice and then after passing through the engine, the outlet water shall be taken directly to the sump through an elevated funnel. Re-circulating thermo siphon system of cooling using a fan cooled radiator or indirect cooling system using heat exchanger shall not be accepted.

ACCESSORIES

The engine shall be mounted on a base plate of fabricated steel construction. Adequate access shall be provided for the big end and main bearings, camshaft and governor drives, water jackets etc., The engine shall have a base plate made from MS sections. There
shall be reasonable space at the big end, camshaft, water jackets, governor drives and main bearings. The engine shall be provided with intake and discharge ductwork, inlet filter and silencer, outlet muffler, expansion joints, dampers etc., as necessary for efficient operation. Intake air should be taken from inside the building in which the engine is located, but the exhaust should be discharged outside the building and exhaust duct shall be adequately sized for minimum pressure drop as per relevant code/standard, and shall be housed clearing man height. The flywheel shall have graduated marking around the periphery to facilitate checking of valve and fuel pump timings. Full set of diesel engine spares as per Standard requirement to be provided along with tool kit.

**INSTRUMENTATION**

The diesel engine shall be provided with adequate instrumentation. The gauges etc., as required are provided for in the Engine Panel. Also Bidder shall supply one set of Spare parts recommended by the manufacturer for maintenance purposes.

**13.0 Testing**

After laying and jointing, the piping shall be pressure tested by hydrostatic method. The piping shall be slowly filled with water in order to expel all the air. The piping shall then be allowed to stand full of water for 24 hours. Any leakage at flanges or elsewhere shall be rectified. The pressure shall then be applied by means of a test pump (either hand operated). The test pressure shall not be less than 1.5 times the working pressure of the system. However the test pressure shall not exceed 10.5 kgs/cm² in any case.

Pressure gauges used for the test shall be accurate and shall preferably have been recalibrated before the test. The open ends of the piping shall be plugged during the test. Capacity of pumps shall be checked with respect to the contractors piping and equipment layout. Tests shall be conducted to determine the delivery head, flow end BHP of pumps after installation. All the test results shall correspond to the performance curves. All the leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Employer/TAC Inspector.

The system shall also be tested for its desired performance and function by opening hydrant valves on each floor separately and four landing valves simultaneously. The flow of water at the top most hydrants shall be checked when three landing valves below are open. The cutting in and cutting out pressure setting of starting device shall also be checked for its correct operation.
The test results shall be recorded and countersigned by Employer’s representatives and submitted in triplicate for approval by the Employer.

14.0 Fire Brigade Inlet Connection

Fire Brigade Inlet Connection to the 150mm feeder line shall be comprised of four instantaneous pattern 63-mm dia. Make inlets with caps and chains complete with non-return valves housed in a 16 Gauge MS cabinet with 4-mm thick glass fronted door. The cabinet shall be 1000 x 300 mm x 400-mm size for recess mounting.

15.0 Base Plate

Pumps and motors shall be mounted on a common structural base plate with antivibration mounting.

16.0 Yard Hydrants

Yard hydrant shall comprise of 80-mm dia M.S. flanged standpipe, 63-mm dia gunmetal instantaneous landing valve. The buried protection shall be anticorrosive treatment as per specification.

2. AUTOMATIC SRINKLER SYSTEM

2.0 SCOPE OF WORK

The sprinkler system shall be provided in basement and all upper floors. This system shall include the following:

Sprinkler main, branch and internal piping complete with valves, alarms and supporting arrangements. Sprinkler heads with spare sprinklers. Connections to risers etc., all material shall be of the best quality conforming to specifications and subject to the approval of the Engineer-in-Charge. Pipes and fittings shall be fixed truly vertical/horizontal or on slopes required in a neat manner. Pipes shall be fixed in such a manner so as to provide easy accessibility for repair and maintenance and shall not cause
obstruction in shafts, passages etc., Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Only approved types of anchor fasteners shall be used for RCC ceilings and walls. Valves and other equipment shall be so located that they are easily accessible for operation, repairs and maintenance.

2.1 SPRINKLER HEADS

The sprinkler heads shall be UL listed fixed temperature type with a quartzoid bulb containing liquid having high vapor pressure held in position by a forged GM yoke and deflector. The rated temperature of quartzoid bulb shall be 68 deg. C for complete building. The spacing shall however conform to the detailed drawing, in Co-ordination with electrical and other allied services at the ceiling level. Contractor shall supply spare sprinkler heads and spanners neatly installed in a steel box with glass shutter at an appropriate position approved by the Engineer-in-Charge.

A water motor gong and an inspection test connection shall be provided on the downstream side of the system.

Sprinklers for below false ceiling shall be fixed with recessed (two piece) type Rosette plate fabricated by M.S. sheet of 2mm thick with Powder coated finish of approved color.

Sprinklers for car parking areas and ceiling void shall be upright and for below false ceiling shall be recessed type.

2.2 PIPES AND FITTINGS

Pipes for the sprinkler system shall refer to the clause No. 2.0,11.0,12.0 and 13.0 of Section – A above.

3. TECHNICAL SPECIFICATIONS FOR 415 VOLTS FIRE PUMP PANEL.

1.0 Scope of Work
This specification is intended to cover the design, manufacture, assembly testing at manufacturer’s works, properly packed for transportation, supply and delivery, testing and commissioning complete in all respects with all components, fittings and accessories for efficient and trouble free operation as specified hereinafter for the proposed project.

2.0 General Information

2.1 The equipment shall be designed, manufactured and equipped with accessories in accordance with these specifications and the applicable code standards indicated below. Materials and components not specifically stated in this specification but which are necessary for satisfactory and trouble free operation and maintenance of the equipment shall be supplied.

2.2 The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance and service life as specified here.

2.3 Switch boards shall be suitable for an ambient temperature of 45 degree C.

3.0 Codes and Standards

3.1 The equipment covered by this specification shall unless otherwise stated be designed, constructed and tested in accordance with the requirements of the Indian Electricity Act and Rules and latest revision of the following standards.

IS-375 : Arrangement of bus bars, main connection and auxiliary wiring.

IS-722 : AC Electricity Meters.

IS-1248 : Direct acting electrical indicating instruments.

IS-1822 : Motor starters AC for voltages not exceeding.
IS-8544 : 1000 V direct-on-line AC starters.

IS-2147 : Degrees of protection provided by enclosures for low voltage Switchgear and control gear.

IS-2419 : Dimensions of panel mounted electrical indicating and recording Instruments.

IS-2705 : Current Transformers.

IS-2959 : Contractors for voltages not exceeding 1000 V AC or 1200 V DC.

IS-3231 : Electrical relays for power system protection.

IS-4064 : Air-break switches, air-break disconnects, air break switch Disconnects and fuse combinations units for voltages not Exceeding 1000 V AC or 1200 V DC.

IS-3842 : Application guide for electrical relays for AC system.

IS-4237 : General requirements for Switchgear and control gear for voltage not exceeding 1000 volts.

IS-4483 : Preferred panel cutout dimensions for electrical relays.

IS-5124 : Induction motor starters, AC (voltage not exceeding 1000 V) Installation and maintenance of code of practice.
IS-5987 : Selection of switches (voltage not exceeding 1000 V)

IS-6875 : Control switches for voltage upto and including 1000 V AC and 1200 DC.

IS-8588 : Code of practice for thermostatic bimetal Part-1 general Requirements and method of tests.

IS-8623 : Factory built assemblies of Switchgear and control gear for Voltages upto and including 1000 V AC and 1200 V DC.

IS-8828 : Miniature air break circuit breakers for voltages not exceeding 1000 Volts.

4.0 Design Requirement

4.1 The switchboards shall be designed for 400/440 V, 3 phase 4 wire, 50 c/s supply.

4.2 Switchboards shall be suitable for direct-on-line starting of all motors.

4.3 Control power supply of the Switchboards shall be 415 Volts, single phase, and 50 Hz AC supply tapped for the respective module itself.

4.4 The switchboards manufacturers shall apply all detracting factors necessary to all components of the switchboards to comply with the conditions detailed in this specification.
5.0  **Constructional Features**

5.1  The switchboard shall be:

- The totally metal enclosed, indoor, floor mounted, free standing, cubicle fixed type, fuse switch units with compartmentalized design.

- Be made up of the requisite vertical section, which when coupled together shall form continuous dead front switchboards.

- Provide dust and damp protection, the degree of protection being no less than IP 54 to IS2147.

- Be readily extensible on both sides by addition of vertical sections after removal of the end covers.

- Switchboards shall have access to the feeders, bus bars, cable termination, cable alley etc. from front only.

5.2  **Each vertical section shall comprise:**

a.  A front framed structure rolled/folded sheet steel channel section, of minimum 3-mm thickness, rigidly bolted, together. The structure shall house the components contributing to the major weight of the equipment, such as circuit breaker cassettes, fuses switch units, main horizontal bus bars, vertical risers and other front mounted accessories.

b.  The structure shall be mounted on a rigid base frame of folded sheet steel of minimum 3-mm thickness and at least 75-mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.
c. Each compartment shall be provided with a hinged door interlocked with switch/breaker housed inside the compartments so that door cannot be opened unless the switch breaker is in “OFF” position.

d. The design shall ensure generous availability of space, ease of installation, maintenance of cabling and adequate safety for working in one vertical section without coming into accidental contact with live parts in and adjacent section.

e. A cover plate at the top of the vertical section, provided with a ventilation hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1-mm diameter perforations to prevent entry of vermin.

f. Front and rear doors shall be fitted with dust-tight neoprene gaskets with easy operating type fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust. The doors shall have concealed hinges. Removable screwed covers shall be provided on the rear of the cubicles.

5.3 The height of the panel should not be more than 2200 mm. The working height shall be limited to a maximum height of 1800 mm. The total depth of the panel should be adequate to cater for proper cabling space.

5.4 Covers and partitions shall be of minimum 16 gauge sheet steel, whereas doors shall be minimum 14 gauge sheet steel. All sheet steelwork forming the exterior of switchboards shall be smoothly finished, leveled and free from flaws.

5.5 All switches, push buttons etc. shall be operable from the front and shall be flush/semi-flush mounted.
5.6 The apparatus and circuits shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.

5.7 Apparatus forming part of the switchboards shall have the minimum clearances as per relevant IS clearances shall be maintained during normal service conditions.

5.8 All insulating material shall be of DMC/FRP/SMC to withstand the effects of high humidity, high temperature, tropical ambient service conditions, etc.

5.9 Foundation bolts and nuts for each panel shall be supplied along with the respective switchboards.

5.10 The lifting eyes for each shipping section and danger notice plates shall be provided for each switchboard.

5.11 Functional units such as circuit breakers and fuse switches shall be arranged in multi-tier formation.

5.12 Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:

a. Main bus bars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.

b. Cable terminations of one functional unit, when working of those of adjacent unit/units.

5.13 All covers providing access to live power equipment/circuits shall be provided with tool operated fasteners to prevent unauthorized access.
5.14 Provision shall be made for permanently earthing the frames and other metal parts of the Switchgear by the independent connections.

6.0 Metal Treatment and Finish

6.1 All steelwork used in the construction of the switchboards should have undergone a rigorous metal treatment process.

All surface to be painted including interior and exterior of panels, and other metal parts shall be chemically treated to remove all rust, scale, grease and other adhering foreign matters using seven tank process. All parts shall be coated with two coats of highly corrosion resistant primer followed by two coats of synthetic enamel paint (post office red) of approved colour and approved manufacturer. Matt finish of the painting is required.

The complete treatment painting, drying with compressed air and stowing operations shall be done in dry and dust free atmosphere.

Should finished paint chip off or crinkle during transit/handling/installation, the contractor shall arrange for repainting the equipment at site at his own cost.

7.0 Bus Bars

7.1 The bus bars shall be air insulated and made of high strength aluminium alloy complying with the requirements of grade E91E of IS-5082 and suitable for 415 Volts, 4 wire 50 Hz system.

7.2 The bus bars and connections shall be suitably supported / braced with non-hygrosecope DMC / FRP / SMC supports.

7.3 High tensile bolts and spring washers shall be provided at all busbar joints.
7.4 The busbars shall be liberally sized and shall have uniform cross section throughout and shall be capable of carrying the rated current at 415 V continuously. The bus bars shall be designed to withstand a temperature rise of 45-degree C above the ambient. A current density of 1.3 Amps/Sqmm. shall not be exceeded for aluminium bus bars.

7.5 All bus connections, joints and taps shall be short and as straight as possible, and applied with contact grease in the mating surface.

7.6 The main horizontal bus bars shall be run through the entire length of the panel and shall be accessible for maintenance from the front as well as rear. Busbar chamber shall have separately screwed covers. All bus bars, links, etc. shall be provided with insulating cover to prevent accidental contacts. The neutral bus bars shall have a continuous rating of at least 50% of the phase bus bars.

7.7 Bus bars shall be encased in colour coded heat shrunk PVC sleeves (snug fit type). An earth bus of size not less than 25x6 mm shall run through the length of switch boards at top or bottom as required.

8.0 Combination – Fuse Switch Units (FSUs):

8.1 The fuse switch units shall be of the load break, fault make heavy duty, and cubicle type conforming to the requirements of IS-4064-1978 (AC 23 duty).

8.2 The fuse switch units shall be double break and have quick make and quick break mechanisms, designed to ensure positive operation even in the event of failure of operating spring.

8.3 All fuse switch contacts shall be silver plated at current transfer surfaces.

8.4 The unit shall be provided with front operating handle. The ON and OFF positions of the switch handle shall be clearly marked.
8.5 Interlocks shall be provided so as to prevent opening of the unit door when the switch is in the ON position, and also to prevent closing of the switch with the door not properly secured. It should, however, be possible to defeat the interlock mechanism to operate the switch with the door open intentionally.

8.6 The switches shall be capable of withstanding the thermal and Electro magnetic strenuous caused by short circuit currents for the time of operation of the associated fuse links.

8.7 Fuse switch and air break switch operating handles shall be provided with padlocking facilities to lock them in OFF position.

8.8 The interior arrangement of the switch unit shall be such that all ‘Live’ parts are shrouded.

9.0 Indicating Lamps

9.1 LED type indicating lamps shall be provided wherever called for in the control schematic diagrams.

10.0 Fuses

10.1 All control and power fuses shall be link type HRC fuses and they shall be provided with visible indication to show that they have operated.

11.0 Current Transformers

11.1 Current transformers shall comply with the requirements of IS-2705. They shall have ratio, outputs and accuracy as specified/required.
11.2 Current transformers wherever required and called for in the single line diagram and/or required shall be furnished.

11.3 The CTs shall be bar primary in epoxy encapsulated type, rated for 415V. The CTs shall be designed to withstand the thermal and mechanical stresses resulting from the maximum short circuit current.

11.4 The vendor shall ensure that the VA output of the CTs is adequate for the relays, meters and loads connecting them.

11.5 The CTs shall be provided with Class A / Class B insulation and proper polarity markings in a suitable manner.

12.0 Indicating Meters

12.1 All indicating instruments shall be of flush mounting industrial pattern, conforming to the relevant standard.

12.2 Integrating meters shall be of flush mounting switch board pattern DIGITAL TYPE complying with the requirements of latest and relevant IS.

12.3 Digital Meter shall have +/- 1% accuracy on full scale.

13.0 Cable Terminations

13.1 Cable entries and terminals shall be provided in the switchboard to suit the number, type and size of the aluminium conductor power cables and copper conductor control cable specified in the detailed specifications.
13.2 Provision shall be made for top or bottom entry of cables as required. Generous size of cabling chambers shall be provided, with the position of cable gland and terminals such that cables can be easily and safely terminated. Removable undrilled plates shall be furnished for fitting the cable glands.

13.3 Sufficient space shall be provided to avoid sharp bending and for easy connection.

13.4 Multiway terminal blocks complete with screws, nuts, washers and marking strips shall be furnished for terminating the internal wiring and outgoing cables.

13.5 Power and control terminals shall be washer head screw type or stud type complete with crimping type connectors. Screw type terminals with screws directly impinging of conductors are not acceptable.

13.6 Each control terminal shall be capable for connection of 2 Nos. 2.5-mm standard copper wire at each end.

13.7 Not more than two wires shall be connected to any terminal. If necessary a number of terminals shall be jumpered together to provide wiring points.

13.8 At least 20% spare terminals shall be provided in each module.

13.9 Terminal block for current transformer secondary lead wires shall be provided with shorting and earthing facility.

13.10 Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit.
13.11 Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.

14.0 Control Wiring

14.1 The wiring shall be completed in all respects so as to ensure proper functioning of control, protection and interlocking scheme.

14.2 All wiring shall be completed upto terminal blocks on the side of each unit.

14.3 All control wiring shall be carried out with 1100/660 V grade single core PVC cable conforming to IS-694/IS-8130 having standard copper conductors switchboard wires of minimum 2.5 Sqm.

14.4 Wiring shall be neatly bunched, adequately supported and properly routed to allow for easy access and maintenance. Wires shall not be spliced or tapped between terminal point.

14.5 Wires shall be identified by numbered ferrules at each end. The ferrules shall be of the ring and of non-deteriorating material. They shall be firmly located on each wire so as to prevent free movement, and shall be interlocking type.

14.6 All control circuit fuses shall be mounded in front of the panel and shall be easily accessible.

14.7 All spare contacts of relays and switches shall be wired up to the terminal blocks.

14.8 Each of the DC circuit shall be provided with two fuses one in the positive and the other in the negative for 2 wire DC ungrounded system of specified voltage.
15.0 Ground Bus

15.1 An aluminium ground bus rated to carry maximum fault current shall be furnished along the entire length of each switchboard. Each stationary unit shall be connected directly to this ground bus by two separate and distinct connections in accordance with Indian Electricity Rules.

15.2 Grounding terminals on the ground bus shall be provided. Connectors shall be provided at either end of each PMCC for connection to station ground mat.

16.0 Terminal Blocks

16.1 Terminal blocks shall be 660 Volts grade of stud type. Insulating barriers shall be provided between adjacent terminals.

16.2 Suitable provision shall be made to terminate control/power connections in the respective module.

16.3 Terminal blocks shall have a minimum current rating of 10 Amps and shall be shrouded. Provisions shall be made for label inscriptions. The wire terminations to the blocks shall be of screw type suitable for crimp type socket.

17.0 Name Plate

17.1 The panel as well as feeders compartments shall be provided with nameplate of anodized aluminium, with white engraving on black background. They shall be properly secured with self-tapping screws at the top of the cubicles. The panel/feeder descriptions shall be as indicated in the drawings. The size of the nameplates shall be proportionate to the respective equipment.

17.2 Also individual panel number and danger plate shall be furnished at back.
18.0 Drawings and Manuals

18.1 The following drawings shall be supplied for each switch board.

18.2 General arrangement drawing for each type of board showing constructional features and space required in the front of withdrawal of breaker, power and control cable entry points, location of various devices, terminal blocks etc. GA drawings shall be submitted along with offer.

18.3 Foundation plan and anchor details including dead load and impact load.

18.4 Drawing and data sheet for each component.

18.5 Electrical wiring diagram.

18.6 Terminal block arrangement drawing for outgoing feeders.

18.7 Operation, maintenance and installation manuals, (one set to Architects).

18.8 Technical catalogues/leaflets of CTs, meters, lamps, etc shall be submitted along with offer.

18.9 The approval of the drawing does not absolve the contractor from his obligation of ensuring proper and correctness of functioning/operation of the system.

19.0 Tests
19.1 **Routine and Type Test:**

Type test certifies and results as per relevant standards (Specifications) for all the equipment offered under the scope of this specification shall be furnished.

20.2 All routine tests on all major components shall be made as per relevant specification.

a. Inspection of Switch boards including inspection of wiring and electrical operational tests wherever necessary.

b. Dielectric Tests:

Insulation of the main circuit that is the insulation resistance of each pole to the earth and that between the poles shall be measured.

Insulation resistance to earth of all secondary wiring should be tested with 1000 V meggar.

Insulation test shall be carried out both before and after high voltage test.

19.3 Each switch board will be completely assembled, wired, adjusted and tested for operation under stipulated conditions to ensure correctness of wiring and proper functioning of all equipment.

19.4 All current carrying parts and wing shall be subjected to a high potential test.

20.0 **High Voltage Test**

A high voltage test with 2.5 KV for one minute shall be applied between the pole and earth. Test shall be carried out on each pole in turn with the remaining poles
All units racked in position and the switches closed. Originals test certificate shall be submitted along with panel.

20.1 Employer reserves the right to get the routine tests witnessed by his representatives if so desired by the Employer. The contractor shall give at least 14 days advance notice for the above to the Employer.

21.0 **Packing and Transportation**

The switchboards shall be sent to site by road transport packed in wooden crates. The packing should be of high quality to avoid any damage to the equipment during transit. They shall be wrapped with polythene sheets before being placed in crates to prevent damage to the finish.

4. **TECHNICAL SPECIFICATIONS FOR STARTERS**

1.0 Contactors shall be air breakers and the electromagnetic type rated for uninterrupted duty as defined in IS-2959 and IS-1822 unless otherwise specified.

2.0 The main contacts shall be of silver or silver alloy. The insulation class for the coils shall be classes ‘E’.

3.0 Contractors shall be provided with minimum 4 Nos. of auxiliary contacts. Out of which 2 Nos. will be normally closed and 2 Nos. normally open.

4.0 A typical module wiring has to be approved by Architects. The exact wiring to be made for each motor shall be intimated to the Contractor.

5.0 To provide facility for inclusion of interlocks, the control circuit has been developed with a number of breaks bridged up with jumpers. In actual wiring, these are to be provided on the terminal board bridging up with jumpers. This arrangement is considered essential to avoid jointing and tapping of wires for inclusion of interlocks.

6.0 The short time rating of the contractors shall be properly coordinated with the operating time of fuse preceding it.
7.0 The protective relays shall be flush mounted type and shall be in draw out type cases with built-in test facilities and having provision for CT shorting when the relays are drawn out. The relays shall be provided with externally reset operation indicators.

8.0 Wherever shown, auxiliary relays, contractors shall be furnished for interlocking and indication purposes.

9.0 All push buttons shall be heavy duty type suitable for flush mounting on sheet steel cubicle doors. The push buttons shall have one ‘NO’ and one ‘NC’ contact. The continuous current breaking capacity of the contacts shall be adequate for the duty involved. The contacts shall be rated for 10A at 240 V, 1 phase, 50 c/s. push buttons shall be suitable colours (“RED” for “ON” (&) “GREEN” for “OFF”) according to their functioning.

5. TECHNICAL SPECIFICATIONS FOR SWITCH BOARDS

1.0 Storing

The panels shall be stored under a shelter and in a well-ventilated and dry place. Suitable polythene covers shall be provided for necessary protection against moisture.

1.1 Erection

Switchboards shall be installed on suitable foundation. Foundation shall be as per the dimensions supplied by the panel manufacturer. 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 switchboards shall be properly aligned bolted to the foundation by atleast four bolts. Cables shall be terminated on the bottom plate or top plate as the case may be, by using brass Siemens type double compression glands. The individual cables shall then be led through the panel to the required feeder compartments for necessary terminations. The cables shall be clamped to the supporting arrangement. The switch board earth bus shall be connected to the local earth grid.

1.2 Pre-commission Tests
Panels shall be commissioned after the successful completion of the following test. The tests shall be carried in the presence of Architect’s representative.

2.0 All main and auxiliary bus bar connections shall be checked and tightened.

2.1 All wiring terminations and bus bar joints shall be checked and tightened.

2.2 Wiring shall be checked to ensure that it is according to the drawing.

2.3 All wiring shall be tested for insulation resistance by a 1000 voltage megger.

2.4 Phase rotation tests shall be conducted.

2.5 All relays and protective devices shall be tested for correctness of settings and operation.

3.0 Hardware

The erection rate shall include supply, fabrication, and installation of necessary m.s. Channel for erection of switchboards.

6. TECHNICAL SPECIFICATIONS FOR MEDIUM VOLTAGE CABLES

1.0 Scope

This specification covers the technical requirements of supply, laying, testing and commissioning of heavy duty medium voltage cables up to 1100 Volts for power, control and lighting application for efficient and trouble free operation.

The cables shall be properly packed for transportation, supply and delivery at site.
2.0 Codes and Standards

The materials covered by this specification shall unless otherwise stated as designed constructed, manufactured and tested in accordance with latest revisions of the relevant Indian Standards.

IS-1554 (Part – 1) 1976 : PVC insulated cables for working voltage upto and including 1100 V.

IS-5831 1970 : PVC insulation and sheath of electric cables.

IS-8130 1984 : Conductors for insulated electrical cables.

IS-3961 (Part – II) 1977 : Recommended current ratings for PVC insulated and PVC sheeted heavy-duty cables.

3.0 Rating

The cable shall be related for a voltage rating of 650/1100 Volts.

4.0 Selection of Cables

Cables have been selected considering the conditions of maximum connected load, ambient temperature, grouping factor, allowance voltage drops. However it is the responsibility of the contractor to recheck the sizes before cables are procured and connected.

5.0 Insulation

The conductor is insulated with suitably compounded PVC applied to the conductor by the extrusion.
6.0 Laying

Cables shall be laid as per the specification given below:

6.1 Cables In Outdoor Trenches

Cables shall be laid in outdoor trenches wherever called for. The depth of the trenches shall not be less than 75 cms from the final ground level. The width of the trenches shall not be less than 45 cms. However where more than 15 cms shall be allowed between the cables. The trenches shall be cut to square with vertical sidewalls and with uniform depth. Suitable shoring and propping may be done to avoid caving in of trench walls. The floor of the trench shall be rammed level. Shall be laid in trenches over the toilers placed inside the trench. The cable drum shall be rolled in the direction of the arrow for rolling. Wherever cables are bent, the minimum bending radius shall not be less than 12 times the diameter of the cable. After the cable is laid and straightened, it shall be covered with 8 cms thick layer of sand. Cable shall be then lifted and placed over this sand cushion, where cable is laid in rocky situation.

Extra thick cushioning sand, as may be required/decided by the Project Manager/Architects shall be done without extra charge. Over this, a course of cable protection tiles orbricks shall be protected by concrete tiles/stone slabs of minimum 25 mm thick placed on top of the trench breadwise for the full length of the cable. Trench shall be back filled with earth and consolidated. Cables shall be laid in hume pipes/stoneware pipes at all road crossings and in GI pipes at wall entries. Approved cable markers made of concrete blocks indicating the voltage grade and the direction of run of the cables shall be installed at regular intervals of 25 Mtrs. The depth of concrete blocks shall be atleast 300 mm below ground and 50 mm above ground.

6.2 Cables In Indoor Trenches

Cables shall be laid indoor trenches wherever specified. Suitable painted M.S base plate, clamps, saddles, GI nuts/bolts shall be used for securing the cables in position at an interval not more than 450 mm. Spacing between the cables shall not be less than 15 cmscentre to centre. Wherever specified, trenches shall be filled with fine sand and covered with steel chequered trench covers or RCC slabs.
6.3 All chases and passage if necessary for the laying of service cables at the entry or of Premises shall have to be cut and made good to the satisfaction of the project Manager/Architects.

6.4 All cables entries into the buildings shall be laid on cable trays.

6.5 All cables will be identified close to their termination point by cable number as per circuit schedule. Cable numbers will be punched on 2mm thick aluminium strips and securely fastened to the cables. In case of control cables, all covers shall be identified by their wire numbers by means of ferrules. For trip circuit identification additional red ferrules are to be used only in the particular case of control cables at the termination points in the switchgear/control panels.

7.0 Jointing and End Terminations

Cable jointing shall be done as per the recommendations of the cable manufacturer. Jointing shall be done by qualified cable jointer under strict supervision.

Each termination shall be carried out using electroplated brass double compression glands and copper cable sockets and approved jointing materials are to be used.

Hydraulic crimping tool shall be used for making the end terminations. Cable gland shall be bonded to the earth by using suitable size copper/G.I. wire. The cable armoring is to be earthed properly so that the earth continuity is maintained.

8.0 Testing

8.1 Copy of cable test certificate of manufacturers shall be furnished to the Employer.

8.2 Cables shall be tested at site after installation and results shall be submitted to Architects.
8.3 Pressure test for 15 minutes.

8.4 Insulation resistance between conductors and neutral and conductors and earth.

7. FIRE EXTINGUISHERS

Fire extinguishers shall be worked out in such a way that the Occupants shall not travel more than 15m to reach a Fire extinguisher. Also there shall be a Fire extinguisher for every 300 sq.m of floor plate / rooms / Shops of suitable type / size. Additional to shopping areas Extinguishers to be provided at Surface car parks, outdoor Transformers / electrical instillations and on the landing of each Staircase of all floors.

All Fire extinguishers shall be portable and hand held, a operating instruction should be pasted on the extinguisher body.

Portable Fire extinguishers should be BIS approved and valid ISI certificates to be furnished at the time of delivery to site.

SIGNAGE

Required, as per Local fire force like exit signs & Floor indication (eg Ground floor, 1st floor..), size shall 200mm x 500mm & action chart ( size shall be 600mm x 1000mm) in case of fire / emergency, Staircase location indication etc. The location / quantity shall be on each landing of every staircase on each floor.

Signs shall be made out of 3mm thick PVC foam board with PVC non – reflective self-adhesive vinyl foam board OR equivalent material with Mirror fasteners for fixing complete.

ANNEXTURE - I

TECHNICAL DATA SHEETS

A. Fire Hydrant System :
   1. Type :
   2. Capacity in LPS :
   3. Delivery held in Mtrs. :
4. Materials of impeller : 
5. Rate speed in RPM : 
6. Suction and delivery sizes in mm : 
7. Type of Drive recommended motor rating : 
8. Recommended motor rating : 
9. Material of casting shaft. : 
10. Efficiency of the Pump at rated capacity And head. : 

B. **Jockey Pump** : 

1. Type : 
2. Make : 
3. Capacity / Head : 
4. Material of Impeller : 
5. Rate speed in RPM. : 
6. Suction and delivery : 
7. Type of motor : 
8. Motor rating / drive : 
9. Material of casting shaft. : 
10. Efficiency : 

C. **Diesel Engine** : 

1. Type : 
2. Make : 
3. Maximum Rating : 
4. Gross Power : 
5. Governed speed : 
6. Continuous rating : 
7. Number of cylinder : 
8. Bore and Stroke : 
9. Piston displacement : 
10. Fuel consumption Ltrs/Hr. :
11. Operating Cycles : 
12. Lube system oil : 
13. Coolant capacity engine only : 
14. Net weight, dry with radiator and base : 
15. Overall dimension of Engine (L x W x H) : 

D. M.S. Pipe :
1. Make :
2. Standard (IS/BS) :

E. Cast Iron Pipes :
1. Make :
2. Standard (IS/BS) :

F. Landing Valve :
1. Make :
2. Type :
3. Standard (IS/BS) :
4. Whether approved by TAC :

G. Valve :
1. Make :
2. Material of seat :
3. Material of body :
4. Whether approved by TAC :

H. Hose Pipes :
1. Make :
2. Material of body :
3. Whether as per IS :
4. Whether approved by TAC :
# List of Approved Makes/Vendors for Fire Fighting

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## Section- 6: General Specifications for Lift / Elevators/ MLCP System Works

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1. GENERAL TECHNICAL CONDITIONS FOR LIFT / ELEVATORS WORKS

1.0 General :-

This specification covers design, manufacture, testing as may be necessary before dispatch, delivery at Site, all preparatory work, assembly and installation, commissioning putting into operation of lifts.

2.0 Rates:-

2.1 The rates quoted by the tenderer, shall be firm and inclusive of all taxes (including works contract taxes) Duties, Octroi and Levies and all charges for packing forwarding, insurance, freight and delivery, installation, testing, commissioning etc. at site i.e. temporary constructional storage, risks, over head charges general liabilities / obligations and clearance from local authorities. Any advance payment to be made to lift manufacturer shall be the sole responsibility of the tenderer.

2.2 The contractor has to carry out routine and preventive maintenance for 12 months from the date of handing over. Nothing extra shall be paid.

3.0 Completeness Of Tender:-

3.1 All sundry equipment, fittings, unit assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections, and all other items which are useful and necessary for efficient assembly and installation of equipment and components of the work shall be deemed to have been included in the tender irrespectively of the fact whether such items are specifically mentioned in the tender documents or not.

3.2 For item / equipment requiring initial inspection at manufacturer’s works the contractor will intimate the date of testing of equipments at the manufacture’s works before dispatch. The Client also reserves the right to inspect the fabrication job at factory and the successful tenderer has to make the arrangement for the same. The successful tenderer shall give sufficient advance notice regarding the dates proposed such tests / inspection to the Client’s representative (s) to facilities his presence during testing / fabrication. The Engineer-in-charge at his discretion witness such testing / fabrication. Also equipment may be inspected at the manufacture’s premises, before dispatch to the site by the contractor.
4.0 Completion Of Period :-

The completion period as mentioned in the Appendix / indicated in the tender documents is for the entire work of planning, designing, supplying, installation, testing, commissioning and handing over of the entire system to the satisfaction of the Engineer-in-Charge after obtaining the license from the lift inspector of Local / State Government. And certification of competent local authority in respect of compliance of factory act lift provision.

5.0 Data Manual And Drawings To Be Furnished By The Tenderer:

5.1 With Tender:
The tenderer shall furnish along with the tender, detailed technical literature, pamphlets and performance data for appraisal and evaluation of the tender.

5.2 After Award of work:
The successful tenderer would be required to submit the following drawings for approval before commencement of installation.

5.3 All General Arrangement Drawings:
Details of foundations for the equipment, load data, location etc. of various aspects of equipments as may be needed generally by other agencies for purpose of their execution. The data will include breaking load on guides; reaction of buffers on lift pits required, support points in machine room, lift well etc.

5.4 The General Arrangement Drawing in triplicate will be forwarded by Contractor. The purpose of this drawing is to clearly indicate to the contractor pertinent dimensional details of the elevator shaft, pit, machine room, car and landing entrances, etc.

5.5 Complete layout dimensions for every unit / group of units with dimensions required for erection purposes.
5.6 Any other drawing / information not specifically mentioned above but deemed to be necessary for the job by the contractor.

5.7 The successful tenderer should furnish well in advance three copies of detailed instruction manuals of manufactures for all items of equipments regarding installation, adjustment, operation and maintenance i.e. preventive maintenance & trouble shooting together with all the required data sheets, spare parts catalogue and workshop procedure for repairs, assembly and adjustment etc. all in triplicate.

6.0 Extent Of Work :-

6.1 The work shall comprise of entire labour including supervision and all materials necessary to complete installation and such tests and adjustments and commissioning as may be required by the Client. The term complete installation shall not only mean major items of the plants, equipments covered by specifications but all incidental sundry components necessary to complete execution and satisfactory performance of installation with all layout charts whether those have been mentioned in details in the tender document in connection with this contract.

7.0 Inspection And Testing :-

7.1 Copies of all documents of routine and type test certificates of the equipment, carried out of the manufacturers premises shall be furnished to the Engineer-in-Charge and consignee.

7.2 After completion of the work in all respect the contractor shall offer the installation for testing and operation.

7.3 The following tests shall be carried out to the satisfaction of the owner.

   a. Insulation and earth test for all electrical apparatus.
   b. Continuous operation of the lift under full load conditions for one hour at the end of which time the temperature of the motor and operating coils will be tested. This shall be as per I.S specifications.

8.0 Compliance With Regulations And Indian Standards:-
8.1 All works shall be carried out in accordance with relevant regulation, both statutory and those specified by the Indian Standards related to the works covered by these specifications. In particular the equipment and installation will comply with the following:

8.1.1 Factories Act.

8.1.2 (ii) Indian Electricity Rules

8.1.3 IS. & BS Standards as applicable

8.1.4 Workmen’s Compensation Act.

8.1.5 Statutory norms prescribed by local bodies.

8.2 Nothing in this specification shall be construed to relieve the successful tenderer of his responsibility for the design, manufacture and installation of the equipment with all accessories in accordance with currently applicable statutory regulations and safety codes. In case of any conflict, interpretation of the Architect shall be deemed final and binding.

9.0 Erection Tools:-

9.1 No tools and tackles either for unloading or for shifting the equipments for erection purposes would be made available by the Client. The successful tenderer shall make his own arrangement for all these facilities.

10.0 Verification Of Correctness Of Equipment At Destination:-

The contractor shall have to produce all the relevant records to certify that the genuine equipment from the manufactures has been supplied and erected.

11.0 Painting:-
This shall include cost of painting of entire exposed iron work complete in the installation. All equipments work shall be painted at the works before dispatch to the site.

12.0 Training:-

The scope of works includes on job technical training of two persons at site. Nothing extra shall be payable on this account.

13.0 Maintenance:-

13.1 Sufficient:-

Trained and experienced staff shall be made available to meet any exigency of work during the guarantee period of one year from the handing over at the installation.

13.2 The maintenance, routine as well as preventive for one year from the date of taking over the installation as per manufactures recommendation shall be carried out and record of the same shall have to be maintained.

2. GENERAL TECHNICAL SPECIFICATIONS

1.0 Scope:

These general specifications cover the details of equipment to be designed, supplied, inspection as may be necessary before dispatch, delivery at site, installation, testing, commissioning and handing over in working condition of electrical lifts.

1.1. Related Documents:

These technical specifications shall be read in conjunction with the General Conditions of contract with all correction slips, as well as schedules and drawings. In the event of any discrepancy between these specifications and inter-connected contract documents, the
technical requirements as per the tender specifications shall be followed and deem to be having over-riding value.

2.0 Conformity With Statutory Acts, Rules, Regulation, Standards And Safety Codes :-

The installation shall be carried out in conformity with the local lifts Act and Rules. The installation shall also conform to requirements of local Municipal Bylaws.

2.1 Indian Electricity Act and Rules

All Electrical works in connection with installation of electric lifts shall be carried out in accordance with the provisions of Indian Electricity Act 2003 and the Indian Electricity Rules 1956 amended up to date.

2.2 Safety Codes and Labour Regulations

The contractor shall at his own expenses arrange for the safety provisions as per the statutory regulations, IS recommendations, regulations under Factory Act etc., where applicable and instructions issued from time to in respect of all labour employed by him directly or indirectly for the installation of the lift.

2.2.1 The contractor shall provide necessary barriers, warning signs and other safety measures etc., wherever necessary so as to avoid accident. In addition all safety procedures as outlined in the tender shall be complied with.

2.3 In case of default the client shall be at liberty to make arrangements and provide facilities as aforesaid and recover the cost from the contractor.

2.4 Fire Regulations

The Installation shall be carried out in conformity with the local fire regulations and rules there under wherever they are in force. The contractor shall be responsible for obtaining
fire clearances for all lift stops, including basement and terrace floors, from local authorities.

3.0 **Works To Be Done By The Contractor:-**

In addition to the manufacture, supply, installation, testing and commissioning of the lift including all auxiliary equipment, following works shall be deemed to be included within the scope of the work to be done by the contractor.

3.1 Supply of necessary R.S joists or angle iron supports brackets etc., for installation of the lift either in the machine room or at other places as may be necessary including their installation in position.

3.2 Responsibility to ensure safety of lift materials against pilferage and damage till the installation is handed over to the Employer.

3.3 All Scaffolding as may be necessary in the lift well during erection work and subsequently removed.

3.4 Temporary barricades with caution boards at each landing to prevent accident during execution of work.

3.5 Supply and installation of landing facia plates made of steel, car apron plates, sill support angles with necessary clamps; foundation bolts supports etc., as are necessary in connection with the installation of the lift.

3.6 Steel ladder to be provided for access to lift pit wherever required under regulations.

3.7 All electrical work from panel to lift controller and machine etc. shall be done by lift supplier and same should be included in his bid.

3.8 Providing of hoisting beam in the machine room for hoisting of equipment during erection and to facilitate maintenance in future including their fixing etc.
3.9 Providing and fixing of necessary sill supporting projection sheet steel fascia plates on all landing as per requirements.

4.0 Completeness Of Tender:-

All fittings, equipments, units, assemblies and accessories, hardware, foundation bolts, terminal lugs for electrical connections, cable glands, junction box and items which are useful and necessary for efficient assembly in operation and installation shall be deemed to have been included in the scope of work. The installation shall be complete in all details whether such details have been mentioned in the specifications or not.

5.0 Information To Be Supplied By Contractor After Award Of Work:-

The contractor shall provide the client his program bar chart for submission of preliminary drawing, manufacturing of equipment, installation, testing, commissioning and handing over. This should be correlated with the building completion program. The contractor shall be required to submit in triplicate the following drawings and information for approval of the client through architect/consultant before commencing the work:

5.1 All general arrangement drawings:

5.2 Details of foundations for equipments, load data location etc. of various assembled equipment as may be needed generally by other agencies for purpose of their work. The data will include breaking load on guides, reaction of buffers on lift pits, reaction on support points in machine room, lift well etc.

5.3 Complete layout dimensions for every unit/group of units with dimensions required for erection purposes.

5.4 Motor sizing calculation.

5.5 Brake selection calculation.

5.6 Single line/Schematic diagram of electronic control panel.

5.7 Layout of lift machine room showing electric control panel, elevator equipment etc.

5.8 Cable size calculation along with cable and equipment layout.

5.9 Rope size calculation.

5.10 Earthing layout.

5.11 Inspection manuals for equipment and accessories covered in the scope of supply.
3. TECHNICAL SPECIFICATION FOR PASSENGER LIFTS

1.0 Scope

This section deals with technical requirements of lift installation, its components, and safety devices various type of controls and methods of operation. The selection of a particular type of control and method of operation will be guided by the requirements in individual case such as nature of building, usage, occupancy traffic pattern etc., and has to be decided in individual cases.

2.0 Drive Machinery:

2.1 Electric Supply

The entire lift equipment should be suitable for operation at three phase, 415 V ±10%, 50 HZ ±3%, A.C electric supply. The supply for illumination and signaling equipment shall be 230 V, 1-ph A.C.

2.2 Gearless machine

The gearless machine shall consist of a motor, traction sheave and break-drum or brake disc completely aligned on a single shaft. Gearless machine shall be A. C. gearless with VVVF drive.

2.3

2.4 Sheaves:
Sheaves and pulleys shall be hard alloy, cast iron, SG iron or steel and free from cracks, sand holes and others defects. They shall have machined rope grooves. The traction sheave shall be grooved to produce proper traction and shall be of sufficient dimension to provide for wear in the groove. The deflector sheave shall be grooved so as to provide a smooth bed for the rope. The deflector or secondary sheave assemblies where used shall be mounted in proper alignment with the traction sheave. Such deflector sheaves shall have grooves larger than rope diameter as specified in clause 8 of IS 14665 (Part – 4 Sec 3): 2000. The size of all the sheaves shall be in accordance with clause 8.4 of IS 14665 (Part – 4 sec 3): 2000. Wherever it is necessary suitable protective guards may be provided.

2.5 Shaft Keys:

Shafts, which support sheaves, gears, coupling and other members, which transmit torque, shall be provided with tight fittings keys of sufficient strength and quality.

2.6 Brake:

Braking of the lift will be done by electronically varying the voltage and the frequency of motor feeding current (Variable voltage and variable frequency control) i.e V.V.V.F control. The electromagnetic holding brake will be applied only after the lift has come to a standstill.

The lift drive machinery shall be provided with an electro-magnetic brake or motor operated brake normally applied by means of springs in compression when the operating device is in off position. The brake shall be suitably curved over the brake drum or brake disc and provided with fireproof friction lining. The operation of brake shall be smooth, gradual and with minimum noise. The brake shall be designed to be of sufficient size and strength to stop and hold the car at rest with rated load. The brake should be capable of operation automatically by the various safety devices current failure and by the normal stopping of the car. The brake shall be released electrically. It shall also be possible to release the brake manually, such releasing requiring the permanent application of manual force so as to move the lift car in short stops. For this purpose suitable brake release equipment wherever necessary shall be supplied with each lift installation and the same shall be kept in safe custody to prevent misuse.
2.6.1 **Hand winding wheel or handle:**

At times of lift stoppage due to any reasons, it shall be possible to move the lift car to the nearest landing manually. The manual operation shall be by means of a winding wheel or handle mounted on the end of the motor shaft. The up or down direction of the movement of the car should be clearly marked on the motor or at suitable location. A warning plate written in bold signal red colour advising the maintenance staff to switch off the mains supply before releasing the brake and operating the wheel is to be prominently displayed.

2.7 **Bearings:**

Bearings shall be either of the anti-friction metal sleeve type with oil reservoirs, self, lubrication, oil gauges, capped filler openings and drains of the ball roller or sintered type subject to oil flood lubrication or grease lubrication.

Grease lubricated bearings shall have grease gun connections and drain plugs. The bearings and lubricant reservoirs shall be dust tight and shall incorporate effective seals to prevent leakage. The outer end of the bearings shall be closed with a removable oil tight plate. Thrust bearings shall be of the ball or roller type and shall have two sets of balls or rollers arranged to minimize backlash for efficient working.

3.0 **Type of Controls:**

3.1 **Single Speed Alternating Current Control**

A control for a driving machine induction motor, which is arranged to run at a single speed.

3.2 **Variable Voltage Variable Frequency**
Incoming mains ac power is first rectified to dc and then inverted to provide controlled
AC current to the elevator drive. Precision monitoring of motor speed and car direction,
position and load enable the pulse width of the ac power supplied to the motor to be
adjusted to ensure that elevator speed is maintained very accurately to an ideal profile.

4.0 Installation aspects:

4.1 Installation in machine room –

MACHINE ROOMLESS LIFT IS PROPOSED

4.1.1 Ventilation of machine room –

MACHINE ROOMLESS LIFT IS PROPOSED

4.1.2 Vibration, Isolation –

Vibration and isolation arrangement shall be provided to prevent transmission of
vibration to the building and structure.

4.2 General Illumination of Lift well

Suitable light points shall be provided in the lift well at a spacing of not more than 10
meters in between, starting at the ground floor. All the points should be group controlled
from the M/C room. The wiring shall be carried out in surface conduit as per General
Electrical Specification. One socket outlet shall be provided in the shaft for use by
maintenance personnel at a level slightly above the ground floor landing.

5.0 Guide rails

Guide rails shall be in accordance with clause 3 of IS: 14665 (Part 4 Sec2) 2000. Only
machined guide rails shall be permitted for cars for passengers and hospital lifts. Formed
sheet metal rails shall be used up to speeds of 1.75 mps for counter weight applications.
In the case of goods lifts, unmachined guides rails shall be permitted for the
counterweight for all speeds and for the cars only up to a speed of 0.5 m/sec. The guide rails shall be continuous throughout the entire travel and shall withstand without any deformation the action of safety gear with a fully loaded car.

Generally the guide rails shall be supported by brackets secured to the hoist way frame at each floor. The rails shall be securely fastened to the brackets or other supports by approved heavy rail clamps. All necessary guide rails packing or additional supports shall be provided to prevent guide rail deflection and stresses exceeding the prescribed limits. The stresses on the guide rail due to the horizontal forces imposed on it during loading, unloading and running calculated without impact, shall not exceed 1100 kg/sq. cm based upon the class of loading and the deflection shall not exceed 5 mm. The guide rail brackets, their fastenings and supports shall be capable of resisting the horizontal forces mentioned above, with the total deflection at the point of support not in excess of 3 mm.

Guide rails shall extend from pit floor to the underside of concrete slabs or roofing at top of the lift well. They shall be erected in plumb and parallel with a maximum deviation of 3 mm. All shimming required shall be of metal securely held in place. Jointing plates shall be so located as not to interfere with supporting clamps and brackets. The bolts shall be used with spring lock washers. The guide rail anchorage at pit floor must be made without puncturing the waterproofing. The expansion joints in the guide rails shall be so designed as to avoid jerks in the lift car. Machined guide rails shall have finished surfaces, which shall be coated with corrosion preventive compound, which shall be maintained till the commissioning of the installation. Before the car is placed in operation, the preventive coating shall be removed and the guide rails thoroughly cleaned and smoothened.

6.0 Lift Car

6.1 Car Frame

The car frame shall be in accordance with clause –4 of IS 14665 (Part 4 Sec 3): 2001 made of sheet steel of rigid construction to withstand without permanent deformation the operation of safety gear. The car shall be so mounted on the frame that vibration and noise transmitted to the passengers inside is minimized.
6.2 Car platform

6.2.1 The car platform shall be of framed construction and designed on the basis of rated load evenly distributed. The dimensions shall confirm to IS: 14665 (Part-1) 2000 unless otherwise specified. The flooring shall be smooth and of anti-skid surface.

6.2.2 A load plate along with overload alarm, giving the rated load and permissible maximum number of passengers (10) should be fitted in each lift car in a conspicuous position.

6.3 Car body

The car shall be enclosed on all sides by a metallic enclosure. The enclosure including the door shall withstand without deformation a thrust of 35 kg applied normally at any point and as per IS 14665 (Part 4 Sec 3) 2001. Ventilation openings if specified shall be as per IS 14665 (Part 4 Sec 3) 2001.

6.3.1 Stretcher guards/trolley guards made of PVC/Rubber extrusion housed in a stainless steel beading shall be fitted at suitable level(s) to rear / side panels for bed lifts / goods lifts.

6.3.2 Lift car door shall have a fire resistance rating of one hour.

6.3.3 Grounding switches, at ground floor level, shall be provided on all the lifts to enable the fire service to ground the lifts.

6.4 Car roof

The roof of the car shall be solid type capable of supporting a weight of at least 140 kg and as per IS 14665 (Part 4 Sec 3): 2001

6.5 Car Thresholds

Car entrance shall be provided with metal thresholds having a grooved surface. Thresholds for lifts having horizontally sliding car doors gates shall have machined or extruded guide grooves.
6.6 **Toe Guard Aprons**

The toe guard apron of gauge not less than 1.6 mm sheet may be provided extending at least 15 mm beyond entrance jambs at each side. The guards shall have a straight vertical face extending below the level of the finished car floor and not less than the depth of the leveling zone plus 7.5 mm. The bottom of guard shall extend 700 mm for lifts up to speed of 1.5 mps & 1000 mm for lifts above speed of 1.5 mps below vertical face and beveled at 15° angle from the vertical. It shall be seamed to car platform construction and be reinforced and braced.

6.7 **Clearance**

The clearance between the top of the car and soffit of the lift shaft roof, bottom of the car and the pit floor, the buffers etc., and the clearance between the car and the lift well, between the car and the landing sill, between two lift cars in the same shaft etc, shall be provided as per IS 14665 (Part 1, 2 & 4) and relevant lift rules mentioned in appendix – 1.

6.8 **Car Apron, Landing Thresholds and Sills**

An apron shall be fitted to the car platform such that no dangerous gap exists at any time when the landing door is opening. Thresholds and sill plates shall be provided at the landings also. The distance between landing sill and the sill on car platform shall not be more than 30 mm.

6.9 **Inter-communication system**

6.9.1 Though para 8.4.3 of IS 14665 (Part 2 Sec 1): 2000 recommends for provision of either an emergency signal or a telephone inside the car but as a general experience, it is seen that over a period of time these devices become inoperative due to one reason or the other. Therefore, in order to have at least one device of communication functioning at all the times, as an alternative arrangement, provision of both i.e. telephone with minimum two connections- one at the operator’s room and other at guard room and the emergency signal with re-chargeable batteries as source of supply shall be made in the lift cars.

6.9.2 The device used for emergency signals should incorporate a feature that gives immediate feedback to the car passengers that the device has worked properly and the signal has
been passed on to the intended agency, this shall be achieved by pressing of button from control room which shall give audio signal to the passengers in the car.

6.9.3 Provision of group indicator panel in the control room shall be made to indicate working of lifts.

6.9.4 Emergency Power Supply for lift car

This shall include suitable secondary battery with trickle / boost charge arrangement and inverter power pack with necessary contactors for supplying the light fixtures in the lift car, the same battery shall also feed the alarm bell and communication equipment. This battery backup shall function minimum for 90 minutes in case of power failure.

6.10 Rating and Instructions

Inside the lift car, the lift supplier shall also provide a stainless steel metallic plate indicating the rated load and detailed instructions for the passengers. This shall be mounted at a suitable place.

6.11 Lift Car Interior Finish

a. Car enclosure shall be of brushed satin stainless steel mat finish. Side paneling also meet brushed satin stainless steel finish. Rear panel with 6mm thick ceiling panel with stainless steel finish. The ceiling panel shall be with 4 down lights & acrylic diffuser for fluorescent lights in stainless steel paneling. Floor with 12mm thick granite flooring laid to pattern over 20mm thick plywood backing/sound isolating platform having 100mm high stainless steel skirting. There shall be pressure fan inside the lift. The owner reserves the right to take a plain car shell and do the interior furbishment as per details supplied by consultant, limiting the weight of the interiors to 200 KG. Tenderers need to mention the lift cost without interiors separately.

b. Other Cabin Features

1. Handrails on two sides and on the rear side walls.
2. Ventilation by motor driven fan built in ceiling panel.
3. Telephone cabinet with phone and lead up to the machine room. Lift phone shall be connected to reception and security room.
4. Single light-ray with photo-electric cells across the car entrance.
5. A friction clutch for passengers trapped between doors.
6. Door reversal feature in case of obstruction of doors.
7. Built-in-music system
8. CCTV camera is to be provided inside the lift car, to be linked with BMS system
9. Provision for Floor Level indication and Mode indication (on/off/service), to be viewed from central security panel. This will have to be coordinated with BMS system.

6.11.1 Operating Panel Inside the car

The car-operating panel shall be metal, flush mounted and duly finished to match the car interior décor and shall contain all the devices as may be specified depending upon the type of operation required. In addition separate illuminated panel for indicating the floor and direction may be provided on the top or the doorway. All switches shall be fade proof and the devices shall be of suitable quality.

Each device and its operating position shall be legible fade proof and marked.

The car operating panel shall contain the following:

a. A series of push buttons numbered to correspond to the landing served which will light up while in service.

b. An emergency “stop button”.

c. An emergency call button connected to a bell to serve as an emergency signal.

d. An alarm buzzer.

e. A non stop priority control button.

f. A door open & close button.

g. A fan switch.

h. Overload indicator with buzzer.

i. Ventilation slots at top and bottom of panel as per requirement.

j. Name plate of manufacturer with load and capacity data.

k. Intercom system built into the panel.

l. Auto-emergency light.
m. Audio speaker for built-in music system & for car next.

7.0 Car and landing entrances

7.1 The car and landing doors shall be of flush type sheet only for power operation. The flush type may further be of single sliding, center opening or two-speed construction. Power operated car and landing door shall be so designed as not to injure any person during their closure by means of provision of a safety pressure switch, which shall cause the doors to reopen on the slightest pressure. In case of power-operated doors, it shall be possible on power failure, to open them from the car side. All the openings for passenger lift shall be 2000 mm clear in height. The door opening and closing shall be accomplished smoothly and quickly without undue noise, vibration and shock and their movements shall be cushioned and checked at both limits.

7.1.1 The car door shall be hung from the top M.S. fabricated track and means shall be provided to prevent the door from jumping of the track. The door shall be provided with two point’s suspension sheave type hangers suitable for the type of door operation specified. The hangers shall be securely fastened on bearings mounted on a malleable iron or steel bracket. Arrangement shall be provided for vertical and literal adjustment of car doors. The sheave shall move on a M.S. fabricated track so shaped as to permit free movement of sheaves with regard to vertical adjustment of sheave bracket or housing.

The car door shall be center opening horizontal sliding.

7.1.2 A potential cause of accidents could be the attempts made to open the landing door lock of lower floor in case the car stops away from floor level due to power failure. Since the car door can be opened in case of power failure so as to improve the ventilation and avoid claustrophobic situations etc. as outlined in IS 14665 (Part 2 Sec 1): 2000 para 10.9.1, there is a tendency among trapped passengers to make attempts to open any accessible landing door which can be opened by a electromechanical latch in the landing doors as the lock is accessible through open car doors. This attempt in panic may result in accidental fall into the lift pit. In order to ensure that the trapped passenger do not attempt opening the landing door, the electromechanical latch should be so designed that it is inaccessible or invisible to the passengers in the car.
7.1.3 In order to avoid accidental closure of door while boarding or alighting the car, a temper proof infrared curtain covering almost the entire height of the doors should be provided in the lift doors.

7.1.4 CALL BUTTON AT LANDINGS: An ‘up’ push button and a ‘down’ push button at each intermediate landing and a single push button at each terminal landing shall be provided to call the lift car in a particular landing for traveling in desired direction. The push buttons shall have call registration lights and shall illuminate when a button is momentarily pressed to indicate that the call is registered and the direction of the call is registered. The button shall remain illuminated until the call is answered. The top covers of landing push button boards shall be of stainless steel.

7.2 Provision as per Barrier Free requirements

7.2.1 A hand rail not less than 600 mm long at 900 mm above floor level shall be fixed adjacent to the control panel.

7.2.2 The time of an automatically closing door should be minimum 5 seconds and the closing speed should not exceed 0.25 M/Sec.

7.2.3 The interior of the cage shall be provided with a device that audibly indicate the floor the cage has reached and indicate that the door of the cage for entrance/exit is either open or closed.

7.3 Landing doors

Each landing door shall be complete with locks, headers, sills, frames, rims, hanger supports with cover plates, fascia plates etc. The finished work shall be strong, rigid and neat in appearance. Plain surfaces shall be smooth and free from warp or buckle. Moulded surfaces shall be clean out, straight and true. Fastenings shall be concealed from the face side of the material. Steel Sills shall be provided with a suitable nosing of approximately 25 mm depth on the shaft side.

The opening for the landing gates or doors shall not be wider than that of the lift car. In the case of bi-parting type steel doors, the locking of the doors should be positive.

7.4 Car landings

7.4.1 All the lift car landings shall be well lit to an illumination level of 150 lux and shall be free from obstructions. The control for landing lights and the sign lights shall be tamper proof. Wherever stand by power supply is available, these lights shall be connected to standby circuits also.

7.4.2 For the purpose of identification, the lift number should be displayed outside the landing door, inside the car and in the machine room. This numbering may be used as reference
for the purpose of routine/preventive maintenance, for operating from machine rooms and reporting of any incidents etc.

7.4.3 Instructions

Detailed instructions as specified for guidance of passengers shall be prominently displayed inside the car by contractor and outside the car at all landings by the client. The Braille signage will be posted by the client outside lift lobby at all landings for the lift meant for barrier free requirements physically challenged people.

7.4.4 It is seen generally, that though the instruction on Do’s and Don’ts, as per provision of the relevant IS, are displayed in lift cars but the same are either displayed in inconspicuous location, or are very small in size or are in one language only. To make these instruction serve the intended purpose, and not a more compliance of relevant IS clause; that these instruction should be displayed at a conspicuous location with larger and understandable script and should be written in Hindi, English, and regional language (where official regional language is notified.)

7.4.5 Leveling

All lift (S) shall be incorporated with suitable floor leveling devices. In case of lifts with automatic power operated doors and A.C. VVVF controller a separate level device for automatic leveling with leveling accuracy of + or – 5 mm shall be incorporated.

7.4.6 Counter Weight

The counter weight for lift cars shall be in accordance with clause 6 of IS 14665 (part 4-sec-3) 2001 and shall be designed to balance the weight of empty lift car approximately 50 per cent of the rated load. It shall consist of cast sections firmly secured in relative movement by at least two numbers steel tie rods having lock nuts/split pins at each end and passing through each section and Housed in a rigid steel frame work. Cracked and broken sub weights shall not be accepted.

7.4.7 Counter Weight Guards

Guards of wire metal/mesh shall be provided in the lift pit to a suitable height above the pit floor to eliminate the possibility of injuries to the maintenance personnel.

8.0 Guide Shoes

Two numbers of guide shoes at the two numbers at the bottom shall be provided on the lift car and counter –weight.

8.1 Type of Shoes

8.1.1 For passenger lifts
(A) For speed up to 1.5 mps sliding guide shoes shall be used. Sliding guide shoes for car shall be always flexible and for counter weight, solid shoes can be used up to 1.0 mps.

(B) For speeds more than 1.5 mps roller guide shoes shall be used for car and counter weight.

8.1.2 For good lifts solid shoes can be used.

8.2 Flexible Type/Solid Type Sliding Guides Shoes.

The car shall be provided with solid or spring loaded swiveling guide shoes with renewable finer, where the lift car speeds are up to and including 1.0 MPS The cars with speeds beyond 1.0 MPS shall be provided with spring loaded guide shoes renewable liners or the guide shoes shall be of roller type.

8.3 Roller Type Guide Shoes

Each roller type shoe shall be of an approved type consisting of rollers assembled on a substantial metal base and mounted as to provide continuous contact of all rollers with the corresponding guide rail surfaces under all conditions of load and operation. The rollers shall run on the three finished guide rail surfaces and shall operate quietly.

8.4 Mounting of Guide Shoes

Guide shoes shall be provided with adjustable mountings & shall be rigidly secured in accurate alignment at the top and bottom on each side of the car sling and counter weight frame construction. When oil buffers attached to the bottom of counter weight are used, additional guide shoes shall be provided on each side of the buffer frame. The design of guide shoes and car safety device shall be coordinated so as to ensure the provision and installation of equipment with clearance specified in clause 5.7 of this chapter.

9.0 Lift Ropes – IS 14665 (Part 4 Sec 8)-2001

Round strand steel wires ropes made from steel wire ropes having a tensile strength not less than 12.5 tonnes/cm² and of good flexibility shall be used for lift. Lubrication between the strands shall be achieved by providing impregnated hemp core. The lift ropes shall confirm to IS 14665 (Part 4 Sec 8): 2001 and the following factor of safety shall be adhered to. The minimum diameter of rope for cars and counter weight of passenger and goods lift shall be 8 mm.

<table>
<thead>
<tr>
<th>Rope Speed of Passenger &amp; Goods Lifts (m/s)</th>
<th>Factor of Safeties</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 or less</td>
<td>8.0</td>
</tr>
<tr>
<td>Exceeding 0.5 to 1.0</td>
<td>8.6</td>
</tr>
<tr>
<td>Exceeding 1.0 to 2.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Exceeding 2.0 to 3.5</td>
<td>11.0</td>
</tr>
</tbody>
</table>
9.1 **Rope fastenings**

The ends of lift rope shall be properly secured to the car and counter weight hitch plates as the case may be with adjustable rope shackles having individual tapers babbitt sockets, or any other suitable arrangement. Each lift rope shackle shall be fitted with a suitable shackle spring, seat washer, shackle nut & lock & shackle nut split pin.

9.2 **Guards for lift ropes**

Where lift rope runs round a sheave or sheaves on the car and/or counterweight of geared/gearless machine suitable guards shall be provided to prevent injury to maintenance personnel.

9.3 **Number & size of ropes**

The contractor must indicate the number and size of lift ropes and governor ropes proposed to be used, their origin, type, ultimate strength and factor of safety. The contractor should furnish certificate of ropes from the rope manufacturers issued by competent authority.

10.0 **Safety Equipments:**

Every lift installation shall necessarily be provided with the following safety features:

10.1 The safety gear shall be provided in accordance with IS 14665 (Part 4 Sec 4): 2001, each type of car safety shall be actuated by a speed governor.

10.2 **Governor:**

The car safety shall be operated by speed governor rope suitably connected to the car and mounted on its own pulleys. The rope shall be maintained in tension by means of weighted or spring loaded tension sheaves located in the pit. The governor rope shall be not less than 6 mm in dia and shall be made of steel or phosfobronze. These shall be in accordance with IS 14665 (Part 4 Sec 4): 2001. Governor for car safety gears shall be adjusted to actuate the safety gear at the following speeds:

(a) For rated speeds up to 1 m/s maximum governor tripping speed shall be either 140 percent of rated speed or 0.88 m/s, whichever is higher. For rated speed above 1 m/s maximum governor tripping speed shall be 115 percent of the rated speed plus 0.25 m/s.

(b) Minimum governor tripping speed shall be 115 percent of the rated speed.

The governor shall be of “V” groove wheel design and only wheel is stopped to actuate the car safety upon a pre-determined over speed downward damaging the rope.
10.3 The governor, rope and sheave shall be so located so as to minimize danger of accidental injury to the equipment.

The governor sheave and tension sheave shall be according to clause 2.4 and the sheave bearing shall be according to clause 2.7 of this Chapter.

The requirement for field-tests on car safely and governor and for drop tests to sliding type car safeties shall be as specified in section 4 of this specifications.

10.4 Terminal Limit switches

10.4.1 Terminal switches

These shall stop the car automatically at terminal floors within the top and bottom permissible over travel. They shall act independently of the operating devices, the ultimate limits switches and the buffers. They shall be in accordance with clause 8 of IS: 14665 (Part 3 Sec 1): 2000.

10.4.2 Terminal stopping devices located in shaft or in the car and operated by cams shall be fitted with rollers having a rubber or other approved composition to provide silent operation when actuated by the cam. When the lift car cross head is 60 cm from the nearest obstruction above it, no projection on the car shall strike any part of the overhead structure.

10.4.3 Lifts with speeds over 1.25 meters/second shall have the normal terminal stopping device located on the car or on the guide rails or in the machine room.

10.4.4 Ultimate Terminal Switches

These shall be provided in accordance with the statutory requirements and standing practices. When provided these shall arrange to stop the car automatically within top and bottom clearances independently of the normal terminal switches but with the buffers operative. These shall be in accordance with clause 8 of IS: 14665 (Part 3 Sec 1)-2000.

10.5 Buffers – (IS 14665 (Part 4 Sec 1)-2001)

Suitable spring buffers shall be installed to stop the car and counter weight at the extreme limits of travels. Buffer must be suitable for installation in the space available

Buffers shall be oil resistance rubber pad type for speeds up to 0.25 mps and spring / oil type for speeds up to 1.5 mps and only oil type for speeds higher than 1.5 mps.

Buffers shall be suitable for installation in the space available. Buffer anchorage at pit floors shall be installed avoiding puncturing of waterproofing.

Oil buffers of the car and counter weight shall be of the spring return type or of gravity type.
The partial compression of spring return oil buffers when the car is in level with terminal landing will not be acceptable.

All buffers shall be tested at manufacturer’s works and a copy of the test report shall be submitted.

When the lift car rests on fully compressed buffers there shall be at least 60 cm clearance between the lowest point in its car frame and any obstruction in the pit exclusive of buffers and their supports. Similarly when the lift car crosses head is 60 cm from the nearest obstruction above it, no projection on the car shall strike any part of the overhead structure.

The contractor must indicate the name of buffer manufacturers, buffer stroke & certified maximum loads.

10.6 Door Locks

Electro – mechanical door lock shall be provided for the entire landing doors and they shall be such that the doors cannot open unless the car is at rest at the particular landing. It shall not be possible to move the car unless all the landing doors and the car door are closed and locked. This requirement however does not apply when the lift car is provided with automatic leveling devices and in such cases, it shall be permitted to move the car with both the doors open in the leveling zone for the purpose of leveling.

All the locks and contacts shall confirm to IS: 14665 (Part 1 Sec 6)-2001 shall be positive and pass the prescribed endurance and reliability test from a recognized testing laboratory. They shall be so located as to be inaccessible to un-authorized personnel. The electromechanical latch should be so designed that it is inaccessible or invisible to the passengers in the car.

10.7 Other Safeties

Besides these safety devices mentioned above, motor operated electro-mechanical brake (Clause 1.6) counter-weight guards (Clause 8.1) alarm bell, emergency door lock release operating key and associated safety and other safety requirements shall also be included.

11.0 Lift operations

The operation shall be duplex full collective-selective with or without attendant.

11.2 Automatic cum Attendant Operation

Single Automatic Push Button with/ without attendant – The operating devices for this operation shall incorporate in the car control panel, car buttons corresponding to the various landings served and single landing button at each landing, all electrically connected to controller governing floor selection, direction of travel, acceleration, retardation etc.
This system shall be so arranged that when the car is not in use, on pressing a landing call button the car shall start automatically provided all the doors are closed. During the movement of the car and also when car stops at floor landing, other landing call buttons are in operative for a predetermined time. The pressing of a car button shall automatically start the car and send it to the desired landing. In all the cases, the starting of the car is contingent on the establishment of landing door and car inter-lock circuits. To indicate the availability, or ‘in use’ light shall be placed in the landing call button panel. When light shall be ‘OFF’ the passenger shall be able to call the car. In case of manual operated door if the lift is standing at any landing with doors open (when not in use), the pressing of the landing call button shall ring a bell, fitted at the top of car to attract the attention of the people soliciting their help for closing the lift door if any one of the them happens to be near the lift.

In case of power operated doors, the landing and car doors shall be arranged to open automatically when the car is parked at landing after all the calls are served and the lift is parked at any landing. The doors can remain open or alternatively if desired, the car shall be arranged to close after a pre-determined time unless closing is prevented or interpreted by the car doors re-opening device or the door open button.

The lift shall be suitable for dual operation with or without attendant by the provision of key operated transfer switch indicating ‘attendant’ and ‘automatic’ positions. During ‘attendant’ operations the landing call shall be disconnected from the control system and shall be connected to an enunciator in the lift car. The attendant shall then operate the car to answer the registered calls. This operation is recommended for single speed control lift for low rising having a single lift installation.

11.3 Simplex Selective Collective Operation with / without Attendant

Automatic operation by means of one button in the car for each landing level served and by up-and-down buttons at the landings, wherein all stops registered by the momentary actuation of the car made as defined under non-selective Automatic Operation but where in the stops registered by the momentary actuation of the landing buttons are made in the order in which the landings are reached in each direction of travel (irrespective of the sequence in which the buttons have been actuated). With this type of operation, all ‘up’ landing calls are answered when the car is traveling in the up direction and all ‘down’ landing calls are answered when the car is traveling in the down direction, except in the case of the uppermost or lowermost calls which are answered as soon as they are reached in-respective of the direction of travel of the car.

11.4 Duplex Collective Selective Operation with/without Attendant

The control system for this operation shall be similar to the one described under simplex selective-collective operation except that in this system there shall be two lift cars in adjacent wells. It shall be arranged to co-ordinate both cars for efficient service and prevent them from answering the same calls by the provisions of only one set of landing call button fixtures. It shall automatically assign each call to the car that will be in the best position to answer promptly. The system shall be so arranged that when the cars idle, normally one car will be parked at the lower main landing with its doors closed or open
and the other car shall be free car parked with the doors closed or open to the landing where it answered its last call, and shall be the one to attend to the nearest call.

Each car shall always respond to calls registered by its own car call buttons. When either car parked out of service for any reasons the other car shall function as single car (simplex) selective collective. Besides the control system shall also be arranged for independent service from inside the car.

A by-pass button (non-stop button) shall also be provided inside the car to enable the attendant to by-pass any landing if the car is full or if otherwise so required.

The two lifts shall be arranged with or without attendant operation and shall function as described using single car selective-collective operation. When the transfer switch is in the attendant position the operation of the cars shall be identical with that described for automatic operations except that:

(a) Closing of doors and starting of cars shall be initiated by the car buttons only;
(b) Buzzers and directional lights in the car are operative, and
(c) Landing by-pass shall be effective.

The pressing of an up or down landing call shall illuminate appropriate direction indicator in the car panel, which is to answer that call and if the doors are open shall also sound buzzers as a signal to the attendant. If both cars are parked at the lower landing the above signals shall be given to the car, which has been at the floor for longest time.

12.0 Automatic group supervisory control

12.1 General Operating Principle

The calls registered inside the car as well as the landings are answered in the sequence in which the floors are reached irrespective of the sequence in which the buttons have been pressed. Only one car will stop in response to any one landing call and will be the nearest car traveling in the corresponding direction of the call. While this car is stopping at this landing, the call will be automatically cancelled to prevent other cars stopping against the same call.

12.2 Automatic selection of traffic programme

The group supervisory control continuously examines traffic conditions in the building and automatically puts into operation the programme that can best cope with the demand at any particular time. This is fully automatic and requires no supervision or attendant. To suit the traffic demand in the building, suitable traffic programmes can be selected for inclusion in this control. The following are the traffic programmes available:

(a) Up Peak Programme,
(b) Down Peak Programme,
(c) Up Down Interfloor Programme, and
(d) Night Programme,

(a) Up Peak Programme:

The group supervisory control responds to the increasing influx of passengers at the main landing in the morning hours, at the start of work, by automatically switching on the up-peak programme. The cars are dispatched from the main landing automatically at a predetermined interval after the previous dispatched car. The ‘Leaves First’ signal is transferred instantaneously from the car dispatched to another car at the main landing. The car answers the registered calls in the natural sequence of the floors and returns directly to the main landing after last passenger has been discharged. At the main landing they are kept for a predetermined time for taking new passengers. However, a car starts its up travel the moment it becomes fully loaded, without waiting for the dispatch interval to lapse.

(b) Down Peak Programme:

An intense traffic flow from the upper floors towards main landing will automatically switch on the down peak programme. The cars, when fully loaded at upper floors, travel directly to the main landing and after discharging the passenger, immediately start up to answer further down landing calls. The down landing call, which has by-passed gets a priority over other down calls, which ensures equal service to all floors.

(c) Up-down Interfloor Programme:

A steady traffic between main floor and upper floor, and between floor-to-floor causes automatic switching on of the Interfloor programme. Specific cars are assigned to answer specific calls by traffic analyser so that the calls are handled most efficiently. The cars are so well distributed that every call gets equal service with short waiting intervals.

As soon as the number of calls drops to occasional calls only such as at night, the cars get automatically parked in their assigned zones to give personalized service with minimum lift travel. If no calls are registered for some time the motor generator sets are automatically switched off.

(d) Night Programme:

When the traffic ceases to occasional call only, the supervisory control automatically switches over to night programme. All cars remain parked at the main landing with doors closed, but are at all times ready for operation. One of the lifts has its ‘Leave First’ signal lighted. On pressing of call button at the main landing, the doors of this particular lift open and the passenger can travel with the lift. The same lift also responds to landing calls from above. The moment this car leaves the main landing ‘Leave First’ signals is transferred to a second lift. Further passengers entering main lobby will take this second lift. This second lift also responds to landing calls from above if one lift can no longer cope with the demand. After these lifts have answered their calls, the one reaching the
main landing last will retain the ‘Leave First’ Signal. Thereby, the service is practically confined to one lift alone and motor generator sets of the remaining lifts remain switched off. If no calls are registered for sometime, the motor generator of the stand by lift also automatically is switched off. The motor generators will start up again, the moment the call is received. The number of lifts going into action is automatically regulated to just so many as are necessary to cope with the occasional traffic surge.

If any of the cars in the group develops any defect it shall be automatically disconnected from the group control until it is rectified.

In the event of failure of automatic dispatch system the lifts shall function by auxiliary means to avoid any disruption of service.

Audiovisual indication shall be provided to bring such failures to notice. The lifts shall be designed for attendant operation as described under (simplex) selective collective operation car except as follow:-

(a) The indicating lights in car shall be operative to inform the attendant when to start loading a car at a terminal and when to leave the terminal.

(b) Landing call by pass switch and car reversal switch and switches shall be effective and load-weighing devices shall be inoperative.

(c) Call above signal shall be illuminated whenever a call is registered at a landing above the car location indicating to attendant that car is to proceed upwards. When the highest call has been answered the light shall be extinguished indicating to the attendant that when the car is started it will proceed downward.

13.0 Controlling Equipment

The movement of the car shall be electrically controlled by means of a controller located at the terrace floor stop, in absence of machine room.

13.1 Control circuits

The control circuit shall be designed to the type of lift specified for safety operation. It shall not be possible to start the car unless all the car and landing doors are fully closed and landing doors locked. The circuit shall have an independent fuse protection for fault and over loads and be arranged so that earth fault or an open circuit shall not create unsafe condition. The circuit shall be so arranged that for the stoppage of the car at specified landing or for action of a contactor by emergency switches or operation of safety gears the system shall not depend upon the completion or maintenance of an electrical circuit to cut off power supply and apply the brakes. This requirement is not applicable to dynamic braking and speed control devices.

13.2 Terminal Boards

All wiring external control circuits shall be brought to a terminal board with means of identification of each wire. Metallic / plastic identification tags shall invariably by
provided. All connections of wires to terminal boards shall be adequately clamped or screwed.

13.3 Auxiliary Switches

13.3.1 Emergency Stop Switches:

On top of the lift car an emergency stop switch shall be provided for use by maintenance personnel. Stop switch shall be provided in the machine room. Operation of these switches/buttons shall cancel all the registered calls and landing calls for that particular lift.

13.3.2 Maintenance Switch on Top of the Car

For purpose of inspection and maintenance, maintenance switch shall be provided on top of the car. The control circuitry shall be so arranged that in the event of the operation of this switch:

(a) The car speed shall be less than the rated speed not exceeding 0.85 meters/sec.

(b) The car movement shall be possible only on the application of the continuous pressure on a button. It shall be so mounted to prevent any inadvertent operation.

13.3.3 Fireman Switch:

Fireman switch with glass to break for access shall be provided at ground or main floor for all the lifts. The operation of this switch shall isolate/ or cancels all calls to all the lifts and the lift will stop at the next nearest landing if traveling upward. The doors will not open at this landing and the lifts will start traveling to ground floor. If these were already traveling down, they will go straight to ground floor direct without stopping enroute.

13.3.4 Inspection Facility:

An inspector’s change over switch and set of test buttons shall be provided in the controller. Operation of the inspector’s change over switch shall make both the car and landing buttons inoperative and permit the lift to be worked in either direction from machine room for test purposes by pressing corresponding test button in the controller. It shall not however interfere with the emergency stop switches inside the car or on the top of the car.

13.3.5 Safety Line Indicators:

If specified visual tell tale lights may be provided to monitor the conditions of faults in the safety line of the lift for easier fault finding. These indicators will remain lit when safety circuits are normal.

One indicator shall be provided for each safety on the controller. If any indicators fail to light up as the lift proceeds in its sequence of operation, there shall be visual indication of
the safety line open circuit and also its location for easier fault finding.

14.0 Control Wiring

14.1 Wiring in Machine Room:

14.2 Power wiring between the controller and main board controller to various landings shall be done in heavy gauge conduit or metal duct & shall confirm to I.E. Rules 1956 and General Specifications for electrical works. Following general principles shall be followed in wiring:

(a)
(I) Control cables carrying DC and power cable carrying AC shall not be run in the same conduit or metal duct and they shall be laid as per I.E. Rules.

(II) Metal duct with removable inspection cover shall be preferred.

(III) In case of control cables also the harness shall be separate as far as feasible for separate functions and laid separately in suitably dimensioned metal duct or in a separate conduit such as the signaling, lamp indication and safeties. Control cables for different voltages in the lift installation works should be laid as per I.E. Rules.

(b) At least 5 percent with a minimum of 5 unconnected spare wires shall be available out of all the lines to be provided in the wiring harness from the midway junction box to the machine room.

(c) There shall be master isolating switch Fuse associated with the controller heavy duty load break, quick make quick break type TP&N preferably interlocked with controller cabinet door. Isolator handle shall have provision for external locking in off position.

All relays shall be suitable for lift service and shall in operate adequate contact wipe for reliable operation. Relays shall operate satisfactorily "Between" 80 percent to 100 percent of their voltage.

Main motor contactors shall be suitable for A.C. duty. Tenderer shall be required to furnish full details of make, type, applicable standard, voltage and current rating, duty class, type and routine test done etc., on contactors and relays. Copies of type test certificates and other test certificates shall also be furnished by the successful tenderer.

All cables shall be with copper conductors and flame retardant or PVC insulated of appropriate size. The cables feeding motor and in heavy current flow paths shall be so selected that the size matches the protecting fuses and will not result in more than 2 percent voltage drop from the main board to the terminals of motor. Control cable shall not be less than 0.5 sq.mm. or equivalent if stranded; where installation of heavy gauge conduits present difficulties, short lengths of flexible conduits will be permitted but effective electrical continuity and earth bonding shall be ensured. Ferrules shall be slipped at the ends of all cables as per standard control wiring practice. All terminal
blocks shall be suitably marked.

14.2 Trailing Cables:

A single trailing cable for lighting control and signal circuit is permitted, if all the conductors of this trailing are insulated for maximum voltage running through any one conductor of this cable. The lengths of the cables shall be adequate to prevent any strain due to movement of the car. All cables shall be properly tagged by metallic/plastic tags for identification. No intermediate jointing shall be permissible in the trailing cable.

Trailing cables shall run from a junction box on the top of the car to a junction box located in the near mid point of travel and from these junction boxes conductors shall be run to the various locations.

Trailing cables exceeding 30 meters in length shall run so that the strain on individual cable conductors will be reduced to a minimum and the cables are free from contact with the car counterweight, shaft walls or other equipment.

Trailing cables exceeding 30 meters in length shall have steel supporting fillers and shall be suspended directly by them without rubbing over other supports.

Cables less that 30 meters in length shall have no-metallic fillers and shall be suspended by looping cables around supports of porcelain spools type or equivalent.

5 percent of the total capacity subject to a minimum of 5 wires shall be available unutilized in the trailing cable everywhere suitably distributed between various functions.

14.3 Earthing:

Metal frames and all metal work of the lift controller frame etc. shall be earthed with double earth leads taken to the earth bar. Looping shall be permitted if such routing is feasible all other individual metallic framework of components etc., shall be loop earthed.

14.4 Miscellaneous

Principle of segregation function wise shall be accepted as far as possible in the general arrangement of components. All terminal blocks shall be of 650 V grade.

14.5 Controller Casing:

The controller unit comprising of the main circuit breaker adjustable overload and phase reversal and phase failure protection all the circuit elements transformer, rectifier for D.C. control supply, inverter power pack, terminal blocks etc., shall be enclosed in an insect proof, sheet steel floor or wall mounted cabinet with hinged doors at front or at both front and rear. Proper warning boards and danger plates shall be provided on both sides of the controller casing. Sheet steel used for controller cabinet shall not be less than 18 gauges and shall be properly braced where necessary. Suitable gland plate shall be provided for cable entry. The battery for the charger unit shall be suitably placed in the machine room.
All sheet steel work shall be painted with two coats of synthetic enamel paint of suitable shade both inside and outside over two coats of zinc primer.

14.0 CONTROL PANEL

Each lift shall be provided with one control panel. Control lift panel shall have MCCBs of adequate rating to receive owners 415 V, 50hz,3-ph,4 wire A.C power supply and if required 240 V AC single phase supply also.

a. Control panel shall be provided with ammeter, voltmeter and selector switches on incoming side.

b. The panel shall be complete with Thyristorstachogenerators, transducers with fuses, over load relays, single phasing preventor, phase reversal protection relay, timer, relay, auxiliary relay, push button, pilot lamp, control components etc.

c. Power contactors for A.C circuit shall be triple pole electromagnetic A.C 4 duty with minimum 2NO+2NC auxiliary contacts and for DC circuit there shall be of double pole electric type DC-3 duty with 2NO+2NC auxiliary contacts.

d. Electronic components contact system shall be free from false alarm operation due to vibration and mechanical shocks. All electrical contacts shall be of silver or other similar cadmium metallic alloy, and shall be capable of withstanding 10,000 operations.

e. Electronic card facilities shall be of modular design using electronic printed circuit boards to facilitate easy replacement of faulty circuit with spare cards.

f. Electronic components and cards shall be compatible and suitable for conditioned environment for satisfactory operation. All components shall be clearly and unambiguously marked for proper identification to facilitate maintenance.

g. Ready accessible and clearly marked test points shall be provided in all important modules and circuits.

h. Heat dissipation components shall not be mounted on PCBs to avoid damage to PCBs and loosening of soldered connections due to heat.

15.0 Lift Rope Compensation

The lift rope compensation for lift travel shall be provided for lift travels beyond 40m in all cases.

16.0 Quality Assurance

Quality assurance shall follow the requirements of owner/consultant as applicable. Quality assurance involvement will commence at enquiry follow through to completion
and acceptance thus ensuring total conformity to purchasers’ requirements.

17.0 Deviation

Deviation from specification must be stated in writing at the quotation stage.

In absence of such statement, it will be assumed that the requirements of the specification are met without exception.

16.1 Automatic Rescue Devices (ARD) – (Mandatory)

The ARD shall have the following specifications:

16.2 ARD should move the elevator to the nearest landing in case of power failure during normal operation of elevator.

16.3 ARD should monitor the normal power supply in the main controller and shall activate rescue operation within 10 seconds of normal power supply failure. It should bring the elevator to the nearest floor at a slower speed than the normal run. While proceeding to the nearest floor the elevator will detect the zone and stop. After the elevator has stopped, it automatically opens the doors and parks with door open. After the operation is completed by the ARD the elevator is automatically switched over to normal operation as soon as normal power supply resumes.

16.4 In case the normal supply resumes during ARD in operation the elevator will continue to run in ARD mode until it reaches the nearest landing and the doors are fully opened. If normal power supply resumes when the elevator is at the landing, it will automatically be switched to normal power operation.

16.5 All the lift safeties shall remain active during the ARD mode of operation.

16.6 The battery capacity should be adequate so as to operate the ARD at least seven times a day provided the duration between usages is at least 30 minutes.
4. TESTING AND INSTALLATION

1.0 Test at Site:

(a) Leveling Test:

Accuracy of the floor leveling shall be tested with the lift empty, fully loaded.

The lift shall be run to each floor while traveling both in upward and downward directions and the actual distance of car floor above/below landing floor shall be measured. In each case there shall not be any appreciable difference in these measurements for leveling at the floors when the car is empty and when it is fully loaded.

(b) Safety Gear Tests:

Instantaneous safety gear controlled by a governor should be tested with contract load and a contract speed, the governor being operated by hand. Two tests should be made, however, with wedge clamp or flexible clamp safeties, one with contract load in the car and the other with 68 kg (equivalent to one person) in the car. The stopping distance obtained should be compared with the specified figures and the guides, car platform, and safety gear should be carefully examined afterwards for signs of permanent distortion.

Counterweight safety gear should be tripped by the counter weight governor and the stopping distance noted. In this case, however the governor tripping speed should exceed that of the car safety governor but by not more than 10 percent.

During the safety gear tests, car speed (from the governor or the main sheave) should be determined at the instant or tripping speed with that stated in IS. The governor jaws and rope should be examined for any undue wear.

(c) Contract Speed:
This should be measured with contract load in the car, with half load with no load, and should not vary from the contract speed by more than 10 percent. The convenient method is by counting the number of revolutions, made by the sheave or drum in a known time. Chalk mark on the sheave or drum and a stop switch will facilitate timing but care must be exercised to ensure that no acceleration or retardation periods are included. If the roping is 2 to 1 the sheave speed is twice the car speed. Alternatively, the speed can be measured by a tachometer applied directly to shaft immediately below the sheave.

(d) **Lift Balance:**

After the above test, some of the weight shall be removed until the remaining weights represent the figures specified by the tendered. With this condition car at half way travel the effort required to move the lift car in either direction with the help of winding wheel shall be as nearly as can be judged by the same.

(e) **Car and Landing Doors Interlocks:**

The lift shall not move with any door open. The car door relay contact and the retiring release cam must be tested. The workings of the door operation and the safety edges and light equipment if any provided shall also be examined.

(f) **Controllers:**

The operation of the contactors and the interlocks shall be examined and it shall be ascertained whether all the requirements have been met.

(g) **Normal Terminal Stopping Switches:**

These shall be tested by letting the car run to each terminal landing in turn, first with no load and then with contract load by taking measurements, top and bottom over travels can be ascertained.

(h) **Final Terminal Stopping Switches:**

The normal terminal stopping switches shall be disconnected for this test. It shall be ensured that these switches operate before the buffers are engaged.
(i) **Insulation Resistance:**

This shall be measured (after removing the electronic PCB’s and their connection) between power and control lines and earth and shall not be less than 5 mega-ohms when measured with D.C. voltage of 500 volts. The test shall be carried out with contactors so connected together as to ensure that all parts of every circuit are simultaneously tested.

(j) **Earthing:**

All conduits, switches, casing and similar metal work shall have earthing continuity.

(k) **Ropes:**

The size, number construction and fastenings of the ropes should be carefully examined and recorded.

(l) **Buffers:**

The car should be run on to its buffers at contract speed and with contract load in the car to test whether there is any permanent distortion of the car or buffers. The counter weight buffers should be tested similarly.

2.0 **Tests at Manufacturer’s work:**

(a) **High Voltage Test:**

The dielectric of electrical apparatus (excluding motors, generators and instruments which are tested in accordance with the appropriate Indian Standards wherever they exist) shall be capable of withstanding a test voltage of ten times the working voltage with a maximum of 2000 volts when applied.

(i) Between the live parts and case of frame with all circuits completed.

(ii) Between main terminals or equivalent parts with all circuits open, and

(iii) Between any live parts of independent circuits.

Note: Owing to the impracticability of applying tests (ii), (iii) mentioned above on controllers and similar apparatus after controller wiring has been completed, these tests may be made at convenient stages of manufacture.
(b) **High Voltage Testing**

(i) **Method of Applying High Voltage:**

The test shall be made with alternating voltage of any convenient frequency, preferably between 49 and 60 cycles per second. The test voltage shall be of approximately sine wave form and during the application of voltage with peak value, as would be determined by spark gap by oscillograph or by any other approved method shall not be more than 1.45 times the RMS value. The RMS values of the applied voltage shall be measured by means of a volt meter used with a suitably calibrated potential transformer or by means of voltmeter used in connection with a special calibrated voltmeter winding or testing transformer by any other suitable voltmeter connected to the output side of the testing transformer.

(ii) **Duration of High Voltage Test:**

The test shall be commenced at a voltage of about one third of the test voltage which shall be increased to the full test voltage as rapidly as is consistent with the value being indicated by the measuring instrument. The full test voltage shall be maintained for one minute. At the end of this period, the test voltage shall be rapidly diminished to one third of its full value before switching off. The oil buffers are examined after the above tests have been made to determine if there has been any oil leakage or distortion and to ensure that buffers return to their normal positions.

(c) **Buffer test:**

A copy of the test report shall be intimated after testing at works.

3.0 **Performance Test:**

This test if meant for passenger lift and is conducted to watch the performance of lift installation in terms of passenger handling capacity and waiting interval as obtained at site vis-à-vis design, data and conducted as below;

(a) **Waiting interval:** (T)-This can be worked out by taking the average of several round trip times as observed physically and then dividing it by the number of lifts in that bank.

(b) **Handling capacity**

\[ H = \frac{300 \times Q \times 100}{T \times P} \]

Where,

H= Handling capacity as the percentage of the peak population handled during 5 minutes.

P= Total population to be handled during peak morning period. (It is related to the
area for which particular bank of lifts serves).

\[ Q = \text{Average number of passenger carried in a car.} \]

\[ T = \text{Waiting interval.} \]

(c) **Service temperature Test:**

A continuous run of one hour should be made with number of starts and stops to reproduce as nearly as practical the anticipate duty in service. (The standard duty cycle is for 90 to 180 start per hour). It is very difficult in practice to carry out test with alternate starts at full load and no load and it is necessary therefore to simulate these cycles. A suitable test for all motors except squirrel cage motors is to run the car up from the bottom landing with contract load and stop at each floor. From the top floor a non stop run is made to the lowest floor and the upward journey with stop is then repeated. The time intervals between stops and starts at the floors should be uniform and such as to give about 150 starts in one hour. At the end of this run the temperatures of the armatures and fields of the motor and generator are recorded. The temperature rise should, not exceed 55 deg C or 75 deg C for classes A or B insulation respectively.
APPENDIX-I

The bottom Runby for cars and counterweights shall be not less than the following:

(a) 15 cm where oil buffers are used.
(b) Where spring buffers are used:
   (1) 15 cm for following controls
   (i) Variable voltage Motor control (Generator field control)
   (ii) Electronic Devices
   (iii) Alternating current variable voltage (ACVV)
   (iv) Alternating current variable voltage variable frequency (ACVVVF) controls.
   (v) Solid state DC variable voltage control

(2) Not less than the following for single speed & two speed Alternating Current control and Rheostatic Control

<table>
<thead>
<tr>
<th>Rated Speed (m/s)</th>
<th>Run by (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 0.125</td>
<td>7.5</td>
</tr>
<tr>
<td>0.125 to 0.25</td>
<td>15</td>
</tr>
<tr>
<td>0.25 to 0.50</td>
<td>22.5</td>
</tr>
<tr>
<td>0.5 to 1</td>
<td>30</td>
</tr>
</tbody>
</table>

Maximum bottom run by: In no case shall the maximum bottom run by exceed the following:-

(a) 60 cm for cars and
(b) 90 cm for counter-weights

Top Car Clearance:

The vertical clearance between the car cross-head and the nearest overhead obstruction within 500 mm measured horizontally to the nearest part of cross-head when the car platform is level with the top landing, shall be not less than the sum of the following:

(a) The bottom counter-weight run by;
(b) The stroke of the counter-weight buffer used;
(c) One half of the gravity stopping distance based on;

(1) 115 percent of the rated speed where oil buffers are used and no provision is made to prevent the jump of the car at counter-weight buffer engagement, and

(2) Governor tripping speed where spring buffers are used.

**Note:** The gravity stopping distance based on the gravity retardation from any initial velocity may be calculated according to the following formula;

\[ S = 5.1 V^2 \]

Where \( S \) = free fall in cm (gravity stopping distance), and \( V \) = initial velocity in m/s.

(d) **600 mm**

Where there is a projection below the ceiling of the well and the projection is more than 500 mm, measured horizontally from the line of the cross- head, but over the roof of the car, a minimum vertical clearance not less than that calculated above shall also be available between the roof of the car and the projection.

Provided that the vertical clearance between any equipment mounted on top of the car and the nearest overhead obstruction shall be not less than the sum of the three items (a), (b) and (c) as calculated above plus 150 mm

**Top Counter-weight Clearances**

The top counter-weight clearance shall be not less than the sum of the following four items:

(a) The bottom car run by,
(b) The stroke of the car buffer used,
(c) 15 cm, and
(d) One-half the gravity stopping distance based on:

(1) One hundred and fifteen percent of the rated speed where oil buffers are used and no provision is made to prevent jump of the counterweight at car buffer engagement, and

(2) Governor tripping speed where spring buffers are used
6. CHECK LIST FOR JOINT INSPECTION OF LIFTS BY DEPARTMENTAL OFFICERS AND FIRM’S REPRESENTATIVES (REFER SECTION - TESTING OF LIFT INSTALLATION)

1. Place of Inspection
2. Date of Inspection
3. Name of the Firm
4. Verify visually particulars as per agreement description and Completeness of work to be executed as per contract.
5. Verify lay-out as per drawing and record discrepancies if any
6. Whether a plate with word lift and instruction to be Displayed / provided on each landing and in lift car.

LIFT WITH EQUIPMENT

(a) Depth of pit and whether ladder provided if required.
(b) Arrangement for lighting in the pit.
(c) Arrangement for lighting in the lift shaft.
(d) Whether adequate tie rods provided for counter weights.
(e) Whether all wiring has been in conduit pipes / troughs properly fixed and earthed.
(f) Guard for counter weights in the pit.
(g) Provision of check nuts and split pins in rope fastenings and terminations.
(h) Whether rope tension equal for all ropes.
(i) Whether buffers symmetrically positioned.
(j) Top car clearance.
(k) Bottom car clearance.
(l) Top counter weight clearance.
(m) Bottom car run by.
(n) Bottom counter weight run by.
(o) Any other.

7. Machine rooms check provision for:

a. Arrangement for hand lamp with flexible cord.

b. A plug and socket.
c. Adequate ventilation
d. A danger plate on door
e. Trap door
f. Main switch
g. Circuit diagram on wall
h. Any other

8. Earthing

Whether machine body controller, car frame, limit switches, and conduits properly earthed & check earthing continuity.

9. Machine and controller

a. Oil leakage if any
b. Abnormal temp rise of oil, bearing and motor
c. Abnormal noise or vibrations
d. Whether UP and DOWN (direction arrows on motor or fly wheel marked)
e. Whether rubber pads provided under machine and its bed plates
f. Whether control circuits have independent fuses
g. Whether protection against breakage of rope or taps for rope selector provided
h. Whether cable ferrules marked
i. Gap between the car and landing sill
j. Any other

10. Operation

a. Operation of all floor buttons from with-in up and down direction on both attendant and auto control.
b. Operation of car by calls given from landing buttons in Up and down direction on both attendant and auto Control.
c. Operation of door close and door open buttons
d. Emergency alarm
e. Emergency stop
f. Light and fan
g. Emergency key opening
h. Emergency light
i. Operation on type of control stipulated in contract
j. Operation of car top safety switches to make the lift inoperative from the car and speed of operation.
k. Door locking as checked from each floor
l. Any abnormal noise vibration jerk interval and stopping
m. Sideway play if any in the car
n. Working of position and direction indicators in car and at each landing.
o. Functioning of sensitive reopening arrangements on moving edge of doors.
p. Smooth sliding movement of car and landing doors.
q. Whether car is stopped in between the floor and whether the doors can be opened manually from inside.
r. Opening of landing or car door when lift is in operation to see that the movement of lift stops.
s. Operation of fireman switch
t. Check for brake release device and hand winding provisions

11. **Safety Devices**

a. Functioning of protection for single phasing and phase reversal.
b. Function of protection for automatic power cut off device before the car and counterweight load on buffers.
c. Function of over load relays.
d. Operation of safety gear and also see for under deformation guide rails and stopping distance.
e. Check operation of safety switches.
f. Operation of upper limit switch & positions
g. Operation of lower limit switch & positions
h. Operation of electrical protection against opening of emergency door.
i. Any other.
12. Checking of rope slip after 3 complete trips by putting a reference mark on the sheave and rope 60 mm / 12 mm, 60 mm / 20 mm.

13. Test to see that the lift does not start in upward direction on no load and down direction on full load and on single phasing.

14. Check application of brake on full load in down direction at full speed by switching off the power supply and for over heating.

15. Load Test: lift no. ______

<table>
<thead>
<tr>
<th></th>
<th>No Load</th>
<th>Full Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UP</td>
<td>Down</td>
</tr>
<tr>
<td></td>
<td>UP</td>
<td>Down</td>
</tr>
</tbody>
</table>

Starting current: AC (Amp)

Running current: AC (Amp)

Travel (Meters)

Speed: Meter / Sec

16. **Any other test**
   a. Size of the lift well
   b. Internal depth of car platform
   c. Size of the car door
   d. Rope protection against breakage have been carried out and test results are found
   e. Insulation resistance test & high voltage test have also been tested. I.R. is found ______M ohm (Requirement 0.5 M ohm minimum) and HV test with stood / not with stood.

**LIFT INSPECTOR APPROVAL**

Obtaining lift inspector’s approval for installation and subsequent approval for commissioning and running of the lift is in the scope of the contractor from the central/state authority who is responsible for such approvals in Lucknow.
### DATA SHEET IN ACCORDANCE WITH THE FOLLOWING DETAILS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOAD –KGS</strong></td>
<td>2 Nos of 680Kgs (10 Persons)</td>
</tr>
<tr>
<td><strong>SPEED – MPS</strong></td>
<td>1.0Meter Per Second</td>
</tr>
<tr>
<td><strong>TRAVEL-MTS</strong></td>
<td>0, 1st TO 7th FLOOR, TERRACE FLOOR RISE: 24 MTRS</td>
</tr>
<tr>
<td><strong>STOPS &amp; OPENINGS (MAX)</strong></td>
<td>9 STOPS 9 OPENINGS (ALL OPENING ON THE SAME SIDE)</td>
</tr>
<tr>
<td><strong>POWER SUPPLY</strong></td>
<td>415±10% V, 50±3% HZ, 3-PH ALTERNATING CURRENT</td>
</tr>
<tr>
<td><strong>CONTROL</strong></td>
<td>A C VARIABLE VOLTAGE VARIABLE FREQUENCY (WITH CLOSED LOOP)</td>
</tr>
<tr>
<td><strong>OPERATION</strong></td>
<td>DUPLEX FULL COLLECTIVE/ SELECTIVE WITH / WITHOUT ATTENDENT</td>
</tr>
<tr>
<td><strong>MACHINE</strong></td>
<td>GEARLESS PLACED DIRECTLY ABOVE THE HOISTWAY</td>
</tr>
<tr>
<td><strong>CAR SIZE (W X D) – mm</strong></td>
<td>ABOUT 1350 MM WIDE X 1300 MM DEEP OR MORE - INSIDE DIMENSIONS</td>
</tr>
<tr>
<td><strong>HOISTWAY REQUIRED (W X D)</strong></td>
<td>ABOUT 1900 MM WIDE X 2000 MM DEEP - FINISHED DIMENSIONS</td>
</tr>
<tr>
<td><strong>CAR ENCLOSURE</strong></td>
<td>IND-160</td>
</tr>
<tr>
<td><strong>CAR PANELS</strong></td>
<td>Car enclosure shall be of brushed satin stainless steel mat finish. Side paneling also meet brushed satin stainless steel finish. Rear panel with 6mm thick ceiling panel with stainless steel finish. The ceiling panel shall be with 4 down lights&amp; acrylic diffuser for fluorescent lights in stainless steel paneling. Floor with 12mm thick granite flooring laid to pattern over 20mm thick plywood backing/sound isolating platform having 100mm high stainless steel skirting. There shall be pressure fan inside the lift.</td>
</tr>
<tr>
<td><strong>HANDRAILS ON 3 SIDES</strong></td>
<td>ROUND SHAPED STAINLESS STEEL HANDRAIL</td>
</tr>
<tr>
<td><strong>FALSE CEILING</strong></td>
<td>CD – 35SS (STAINLESS STEEL)</td>
</tr>
<tr>
<td><strong>FLOORING</strong></td>
<td>RECESS IN PLATFORM OF 25 MM FOR MARBLE / GRANITE FLOORING BY CLIENT</td>
</tr>
<tr>
<td>CAR ENTRANCE</td>
<td>PROTECTED BY MILD STEEL/C/O AUTOMATIC SLIDING DOOR WITH V.P.</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>SIZE (W X H)-mm</td>
<td>CLEAR OPENING ABOUT 800 MM X 2100 MM HIGH</td>
</tr>
<tr>
<td>HOISTWAY ENTRANCES</td>
<td>PROTECTED BY MILD STEEL/C/O AUTOMATIC SLIDING DOOR WITH V.P.</td>
</tr>
<tr>
<td>SIZE (W X H) - mm</td>
<td>CLEAR OPENING ABOUT 800 MM X 2100 MM HIGH</td>
</tr>
<tr>
<td>DOOR OPERATION</td>
<td>AUTOMATIC VF DOOR OPERATOR &amp; ELECTRONIC DOOR PROTECTION DEVICE</td>
</tr>
<tr>
<td>SIGNALS (DESIGN)</td>
<td>GIEN</td>
</tr>
<tr>
<td>DETAILS</td>
<td>1. HALL BUTTON WITH DOT MATRIX HALL POSITION INDICATOR AND DIRECTION ARROWS AT ALL UPPER FLOORS AND LCD DISPLAY AT GROUND FLOOR ONLY WITH SEPARATE HALL BUTTON FIXTURE.</td>
</tr>
<tr>
<td></td>
<td>2. CAR OPERATIONG PANEL WITH MICROSTROKE PUSH BUTTONS WITH LCD CAR POSITION NDICATOR, CAR DIRACTION INDICATOR.</td>
</tr>
<tr>
<td></td>
<td>3. BATTERY OPERATED ALARM BELL AND EMERGENCY LIGHT</td>
</tr>
<tr>
<td></td>
<td>4. FIREMAN’S SWITCH AT MAIN LOBBY</td>
</tr>
<tr>
<td></td>
<td>5. VOICE SYNTHESIZER &amp; CAR CHIME &amp;INTERCOMMUNICATION SYSTEM</td>
</tr>
<tr>
<td></td>
<td>6. PHONE FOR COMMUNICATION</td>
</tr>
<tr>
<td>FACE PLATE FINISH</td>
<td>STAINLESS STEEL</td>
</tr>
<tr>
<td>FACE PLATE SHAPE</td>
<td>STANDARD</td>
</tr>
<tr>
<td>Optional requirement</td>
<td>The lift supplier shall quote for the following in addition to above and what has been mentioned in the bill of quantities.</td>
</tr>
<tr>
<td></td>
<td>Emergency Rescue Device (The Emergency Battery Drive Unit): In the event of power failure, the lift shall come to the nearest landing automatically and individually for each lift.</td>
</tr>
</tbody>
</table>
DATA SHEET IN ACCORDANCE WITH THE FOLLOWING DETAILS

(CAR LIFT/HOIST)

1. **Max. System Dimensions**
   - Length: 5500 mm (Can be customized)
   - Width: 3000 mm (Can be customized)
   - Overall Height: 3500 mm
   - Minimum Stand Height: 150 mm
   - Distance Between Columns: 2400 mm
   - Runway width: 2194 mm (Can be customized)
   - Lifting Capacity: 2500 kg

2. **Lifting drive**
   Motor power for Hydraulic lifting Mechanism- 3 KW (230 V), Single phase/ 3 KW Electrical motor operating at 415 V

3. **Operation mode**- Switch operated

4. **Power Supply**- As per local power supply (415/ 220 V, AC, 50Hz)

5. **Time taken (max.)** for the car from the ground level to Basement level 60 – 90 seconds.

6. **Electrical back-up**- DG Set for power back-up (to be supplied by client)

DATA SHEET IN ACCORDANCE WITH THE FOLLOWING DETAILS

Multilevel Car Parking System: 10 nos

1. **Max. System Dimensions**
   - Length of car holding plate: 3620 mm (wheel centres)
   - Width: 2600 mm
   - Overall Height: 2800 mm
   - Maximum Lifting Height: 1850 mm
   - Minimum Stand Height: 120 mm
Distance Between Columns 2270 mm
Runway width 2194 mm
Lifting Capacity 2000 kg

2. **Module**
   GLOBAL L2C1 1 Module - 2 cars

3. **Lifting drive**
   Motor power consumption for Hydraulic lifting Mechanism **2.2 KW (230 V), Single phase**

4. **Operation mode- Switch operated**
5. **Power Supply**
   As per local power supply (220 V, AC, 50 Hz, Single Phase)

6. **Time taken** (max.) for the car from the top pallet to reach the driving level- Maximum 45 sec

7. **Electrical back-up**
   DG Set for power back-up (to be supplied by customer)

8. **Safety:**

   1. There is a thermal relay in the electric box which will trip, if the motor is overloaded.

   2. The pressure-regulated valve, located in the hydraulic oil power unit, will trip if the pallet of the system is overloaded.

   3. If the hydraulic cylinder breaks, the block on the pillar is locked by mechanical lock and immediately stops the pallet from descending down.

   4. Until this mechanical lock is released electrically the pallet cannot be moved down.

   5. On the upper part of the pillars, there is one limit switch which ensures and stops the pallet once it reaches the maximum lifting height.
APPROVED VENDORS FOR ELEVATORS

1. MITSUBHUSHI
2. SCHINDLER
3. OTIS
4. KONE

APPROVED VENDORS FOR CAR LIFTS/AUTOMATED MULTILEVEL CAR PARKING

1. RR PARKON
2. GLOBAL ENGINEERS

*****
GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT (GRIHA).

1.0. Introduction:

1.1 Ministry of New and Renewable Energy, Govt of India (MNRE) has developed a comprehensive building rating system called Green Rating for Integrated Habitat Assessment (GRIHA).

1.2 The proposed buildings envisage incorporation of eco concepts at all levels. It is the vision of HPCL to achieve best standards as per Green building norms for the proposed building. HPCL intends to acquire a minimum of GRIHA 3-STAR or higher rating for its buildings.

1.3 HPCL has registered the proposed North Central Zone Office building with GRIHA Secretariat, the institution authorized by MNRE to process and evaluate the buildings under GRIHA.

1.4 HPCL is engaging consultants for providing Comprehensive services for Architectural, Engineering and Design Works & Services, herein further referred as Architect/Designer.

1.5 In order to comprehensibly design the new buildings in association with the architect by suitably incorporating green building requirements and to address issues involved at various stages of the project, in achieving the Green rating, HPCL is availing Green building Advisory Services from a Competent Agency, herein further referred as Green Building Advisor.

1.6 In association with the architect and Green building designer, the Owner has incorporated possible GRIHA criteria in the design, specification and BOQ. However the achievement of GRIHA 3 Star rating is possible only upon contractor’s commitment and compliance of relevant GRIHA criteria. Accordingly the criteria and points assigned for achievement by the contractor are indicated.
1.7 Manual Volume – I (Introduction to National Rating System) published by The Energy and Resources Institute and MNRE available in its website should be read with this specification. The bidders shall understand the rating system and its evaluation process concept, the scope of their works and assist the owner in all aspects to achieve the proposed rating. The details provided in the manual are indicative. Best practices of the industry shall be implemented. For a more detailed understanding the bidders are advised to refer to the relevant portions of the entire set of five volumes of the GRIHA manual. These manuals are available for purchase with The Energy Resources Institute (TERI), Bangalore and New Delhi.

1.8 A few activities under GRIHA are already included in GCC. This specification is for activities over above that are already covered under different sections. The contractor shall consider the same and assess his costs to comply with this specification.

2.0 Commitment, Compliance & Appraisal of GRIHA Criteria :

The contractor shall commit and comply with the GRIHA guidelines, advise and instructions of the Green Building Advisor, Architectural Consultant and Owner. The criteria and the points to be achieved during appraisal are indicated hereunder.

2.1 Criteria 2: Preserve and protect landscape during construction

2.1.1 Objective : To preserve the existing landscape and protect it from degradation during the process of construction.

2.1.2 No. of Points to be achieved : 3

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confine construction activity to pre-designated areas.</td>
<td>1</td>
</tr>
<tr>
<td>Proper implementation of staging and spill prevention plan and</td>
<td>1</td>
</tr>
<tr>
<td>Effective erosion and sedimentation control to prevent erosion.</td>
<td></td>
</tr>
<tr>
<td>Preserve top soil by employing suitable measures</td>
<td>1</td>
</tr>
<tr>
<td>Protect &amp; Preserve existing tress if any as per directions of</td>
<td></td>
</tr>
<tr>
<td>Engineer in charge</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

2.2 Criteria 3: Soil Conservation till post construction

2.2.1 Objective : Conserve top soil till completion of construction activity.

2.2.2 No. of Points to be achieved : 2.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper top soil laying for vegetative growth</td>
<td>1</td>
</tr>
<tr>
<td>Proper stabilization of soil</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

2.3 **Criteria 8 : Provide Minimum level of sanitation and safety facilities for construction workers.**

2.3.1 Objective : To ensure the health and safety of workers during construction, with effective provisions for the basic facilities such as sanitation and drinking water, and safety of equipment or machinery.

2.3.2 No. of Points to be achieved : 2

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance with Latest National Building Code norms on construction safety for ensuring safety during construction</td>
<td>1</td>
</tr>
<tr>
<td>Provision for health and sanitation facilities</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

2.4 **Criteria 9 : Reduce air pollution during construction.**

2.4.1 Objective : The dust generated by various construction site activities can contribute significantly to air pollution. Dust and outdoor air pollutants can cause respiratory problems. Good construction practices involve major mitigation measures for prevention or minimization of air pollution from construction activities. This criterion aims to reduce air pollution due to on–site construction.

2.4.2 No. of Points to be achieved :

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrated use of air pollution preventive measures</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

2.5 **Criteria 12 : Efficient Water use during Construction**

2.5.1 Objective : To minimize use of potable water during construction activity

2.5.2 No. of Points to be achieved :
<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efforts to minimize potable water use for construction</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

2.6 **Criteria 22 : Reduction in waste during construction**

2.6.1 Objective : To ensure maximum resource recovery and safe disposal of wastes generated during construction, and to reduce the burden on the landfill.

2.6.2 **No. of Points to be achieved : 1**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segregation of inert and hazardous wastes and recycling and safe disposal of segregated wastes</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

3.0 **Documentation, Evaluation & Appraisal:**

3.1 The facilitation with MNRE / GRIHA Secretariat shall be undertaken by Green Building advisor on behalf of the owner. All necessary cooperation shall be extended to them.

3.2 The contractor shall submit documents, photographs, narratives and certificates if any from statutory authorities, and any other proof in requisite formats, demonstrating compliance to the GRIHA norms both in hard copy and soft copy forms as per requirement and as decided by Engineer In charge / Architect / Green building Advisor. The guidelines issued by Green building Advisor time to time at various stages of the Project shall be binding on the contractor.

3.3 The evaluation team from MNRE / GRIHA Secretariat or their authorized representative shall be conducting periodic and surprise checks at site for assessing compliance to GRIHA norms. The contractor shall demonstrate compliance through actual site situation, documents, photographs and certificates if any from statutory authorities.

3.4 The contractor shall take all necessary actions to ensure that there are no adverse remarks on compliance.

3.5 Upon completion of the building, all documents, photographs, narratives and also certificates if any from statutory authorities shall be submitted for evaluation and appraisal by GRIHA Secretariat, who shall issue provisional rating. This
provisional rating shall be ratified finalized upon suitable audit and verification upon occupation of the building.

4.0 **Bill of Quantities, Method of Measurement & Terms of Payment:**

4.1 The Bill of Quantities is enclosed with the bidding documents. The contractor shall assess the requirements and quote accordingly.

4.2 The units of measurement shall be lumpsum and payable upon achievement of all the points and receipt of provisional rating certificate from GRIHA Secretariat / MNRE.

5.0 **General guidelines:**

5.1 **PROTECTION OF LANDSCAPE:**

5.1.1 Trenching, placing backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other material detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the trees.

5.1.2 Trees should not be used for support; their trunks should not be damaged by cutting and carving, by nailing posters and advertisements or in any other way.

5.1.3 Lighting of fires or carrying out heat or gas emitting construction activity within the ground covered by canopy of the tree should not be permitted.

5.1.4 Young trees or saplings identified for preservation within the construction site must be protected using tree guards of approved specification.

5.1.5 Existing drainage patterns through or into any preservation area should not be modified unless specifically directed by the landscape architect/architect/engineer-in-charge.

5.2 **SOIL CONSERVATION:**

5.2.1 Existing grades of soil should be maintained around existing vegetation. Lowering or raising the levels around the vegetation should not be allowed unless specifically directed by the landscape architect/architect/engineer-in-charge.

5.2.2 Staging should be done to separate undisturbed land from land disturbed by construction activity and material storage.

5.2.3 The staging areas/construction areas should be barricaded to prevent spilling of contaminated areas.

5.2.4 Segregate waste during construction on site into inert, chemical or hazardous waste.

5.2.5 Recycle the unused chemical/ hazardous wastes such as oil, paint, asbestos etc.
5.2.6 Contaminated material and hazardous wastes like pesticides, paints, cleaners, and petroleum products should be separated and contain safely in the constructed area.

5.2.7 Inert waste should be disposed off by municipal corporations/ local bodies at landfill sites.

5.2.8 Drainage channel should be made for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas.

5.2.9 Topsoil should be stripped to a depth of 20 cm from the areas proposed for buildings, roads, paved areas, and external services and stored plus preserved in a stockpiled to a height of 40 cm in designated areas.

5.3 SANITATION/SAFETY FACILITIES SANITATION/SAFETY FACILITIES FOR CONSTRUCTION WORKERS.

5.3.1 Comply with the safety procedures, norms and guidelines (as applicable) as outlined in NBC 2005 (BIS 2005c).

5.3.2 Adopt additional best practices and prescribed norms as in NBC 2005 (BIS 2005).

5.3.3 Provide clean drinking water to all workers.

5.3.4 Provide adequate number of decentralized latrines and urinals to construction workers.

5.4 REDUCE AIR POLLUTION DURING CONSTRUCTION

5.4.1 There should be adequate water supply/storage for dust suppression on site.

5.4.2 Water should be sprayed at regular interval to suppress the dust during construction activity.

5.4.3 Devise and arrange methods of working and carrying out the work in such a manner so as to minimize the impact of dust on the surrounding environment.

5.4.4 Clear vegetation only from the areas where work will start right away.

5.4.5 Limit vehicular speed on-site to 10 km/h when construction is in progress.

5.4.6 Water should be sprayed on any dusty materials before transferring, loading, and unloading.

5.4.7 Spray water in areas where demolition work is being carried out.

5.4.8 Water should be sprayed in areas where excavation or earth-moving activities are to be carried out.

5.4.9 Washing bay to be provided for Trucks/ any vehicle carrying loads out of the site.

5.5 EFFICIENT WATER USE DURING CONSTRUCTION

5.5.1 Water should be sprayed on concrete structures after covering them with cloth/gunny bags. To reduce water consumption approved Curing
chemicals should be sprayed on concrete structures and free flowing water should not be used for curing.

5.5.2 Ponds should be made using cement and sand mortar to avoid water flowing away from the flat surface while curing. Water ponding should be done on all sunken slabs.
8. **APPROVED MAKES**
LIST OF RECOMMENDED MAKES/ MANUFACTURERS/

1.00 GENERAL

1.01 The makes and manufacturers shall be preferably from the following list. In case the same is not available in the market or in case of a change in trade name, equivalent makes/ re-designated manufacturer shall be used with the approval of EIC. For Items which have been missed in the current list, vendor shall seek details from owner during execution. Decision of EIC will be final in selection of approved make.

1.02 In case of items not covered in the list, the material shall be best available in the market and each item should have BIS certification mark.

CIVIL

LIST OF APPROVED VENDORS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of Item</th>
<th>Standard make / brand names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chlorpyriphos (For anti-termite treatment)</td>
<td>Sahakar of M/s.Karnataka Co-op. Marketing Fed. Ltd., Termisac of M/s.Bayer India Ltd, Bhagiradha Chemicals Ltd, Hyderabad</td>
</tr>
<tr>
<td></td>
<td>Reticulate Antitermite with Imidaclorpid</td>
<td>Itemsecure – Ivory terrace, Alkapuri Baroda, Gujarat</td>
</tr>
<tr>
<td>2</td>
<td>Water proofing compound</td>
<td>Pidilite Industries, CICO No. 1, SCOTT No.1, Accoproof, Fosroc chemicals; Sikka</td>
</tr>
<tr>
<td>3</td>
<td>Cement</td>
<td>ACC, Birla cements, L&amp;T, Ultra Tech Cement, Ambuja</td>
</tr>
<tr>
<td>4</td>
<td>Ready Mix Cement Concrete (RMC)</td>
<td>Ultra Tech Concrete, ACC Concrete, L&amp;T Concrete /approved equivalent</td>
</tr>
<tr>
<td>5</td>
<td>Reinforcement Steel</td>
<td>TISCO, SAIL, RINL</td>
</tr>
<tr>
<td>6</td>
<td>Flush door shutter</td>
<td>Kutty Flush doors, Chennai / KSFIC, Bangalore / Anand Wood Crafts, Hyderabad / Anchor flush doors</td>
</tr>
<tr>
<td>7</td>
<td>Hydraulic door closers</td>
<td>Dorma, Hafle/approved equivalent</td>
</tr>
<tr>
<td></td>
<td>Item</td>
<td>Supplier/Equivalent</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>8</td>
<td>Structural Steel, MS pipes</td>
<td>TISCO, SAIL, RINL (For Misc requirement like railings, grills etc procurement can be made from local market if the materials are not available with main producers as decided by the Engineer in Charge)</td>
</tr>
<tr>
<td>11</td>
<td>Aluminium sections</td>
<td>Hindalco, Jindal/approved equivalent</td>
</tr>
<tr>
<td>12</td>
<td>Glazing</td>
<td>Modi glass, AIS glass, Saint Gobain</td>
</tr>
<tr>
<td>13</td>
<td>Floor springs</td>
<td>Dorma, Hafle</td>
</tr>
<tr>
<td>14</td>
<td>Silicon sealants</td>
<td>Dow corning. Other Brand if any shall be as per advice of the consultant.</td>
</tr>
<tr>
<td>15</td>
<td>Wall putty</td>
<td>Birla putty, JK putty, Asian putty</td>
</tr>
<tr>
<td>16</td>
<td>Spider fittings</td>
<td>Dorma, Nexus, Hafle</td>
</tr>
<tr>
<td>17</td>
<td>UPVC Windows</td>
<td>Fenesta, Sintex, Wintech</td>
</tr>
<tr>
<td>18</td>
<td>GI plaster mesh</td>
<td>Arpitha Building products, Bangalore, National Wire Products, Pune</td>
</tr>
<tr>
<td>19</td>
<td>Automatic sliding door</td>
<td>Dorma, Gandhi Automation Pvt Ltd, Mumbai</td>
</tr>
<tr>
<td>20</td>
<td>Laminated glass</td>
<td>AIS Glass/saint goban/approved equivalent. Other Brand if any shall be as per advice of the consultant.</td>
</tr>
<tr>
<td>21</td>
<td>Frosted film</td>
<td>Garware films, 3 M films</td>
</tr>
<tr>
<td>22</td>
<td>Epoxy leveling topping</td>
<td>Epoxy.com, Arcoy Industries, MRF</td>
</tr>
<tr>
<td>23</td>
<td>LOW VOC paints</td>
<td>Asian Paints, Nerolac paints, Alconoble(ICI)</td>
</tr>
<tr>
<td>24</td>
<td>Adhesives</td>
<td>Pidilite Industries, Fosroc chemicals, Sika India Ltd</td>
</tr>
</tbody>
</table>

**FOR PHE WORKS**

<table>
<thead>
<tr>
<th></th>
<th>Item</th>
<th>Supplier/Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wash basin</td>
<td>Hind ware, Parryware, jaquar</td>
</tr>
<tr>
<td>2</td>
<td>Indian type water closets</td>
<td>Hind ware, Parryware, jaquar</td>
</tr>
<tr>
<td>3</td>
<td>European type water closets</td>
<td>Hind ware, Parryware, jaquar</td>
</tr>
<tr>
<td>4</td>
<td>Flushing cisterns</td>
<td>Hind ware, Parryware, jaquar</td>
</tr>
<tr>
<td>SL.NO.</td>
<td>ITEM</td>
<td>MAKE</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Urinals</td>
<td>Hind ware, Parryware, Jaquar</td>
</tr>
<tr>
<td>6</td>
<td>Pillar cock, health faucets, angle cocks, bib cocks, Toilet paper holders, Towel rings and other fixtures</td>
<td>Jaguar, Kohler</td>
</tr>
<tr>
<td>7</td>
<td>Valves</td>
<td>Leader, HAWA, Globe, Zoloto</td>
</tr>
<tr>
<td>8</td>
<td>Stainless Steel kitchen Sink</td>
<td>Franke, Futura</td>
</tr>
<tr>
<td>9</td>
<td>Automatic hand dryer</td>
<td>Euronics Industries, Bangalore, Kimberly clark/approved equivalent</td>
</tr>
<tr>
<td>10</td>
<td>UPVC pipes,</td>
<td>Finolex, Supreme, Prince, Kissan</td>
</tr>
<tr>
<td>11</td>
<td>CPVC pipes</td>
<td>Ashirwad Flow Guard, Prince, Astral</td>
</tr>
<tr>
<td>12</td>
<td>Cast Iron Manhole covers</td>
<td>Bengal Iron Corpn (BIS), NECO, Zenith</td>
</tr>
<tr>
<td>13</td>
<td>Pumps</td>
<td>Kirloskar, Suguna, Texmo</td>
</tr>
<tr>
<td>14</td>
<td>Water treatment items like Sand filters, Activated carbon filters, RO system, Water softner, Chlorine dosing system etc</td>
<td>ION EXCHANGE , DOSION</td>
</tr>
<tr>
<td>15</td>
<td>Solar Water System</td>
<td>TATA BP Solar, Racold</td>
</tr>
<tr>
<td>16</td>
<td>Solar PV panels</td>
<td>TATA BP Solar, Racold</td>
</tr>
</tbody>
</table>

**LIST OF APPROVED MAKES OF MATERIALS FOR FIRE FIGHTING**

<table>
<thead>
<tr>
<th>SL.NO.</th>
<th>ITEM</th>
<th>MAKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FIRE PUMPS</td>
<td>KIRLOSKAR / MATHER &amp; PLATT</td>
</tr>
<tr>
<td>2</td>
<td>ELECTRICAL MOTORS</td>
<td>KIRLOSKAR/SEIMENS/NGEF/CROMPTON</td>
</tr>
<tr>
<td>3</td>
<td>BOOSTER PUMP</td>
<td>KIRLOSKAR / MATHER &amp; PLATT</td>
</tr>
<tr>
<td>4</td>
<td>GI / MS. PIPES (‘C’ CLASS)</td>
<td>JINDAL/ (HISSAR)</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Brand(s)</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>MS fittings</td>
<td>UNIK</td>
</tr>
<tr>
<td>6</td>
<td>BUTTERFLY VALVES</td>
<td>HAWA / ZOLOTO / AUDCO</td>
</tr>
<tr>
<td>7</td>
<td>BALL VALVE (15-40mm dia)</td>
<td>ZOLOTO / HAWA / VB</td>
</tr>
<tr>
<td>8</td>
<td>SLUICE VALVES</td>
<td>KIRLOSKAR / VB / ZOLOTO</td>
</tr>
<tr>
<td>9</td>
<td>NON - RETURN VALVE - FLAP TYPE CAST IRON</td>
<td>INTERVALVE / ZOLOTO / VB</td>
</tr>
<tr>
<td>10</td>
<td>CANVASS HOSE</td>
<td>JAYSHREE / NEWAGE / MINIMAX</td>
</tr>
<tr>
<td>11</td>
<td>FIRE EXTINGUISHER</td>
<td>SAFEX / MINIMAX / ALERT</td>
</tr>
<tr>
<td>12</td>
<td>PRESSURE GUAGE</td>
<td>H - GURU</td>
</tr>
<tr>
<td>13</td>
<td>PRESSURE SWITCH</td>
<td>DANFOSS / INDFOSS</td>
</tr>
<tr>
<td>14</td>
<td>PVC INSULATED COPPER WIRES</td>
<td>FINOLEX / UNIVERSAL / CCI</td>
</tr>
<tr>
<td>15</td>
<td>CABLES</td>
<td>FINOLEX / UNIVERSAL / CCI</td>
</tr>
<tr>
<td>16</td>
<td>OVER LOAD RELAYS</td>
<td>EE / L&amp;T</td>
</tr>
<tr>
<td>17</td>
<td>SINGLE PHASE PREVENTOR</td>
<td>L&amp;T / SEIMENS</td>
</tr>
<tr>
<td>18</td>
<td>INDICATING LAMPS &amp; PUSH BUTTONS</td>
<td>L&amp;T / SEIMENS</td>
</tr>
<tr>
<td>19</td>
<td>SPRINKLER HEAD</td>
<td>TYCO / RELIABLE / SPRAYSALE</td>
</tr>
<tr>
<td>20</td>
<td>SPRINKLER ICV</td>
<td>WORMALD / RELIABLE</td>
</tr>
<tr>
<td>21</td>
<td>GUN METAL BRANCH PIPE</td>
<td>NEWAGE / WINCO</td>
</tr>
<tr>
<td>22</td>
<td>GUN METAL NOZZEL</td>
<td>NEWAGE / WINCO</td>
</tr>
<tr>
<td>23</td>
<td>AIR RELEASE VALVE</td>
<td>RB / TBS / VB</td>
</tr>
<tr>
<td>24</td>
<td>RUBBER HOSE REEL</td>
<td>EVER SAFE / MINIMAX</td>
</tr>
<tr>
<td>25</td>
<td>FIRE BUCKETS</td>
<td>SAFEX / MINIMAX</td>
</tr>
<tr>
<td>26</td>
<td>SUCTION STRAINER 'Y'</td>
<td>ANIL / UPADYAYA</td>
</tr>
<tr>
<td>27</td>
<td>FLOW SWITCH</td>
<td>NOTIFIER</td>
</tr>
</tbody>
</table>
APPROVED VENDORS FOR ELEVATORS

8.1.1.1. MITUBUSHI
8.1.1.2. SCHINDLER
8.1.1.3. OTIS
8.1.1.4. KONE

APPROVED VENDORS FOR CAR LIFTS/AUTOMATED MULTILEVEL CAR PARKING

1. RR PARKON
2. GLOBAL ENGINEERS
9. PROPOSAL FORMS
PROJECT AND SITE ORGANISATION DESCRIPTION

The bidder must attach a description of the Head office and site of the organization proposed to be committed for execution of the work. Organization chart must include details of key personnel, categories and numbers of personnel reporting at Head office and Site Office, separately.

The description shall show lines of authority/responsibility/communication together with a written description of the overall working of the organization with particular emphasis on the Head office/site interface and monitoring and control of progress.

Bidder agrees to augment the above chart with additional number/categories, if required and as directed by Engineer in charge to complete the work within the completion time schedule and quoted price.

SIGNATURE OF BIDDER: _________________________

NAME OF BIDDER: _________________________

COMPANY SEAL: _________________________

This form shall be part of contract documents.
SUMMARY OF KEY PERSONNEL

Bidder to provide a resume for each key person (indicated in the organization chart) to be assigned by the Contractor, containing at least the following information on each person (Additional pages are to be attached and properly designated, if necessary). Such key personnel shall cover contractor’s own as well as sub-contractor’s employees.

<table>
<thead>
<tr>
<th>Position</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Name:</td>
<td></td>
</tr>
<tr>
<td>b) Education Qualifications:</td>
<td></td>
</tr>
<tr>
<td>c) Present Position in Bidder’s Company:</td>
<td></td>
</tr>
<tr>
<td>d) Relevant Experience with Employment History:</td>
<td></td>
</tr>
</tbody>
</table>

Note: Resume is generally required for the Project Manager, Lead Site Engineers and Lead Site Supervisors, all of whom would be assigned full time to the contract.
NAME OF WORK : 

BIDDING DOCUMENT NO. : 

COMPLIANCE TO BID REQUIREMENT

We confirm that our Bid complies with the total Techno-Commercial requirements of Bidding Document.

SIGNATURE OF BIDDER : ____________________

NAME OF BIDDER : ____________________
10. GENERAL TERMS AND CONDITIONS (GTC)

Attached Separately
11. **DRAWINGS**

Attached Separately
# LIST OF DRAWINGS

<table>
<thead>
<tr>
<th>No.</th>
<th>ARCHITECTURAL DRAWINGS</th>
</tr>
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12. ENVIRONMENT HEALTH AND SAFETY REQUIREMENTS (EHS POLICY)
**ENVIRONMENT, HEALTH & SAFETY POLICY**

**SPECIFICATION FOR ENVIRONMENT, HEALTH & SAFETY POLICY (EHS) MANAGEMENT**

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1.0 SCOPE

This specification established the Environment, Health and Safety (EHS) management requirement to be complied with by the Contractors during construction.

Requirements stipulated in this specification shall supplement the requirements of EHS Management given in relevant Act(s) / legislations. General Conditions of Contract (GCC), Special Conditions of Contract (SCC) and Job Specifications. Where different documents stipulate different requirements, the most stringent shall be adopted.

2.0 REFERENCES

This document should be read in conjunction with following:

- General Conditions of Contract (GCC)
- Special Conditions of Contract (SCC)
- Job Specifications

3.0 REQUIREMENTS OF ENVIRONMENT, HEALTH & SAFETY (EHS) MANAGEMENT SYSTEM TO BE COMPLIED BY BIDDERS

3.1 MANAGEMENT RESPONSIBILITY

3.1.1 The Contractor should have a documented EHS policy to cover commitment of their organization to ensure health, safety and environment aspects in their line of operations.

3.1.2 The EHS management system of the Contractor shall cover the EHS requirements including but not limited to what is specified under Para 1.0 and para 2.0 above.

3.1.3 Contractor shall be fully responsible for planning and implementing EHS requirements. Contractor as a minimum requirement shall designate / deploy the following to co-ordinate the above:

No. of workers deployed

- Designate one safety supervisor

- Deploy one qualified and experienced safety Engineer / officer

- One additional safety (for every 500 or less) engineer/office as above.
Contractor shall indemnify & hold harmless Owner / HPCL & either representatives free from any and all liabilities arising out of non – fulfillments of EHS requirements.

3.1.4 The Contractor shall ensure that the Environment, Health & Safety (EHS) requirements are clearly understood & faithfully implemented at all levels at site.

3.1.5 The Contractor shall promote and develop consciousness for Safety, Health and Environment among all personnel working for the Contractor. Regular awareness, program site meetings shall be arranged on EHS activities to cover hazards involved in various operations during construction.

3.1.6 Arrange suitable first aid measures such as First Aid Box, trained personnel to give First Aid, Stand by Ambulance or Vehicle and install fire protection measures such as : adequate number of steel buckets with sand and adequate fire extinguishers to the satisfaction of HPCL/Owner.

3.1.7 The Contractor shall evolve a comprehensive planned and documented system for implementation and monitoring of the EHS requirements. This shall be submitted to HPCL/Owner for approval. The monitoring for implementation shall be done by regular inspections and compliance to the observations thereof. The Contractor shall get similar EHS requirements implemented at his sub-contractor(s) work site/office. However, compliance of EHS requirements shall be the sole responsibility of the Contractor. Any review / approval by HPCL/Owner shall not absolve contractor of his responsibility / liability in relation to all HSE requirements.

3.1.8 Non-Conformance on EHS by Contractor (including his Sub-contractors) as brought out during review/audit by HPCL/Owner representatives shall be resolved forthwith by Contractor. Compliance report shall be provided to HPCL/Owner.

3.1.9 The Contractor shall ensure participation of his Resident Engineer / Site-in-Charge in the Safety Committee / EHS Committees meetings arranged by HPCL/Owner. The compliance of any observations shall be arranged urgently. He shall assist HPCL/Owner to achieve the targets set by them on EHS during the project implementation.

3.1.10 The Contractor shall adhere consistently to all provisions of EHS requirements. In case of non-compliance or continuous failure in implementation of any of EHS provisions; HPCL/Owner may impose stoppage of work without any Cost & Time implication to Owner and/or impose a suitable penalty for non-compliance with a notice of suitable period, up to a cumulative limit of 1.0% (one percent) of Contract Value.
with a maximum limit of Rs. 10 lakhs. This penalty shall be in addition to all other penalties specified else where in the contract. The decision of imposing stoppage work, its extent & monitory penalty shall rest with HPCL/Owner & binding on the Contractor.

3.1.11 All fatal accidents and other personnel accidents shall be investigated by a team of Contractor’s senior personnel for root cause & recommend corrective and preventive actions. Findings shall be documented and suitable actions taken to avoid recurrences shall be communicated to HPCL/Owner. Owner / HPCL shall have the liberty to independently investigate such occurrences and Contractor shall extend all necessary help and co-operation in this regard.

3.2 HOUSE KEEPING

3.2.1 Contractor shall ensure that a high degree of house keeping is maintained and shall ensure inter alia the followings wherever applicable:

a. All surplus earth and debris are removed/disposed off from the working areas to identified location(s).

b. Unused/Surplus Cables, Steel items and steel scrap lying scattered at different places within the working areas are removed to identified location(s).

c. All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).

d. Roads shall be kept clear and materials like: pipes, steel, sand boulders, concrete, chips and bricks etc. shall not be allowed on the roads to obstruct free movement of men & machineries.

e. Fabricated steel structural, pipes & piping materials shall be stacked properly for erection.

f. Water logging on roads shall not be allowed.

g. No parking of trucks / trolleys, cranes and trailers etc. shall be allowed on roads which may obstruct the traffic movement.

h. Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas.

i. Trucks carrying sand, earth and pulverised materials etc. shall be covered while moving within the premises.
j Only properly designed steel scaffolding materials to be used for working at heights more than 3.0M. Double scaffolding using wooden ballis may be allowed for working at height less than 3.0M

3.3 ENVIRONMENT, HEALTH AND SAFETY

3.3.1 The Contractor shall provide safe means of access to any working place including provisions of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen, and, HPCL/Owner. Contractor shall ensure deployment of appropriate equipment and appliances for adequate safety and health of the workmen and protection of surrounding areas.

3.3.2 The Contractor shall ensure that all their staff and workers including their sub-contractor(s) shall wear Safety Helmet and Safety shoes. Contractor shall also ensure use of safety belt, protective goggles, gloves etc. by the personnel as per job requirements. All these gadgets shall conform to relevant IS specifications or equivalent.

3.3.3 Contractor shall ensure that a proper Safety Net System shall be used at appropriate locations. The safety net shall be located not more than 30 feet (9.0 metres) below the working surface at site to arrest or to reduce the consequences of a possible fall of persons working at different heights.

3.3.4 Contractor shall ensure that flash back arrester shall be used while using Gas Cylinders at site. Cylinders shall be mounted on trolleys.

3.3.5 The Contractor shall assign to his workmen, tasks commensurate with their qualification, experience and state of health for driving of vehicles, handling and erection of materials and equipments. All lifting equipments shall be tested certified for its capacity before use. Adequate and suitable lighting at every work place and approach there to, shall be provided by the Contractor before starting the actual operations at night.

3.3.6 Hazardous and/or toxic materials such as solvent coating, or thinners shall be stored in appropriate containers.

3.3.7 All hazardous materials shall be labelled with the name of the materials, the hazards associated with its use and necessary precautions to be taken.

3.3.8 Contractor shall ensure that during the performance of the work, all hazards to be health of personnel, have been identified, assessed and eliminated.

3.3.9 Chemical spills shall be contained & cleaned up immediately to prevent further contamination.
3.3.10 All personnel exposed to physical agents such as ionizing radiation, ultraviolet rays or similar other physical agents shall be provided with adequate shielding or protection commensurate with the type of exposure involved.

3.3.11 Where contact or exposure of hazardous materials could exceed limits or could otherwise have harmful affects, appropriate personal protective equipments such as gloves, goggles, aprons, chemical resistant clothing and respirator shall be used. 

- A Crèche where 10 or more female workers are having children below the age of 6 years.

- Reasonable Canteen facilities are made available at appropriate location depending upon site conditions.

3.3.13 Suitable facilities for toilet, drinking water, proper lighting shall be provided at site and labour camps, commensurate with applicable Laws / Legislation.

3.3.14 Contractor shall ensure storage and utilization methodology of materials that are not detrimental to the environment. Where required Contractor shall ensure that only the environment friendly materials are selected.

3.3.15 All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules & regulations relating to the hazardous materials substances and wastes. Contractor shall not dump, release or otherwise discharge or dispose off any such materials without the express authorization of HPCL/Owner.

4.0 DETAILS OF EHS MANAGEMENT SYSTEM BY CONTRACTOR

4.1 On Award of Contract
The Contractor shall prior to start of work submit his Safety Health and Environment Manual or procedure and EHS Plans for approval by HPCL/Owner. The Contractor shall participate in the pre-start meeting with HPCL/Owner to finalise EHS Plans including the following :

- Job procedure to be followed by Contractor for activities covering. Handling of equipment, Scaffolding, Electric Installation, describing the risks involved, actions to be taken and methodology for monitoring each activity.

- HPCL/Owner review / audit requirement.

- Organization structure along with responsibility and authority records / reports etc. on EHS activities.
4.2 During job execution

4.2.1 Implement approved Environment, Health & Safety management procedure including but not limited to as brought out under para 3.0. Contractor shall also ensure to:

- arrange workmen compensation insurance, registration under ESI Act, third party liability insurance etc., as applicable.

- arrange all HSE permits before start of activities (as applicable) like hot work, confined space, work at heights, storage of chemical / explosive materials and its use and implement all precautions mentioned therein.

- submit timely the completed checklist on EHS activities, Monthly EHS report, accident reports, investigation reports etc. as per HPCL/Owner requirements. Compliance of instructions on EHS shall be done by Contractor and informed urgently to HPCL/Owner.

- ensure that Resident Engineer / Site-in-Charge of the Contractor shall attend all the Safety Committee / EHS meetings arranged by HPCL/Owner. Only in case of his absence from site that a second senior most person shall be nominated by him in advance and communicated to HPCL/Owner.

- display at site office and work locations caution boards, list of hospitals, emergency services available.

- provide posters, banners for safe working to promote safety consciousness.

- carryout audits / inspection at sub contractor works as per approved EHS document and submit the reports for HPCL/Owner review.

- assist in EHS audits by HPCL/Owner, and submit compliance report.

- generate & submit HSE records / report as per EHS Plan.

- appraise HPCL/Owner on EHS activity