TENDER DOCUMENT

TENDER No.: DLI/CON/ITBP/527

FOR

CONSTRUCTION OF HOSTEL BUILDING AT ITBP SCHOOL,
SECTOR- 16B DWARKA, NEW DELHI

VOLUME – II

ADDITIONAL CONDITIONS OF CONTRACT, TECHNICAL
SPECIFICATIONS AND DRAWINGS
ADDITIONAL CONDITIONS OF CONTRACT

The following Additional conditions shall be read in conjunction with General Conditions of Contract. The provisions in Additional Conditions of Contract shall take precedence over General Conditions of Contract.

INTRODUCTION

Indo Tibetan Border Police (ITBP) intends “Construction of Hostel Building at ITBP School, Sector-16B Dwarka, New Delhi”.

The following clauses of Additional Conditions of Contract (ACC) shall be applicable for this contract:

These Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract, Instructions to Tenderers (ITT), Notice Inviting Tenders (NIT), Bill of Quantities (BOQ), Tender Drawings, and Technical Specifications & Other Tender Documents

1) GENERAL

The work in general shall be carried out as per the latest CPWD specifications with up to date correction slips, unless otherwise specified in the nomenclature of the individual item or as per specifications provided with this tender. Any item not covered under these specifications shall be carried out as per approved specifications. In case any item is not covered in any of these documents, the same shall be carried out as per the latest BIS Code in practice or as per approval of Engineer in Charge of EPIL.

Where any portion of additional conditions of contract is repugnant to or at variance with any provision of the Instructions to Tenderers and General Conditions of contract and/or the other documents forming part of the contract then unless a different intention appears the provision of the Additional Conditions of Contract shall be deemed to over-ride the provisions of the general conditions of contract and/or the other documents forming part of the contract only to the extent such repugnant/variations in the additional conditions of contract as are not possible of being reconciled with the provision with Instructions to Tenderers or General Conditions of contract and/or the other documents forming part of the contract.

2) DEFINITIONS

Definitions as per General Conditions of Contract (GCC) shall be amended or the following definitions appended as under
The words “Site” in various clauses of General Conditions of Contract (GCC) and other documents of this Tender shall mean Construction of Hostel Building at ITBP School, Sector- 16B Dwarka, New Delhi.

a) Wherever the sentence “the cost to be incurred by the Contractor shall deemed to be included in the quoted rates of the BOQ items” as mentioned in various General Conditions of contract is appearing, the same shall be read as “the cost to be incurred by the contractor shall deemed to be included in the BOQ rates including the percentage quoted on the BOQ rates / amount.”

b) Wherever in General Conditions of Contract, approval of EPIL / Executing Agency is mentioned, it shall include the approval from the Owner’s representative also.

3) APPROACH TO SITE

The proposed site ITBP, is situated at ITBP School, Sector- 16B Dwarka, New Delhi.

SCOPE OF WORK

The brief scope of work included in this tender shall include (but not limited to) Civil, Structural, Sanitary & Sewerage, Electrical Works, Firefighting & Pretension systems and other misc. works as required for making the building functional for Construction of Hostel Building at ITBP School, Sector- 16B Dwarka, New Delhi. The scope of work, in general, includes (hereinafter referred to as “Works”) as per Technical specifications, Designs, Drawings, BOQ, Instructions and Terms and Conditions given in Tender Documents and its amendments/ clarifications etc. received from Client/ EPI from time to time.

4) SET OF CONTRACT DOCUMENTS

The clause No. ‘6.0’ of General Conditions of Contract (GCC) of this Tender document shall be read as under:

The following documents will complete a set of tender documents:

a) Notice Inviting Tender, Addendum to ITT, Special instructions to Bidders for e-Tendering, Letter of Undertaking, Form of tender, Memorandum, Addendum of GCC, Instruction to Tenderers & General Conditions of Contract (Vol-I)

b) Additional Conditions of Contract, Technical Specification, Drawings (Vol-II)

c) Price Bid /Bill of Quantity (Vol-III)
5) **Order of Precedence**: - In the event of any ambiguity or conflict between the contract documents, the order of precedence shall be in the following order.

(i)   NIT, Memorandum, BOQ
(ii)  Additional Condition Of contract (ACC).
(iii) Technical Specifications & Drawings
(iv) General Condition of Contract (GCC)

6) **TIME SCHEDULE & PROGRESS**

The sub-clause no. ‘43.2’ of clause no. ‘43.0’ of General Conditions of contract shall be read as under:

“The contractor shall also furnish within 10 days of date of letter/ telegram of Intent a Time and Progress Chart (Bar Chart) for completion of work within stipulated time. This time & progress chart shall be based on the milestones given hereunder. This will be duly got approved from EPIL. This approved Bar Chart shall form a part of the agreement. Achievement of milestones as well as total completion has to be within the time period allowed. The milestones to be applicable for this contract shall be as under:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Milestone</th>
<th>Time allowed for completion (since inception of project)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Building work up to plinth level</td>
<td>1 months</td>
</tr>
<tr>
<td>2</td>
<td>RCC framed structure</td>
<td>3 months</td>
</tr>
<tr>
<td>3</td>
<td>Misc, finishing work like cement Plaster, flooring, painting electrical work, firefighting work etc. i/c handing over</td>
<td>1 months</td>
</tr>
<tr>
<td>4</td>
<td>External Development &amp; Bulk Services (Civil &amp; Electrical)</td>
<td>1 months</td>
</tr>
</tbody>
</table>

The contractor shall also ensure achievement of following milestones in terms of financial targets, failing which intermediate liquidity damages shall be liable to be effected;
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Time allowed for Achievement of financial Targets (since inception of project)</th>
<th>Financial Achievement During the Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 Months</td>
<td>25%</td>
</tr>
<tr>
<td>2</td>
<td>3 Months</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>1 Months</td>
<td>75%</td>
</tr>
<tr>
<td>4</td>
<td>1 Months</td>
<td>100%</td>
</tr>
</tbody>
</table>

7) PROGRESS REPORTS AND SCHEDULES

The contractor shall submit to the Engineer-in-charge by the third day of every Month two copies of a report duly updated along with BAR/CPM/PERT Chart in an approved Perform showing the progress made in construction of the works during the previous month. Photographs indicating progress and other activities at site will be provided by the contractor along with progress report.

8) REVIEW MEETINGS

During the progress of the works the Contractor or his authorized representative is expected to participate in the monthly review meetings and/or any additional meetings as instructed by the Engineer-in-Charge. Any revision of the schedule of completion as a result of the review, will be submitted by the Contractor to the Engineer-in-Charge within a week who will approve it after due scrutiny. The Contractor will adhere to the revised schedule thereafter. No additional payment shall be made to the Contractor for any multiple shift work or other incentive methods contemplated by him in his work even though the EPIL/ITBP approves the time schedule. The approval of the revised time schedule shall not in any way relieve the contractor from the terms & conditions of contract contained elsewhere in the contract documents.

9) QUALITY ASSURANCE PROGRAMME

The last paragraph of clause no. '81.0' of General Conditions of contract (GCC) shall be read as under:

“The quality formats/ checks lists for different components of the work shall be as directed and approved by the Engineer-in-Charge. The approved formats shall be adopted for manufacturing, installation, inspection & commissioning of the work. These filled in formats shall be prepared in two copies and duly signed by representatives of contractor and EPIL. All the costs associated with printing of
formats and testing of materials required as per Technical Specification or as desired by Engineer-in-charge shall be borne by contractor without any extra cost to EPIL and shall be deemed to be included in contractor’s quoted rates in the schedule/ Bill of quantities (BOQ).”

The Quality Control Forms and Checklists provided in the General Conditions of Contract (GCC) shall be modified by Engineer-in-Charge as per requirements of quality checks on the basis of Technical Specification & codal requirements, shop drawings etc.

The formats for quality checks/inspection shall be developed and submitted to Engineer-in-Charge for approval and shall be adopted after approval.

10) ARRANGEMENT OF CONCRETE

The Contractor has to submit the design mix for the work to be executed and get it approved from a reputed lab. Other requirements will be as decided by Engineer in charge.

11) PROTECTION OF SITE

The contractor is required to make arrangements for protection of site at which the works are to be executed from inundation due to water, floods or other such situations etc. No extra payments shall be allowed for any delay in execution of the works on account of water standing at site of works and no claims for an extra rate shall be entertained on these accounts unless otherwise expressly specified.

12) DAMAGE AND LOSS

Damage to the existing structures: Any damage to the existing structures during the execution of work shall be made good by the contractor at his own cost and the site of work left clean and tidy on completion. Rectification/reinstatement/making good etc. shall conform to the standard materials originally used in the work and finished work shall match with existing work in all respects to the entire satisfaction of the Engineer-in-charge.

13) SITE DOCUMENTS

The following site documents shall mainly be maintained by the contractor at site:

a) Copy of contract documents and drawings.
b) Computerized bill format.
c) Site Order Book.
d) Material testing registers/ Quality Inspection Reports.
e) Measurement books on computerized format.
f) Progress bar chart.
g) Sample approval register.
h) Visitors register.
i) Any other detail and specific requirement as deemed necessary.
j) Hindrance Register
k) Work Diary,
l) Stage passing Register

In case the above are not provided at site within 10 days of placement of LOI, EPIL shall provide the same and necessary expenditure shall be deducted from the bills for documents.

14) MINOR DETAILS OF CONSTRUCTION:
The rates quoted by the Contractor shall be deemed to cover for all the minor details / requirement of construction which may not have been specifically shown on the drawings or given in particular specifications, BOQ, but are required as per established engineering practice.

15) DISCREPANCY IN DRAWINGS:
The Contractor shall be responsible to ensure co-relation in Structural drawings Architectural Drawings and Bill of Quantities, before commencement and execution of work. In case of discrepancy, the Contractor shall bring it to the notice of the Engineer-in-Charge for clarifications within 28 days of the issue of Letter of Acceptance. In the event of such discrepancy arising during the course of the work for which drawings are given after the date of issue of Letter of Acceptance, the Contractor shall seek clarifications within 14 days of receipt of such drawings. The Contractor shall take into consideration such contingencies in the completion schedule. The Contractor shall not be eligible for any extension of time for such occurrences. The decision of the Engineer-in-Charge shall be final and binding in this case. The bidder is also advised to visit the site and seek clarifications before submitting his bid.

16) EMPLOYER NOT TO SUPPLY ANY MATERIALS:
The Employer shall not supply or procure any material, for use on works, to the Contractor and he has to make his own arrangements for supplying, procuring, transportation and storage of all such materials required for the construction works at his own cost. However at any point of time EPI/Client feels that the requisite material is not being provided by contract the same shall be arranged by EPI and cost Plus 10% will be debited to contractor.

17) WITNESSING OF TESTS BY THE ENGINEER-INCHARGE
The Contractor shall make under the direction and in the presence of Engineer-in-charge, such tests and inspections as have been specified or as the engineer-in-charge shall consider necessary to determine whether or not the full intent of requirements of the specifications and the other related contract documents have been fulfilled. In case the work does not meet the full intent of the specifications
and the other related contract documents it shall be rectified by the Contractor at no extra cost and the Contractor shall bear all the expenses for any further tests considered necessary.

18) **PROJECT COMPLETION**

The contractor shall inform in writing at least One month in advance about the date of completion of work so that arrangements for taking / handing over are organized by EPIL along with the OWNER well in time. The completion certificate shall be issued by EPIL in consultation with the OWNER after having fully satisfied themselves about the satisfactory completion of the work.

19) During post construction phase the contractor shall be responsible for carrying out the following activities but not limited to the following:

i) Rectification of the defects promptly as pointed out by EPIL or Owner's representative(s) during the Operation & Maintenance period.

ii) Submission of “FINAL REPORT" of the completed project containing all technical & other related details.

20) The Contractor shall hold harmless and indemnify the EPIL and the OWNER against any claims or liability because of personal injury including death of any employees of the contractor arising out of or in consequence of the performance of this contract.

EPIL and the OWNER shall not be responsible for any loss or damage to property of any kind belonging to the Contractor or its employees, servants or agents during execution of the contract.

In case of any damage or loss of property relating to the WORK (S) that may happen, the Contractor shall at his own cost, repair and make good the same in conformity with the Contract. Adequate insurance coverage shall be obtained by the Contractor for this purpose.

21) **PLANTS & MACHINERY:**

All plant and machinery required for execution of work shall have to be arranged by the contractor at his own cost. At least following plats & machinery shall be deployed at site.

1) Total Station- 1 no.

2) Leveling Instruments- 1 no.

3) Water tanker- 2 nos

4) Weigh batcher mixture machine- 2 nos.

5) Weigh batches- 2 nos.
6) Vibrator (Petrol / Electrical) -5nos.
7) Needle of vibrator- 10 nos.
8) Earth rammer-2nos.
9) De-water pump-2nos.
10) Vibrator -5nos.
11) DG Set (63 KVA) -1 no.
12) Builder Hoist- 1 nos.
13) Monkey Crane- 2 nos.
14) Concrete Pump with placement boom- 1 nos.

22) EQUIPMENTS FOR TESTING OF MATERIALS & CONCRETE AT SITE LABORATORY

All necessary equipment for conducting all necessary tests shall be provided at the site laboratory by the contractor at his own cost.

23) DOCUMENTS FOR SUPPLY ITEMS

For supply items in Part III of BOQ the Supplier shall submit the following documents to EPIL.

a) Warranty Cards.
b) Manufacturer’s test certificate.
c) Any other test certificate from an external laboratory to determine the Technical Specification.
d) Catalogues
e) Pollution Control Certificate.
f) Documents required for registration of vehicle with the local transport Authority and other inter state movement of vehicle.
g) List of recommended spares with specification and costs thereof.
h) Operation & Maintenance manuals.

24) The following minimum key personnel would be deployed on the project by the Contractor for day to day execution and supervision of its works during the entire duration of the project. The minimum number and level of Engineers, Supervisors and other personnel to be deployed by the contractor during Maintenance/defect liability period shall be as directed by EPI. In case contractor fails to deploy adequate number of personnel at site/ office, EPI after giving seven days notice shall engage the required personnel solely at the risk and cost of the contractor and debit the cost of the same to the account of the contractor.
25) **SECURITY DEPOSIT:**

In the event of award of “Works”, Contractor shall submit to EPI, Bank Guarantees from a Nationalised Bank / Scheduled Bank towards security deposit @ 5% of the contract value of the accepted tender within 10 days from the date of LOI as per the EPI format enclosed and BG shall be valid upto the defect liability period i.e. 12 months from the date of taking over the project, with claim period of 6 months failing which EPI at his discretion may revoke the LOI & forfeit the EMD furnished along with tender. Security deposit will be returned to the contractor after satisfactory completion of Project and defect liability period.

26) **RETENTION MONEY**:

The Retention Money shall be deducted from each running bill of the Contractor at 5% (five only) of the gross value of the Running Account bill. The retention money shall be refunded to the contractor after completion of the Project successfully upto the satisfaction of EPI/CLIENT along with final Bill. Clause no 9.00 of GCC shall also be referred for payment of Retention money.

27) **MOBILIZATION ADVANCE**:

Shall not be applicable for this work.

28) **Taxes and Duties**:

All Taxes, Duties, VAT, Cess, Levies, Octroi, Entry Tax, Royalties, Works Contract Tax, Turnover Tax, Labour Welfare Cess, Service Tax and other expenses etc. as applicable for this “Works” as on date of NIT are included in the contract price. The payment of total Works contract Tax, VAT, Turnover Tax,
Labour welfare cess etc. applicable on the Contract value shall be responsibility of the CONTRACTOR and is included in the Contract price of the CONTRACTOR. In case EPI pays any WCT/VAT/TOT/Labour welfare cess etc. on this project, the same shall be recovered as reimbursement from the CONTRACTOR by deducting the same from their bills or other dues and in such cases no certificate in this regard shall be issued by EPI to the CONTRACTOR. Any variation in taxes and imposition of new taxes by state or central government shall be paid/recovered over and above the quoted price upon submission of proof by either side during execution of the contract subject to reimbursement by client.

29) The contractor shall prepare and submit shop drawings for, electrical work etc. to Engineer In-charge for approval before execution of the work.

30) The contractor shall get approval of plinth area on completion of work at plinth level and final approval of the area at the completion of building from authority as per approved drawing/norms followed by local authority during approval of construction drawing. No extra claim shall be entertained on this account.

31) The contractor has to get executed the works from specialized agencies for the specialized nature of works such as aluminum works, wood works, false ceiling works, flooring works, finishing items, arboriculture, electrical works any other specialized work as decided by Engineer In charge. The contractor has to obtain the approval from Engineer-In charge of EPIL for execution of specialized nature of work.

32) It is the responsibility of the contractor for getting the approval from the local statutory authorities such as town planning / municipal authorities / electricity board/fire department etc. and other department for the works executed at site as per the approved plans and designs etc. The statutory fees payable for approval shall be made directly to the local government department / state authorities by EPIL/ITBP authorities. Other incidental expenditure if any shall be borne by the contractor and no reimbursement will be made for the same.

33) The contractor is responsible for obtaining the connection for water supply, sewer connection, electric connection and other connections if any from local authorities/state Electricity board. However the statutory official payments payable to Govt. department shall be paid by EPIL/ITBP directly to the concerned authorities.

34) The contractor shall have to obtain all Approvals including Connections/ NOCs/ Completion Certificates/ Occupancy Certificate, etc from the concerned Local/Statutory authorities for Sewerage works, Water Supply works, Fire Fighting work, Fire Alarm system work, DG set etc. at his own cost and nothing extra other than statutory fee/charges shall be payable on this account to the contractor. However, the letters required from the owner for the needful stated
purposes will be arranged by EPIL from the owner as per the request of contractor along with the statutory charges/fee demanded by the local/statutory authorities.

35) The contractor shall engage a specialized agency for execution of Fire fighting, CCTV work etc. The specialized agencies so engaged should have relevant license as required for execution of these works. The contractor will submit the credentials of the specialized agencies along with their consent for approval of EPIL before engaging the specialized agency. It may, however, be noted that the entire responsibility towards quantity and quality of the entire project including services shall remain with the main contractor. Nothing extra will be paid on this account.

36) Concrete mixed design by using approved admixture shall be carried out by the contractor at his own cost from approved laboratory before starting the work.

37) Electrical Works shall be carried out as per CPWD specifications for Electrical Works (Part-I) Internal, 2005, (Part-II) External, 1994 with up to date correction slips, General specifications for Electrical Works part-VII (DG sets), 2006; General specifications for Electrical Works part-IV (Sub-station), 2007; General specifications for Electrical works- Part V (Wet riser & sprinkler systems) 2006.

38) For items not covered under any of the specifications mentioned in Tender Documents, the works shall be carried out as per CPWD Specifications/manufacturer's specifications/General Engineering Practice and/or as per directions of Engineer-in-Charge. The rate for such extra work shall be derived as as follows:

a) If the item is available in DSR 2014, contractor has to execute the item with the same rate below or at par tender percentage.

b) If the item is not available in DSR 2014 and similar item is available, rate for such extra work shall be derived from the similar item by adding or deleting the differences below or at par tender percentage.

c) If the rate for any item is not possible to derive as mentioned above, the rate for which shall be derived by analyzing as per the prevailing market rates.

39) The Contractor shall procure Reinforcement steel and Structural steel required for the works directly from the Manufacturer/authorized dealer which mandatorily have to be primary procedure re-rolled reinforcement shall be used.

40) The contractor should invariably obtain necessary manufacturers test certificates from the suppliers of steel and cement for each and every consignment and furnish them to the Engineer-in-charge before use on works.
41) The original bills of procurement should be submitted to the Engineer-in-charge for making payment of the item. The contractor shall purchase the steel and cement on the name of work, the name of contractor and furnish the same to the Engineer-in-charge. The steel and cement without the above two names will not be accepted on the works.

42) If any difference is observed on carriage inwards, carriage outwards and theoretical requirement of steel and cement for finished works, recovery at double the rate will be effected from the contractors bills for the quantity varied above the allowable limits.

43) Three sets of As Built Drawings shall be submitted by the contractor in hard and soft copies.

44) For all Schedule BOQ items the nomenclature /rates/ unit of DSR items shall be followed. In case of any ambiguity is observed in Scheduled BOQ items relevant DSR item will hold good.

45) The contractor will arrange to carry out total station survey before start of work and after completion of work at his own cost and will provide sufficient Hard & soft Copies to EPIL.

46) All the cost of travel, lodging, boarding etc. towards visits by Client, their Consultant etc. to the manufacturing units/works for the inspection of materials, equipment etc. under the scope of work of Contractor shall be borne by the Contractor.

47) Water and Electricity required for constructions activities shall be arranged by the Contractor on their own and no payment shall be releases for the same. The rates quoted by the Contractor are deemed to be inclusive of above.

48) The Contractor shall provide and maintain facilities as per Annexure –I for exclusive use of EPI. These facilities and vehicles shall be the property of the Contractor at the end of the contract.

49) The Contractor shall be fully responsible to complete the “Works” in workmen like manner to the satisfaction of Client and EPI by maintaining high standard of quality and precision as per ‘Tender documents’, Agreements, Terms & Conditions, Specifications, Drawings etc., within the contractual completion period and within their quoted rates/amount. In case Client reduces or increases scope of work related to Contractor’s portion of work, the same shall be binding on Contractor and the Contractor has to execute the same at rates quoted by them.
50) In case Contractor is awarded the “Works” and fails to execute the same as per agreed schedule of progress of work and as per specified quality and/or lags behind in activities required for timely completion of “Works”, as determined by EPI/Client, then EPI shall give 15 days written notice to Contractor to achieve the specified quality and/or to deploy adequate resources to the satisfaction of EPI, for timely completion of “Works”. Upon expiry of the notice period, if Contractor fails to achieve specified quality and/or fails to take action for timely completion of “Works”, then EPI shall have option to withdraw the remaining work partly or in full from Contractor and get the same executed at the risk and cost of the Contractor from alternative agency/agencies.

51) The Contractor confirms that it holds EPF Code number, CST-TIN, VAT-TIN/Sales tax on Works contract number, Service tax registration number, PAN (Permanent Account Number of Income Tax) etc. and shall be responsible for depositing EPF subscription and contribution for labour and staff employed by it on the “Works” and Service tax, other taxes, duties and dues etc. as per statutory requirements and documentary evidence of same shall be provided to EPI. The Contractor shall also be responsible for labour welfare and for arranging labour and other licenses/permits/clearances etc. for the project at their own cost. The Contractor shall comply with all the requirements as per labour laws/acts. All the records in this regard shall be maintained by Contractor as per statutory requirements and rules and shall be produced by the Contractor on demand if required.

52) The Contractor shall be responsible for obtaining all approvals from EPI/Client with regard to quality of materials & workmanship and measurements etc. for their portion of work. The Contractor shall be responsible for reconciliation of issue material, if any. In case there is any shortfall of free issue items found during reconciliation, recovery at double the cost of materials prevailing at that time of recovery shall be made from the Contractor’s due payment.

53) In case of non-approval of Contractor’s association for the Project by the Client and/or by the corporate office of EPI due to any reasons whatsoever at any stage of the “Works”, the Contractor shall have no claim on EPI.

54) Income tax shall be deducted as per the prevailing rate of tax as applicable.

55) The Contractor shall plan and execute the “Work” in his scope of work in such a manner that the other works, connected with the “Works” of the Contractor, but not included in Contractor’s scope of work do not get affected / delayed.

56) The quantities indicated in the BOQ are tentative. However contractor has to execute the works as per drawings and site conditions. Payment will be released for the work executed as per the rates quoted by contractor even if the quantities increases or decreases upto any extent.
57) The Contractor shall deploy sufficient plant & equipment of the required capacity and in good working condition for completion of the works in stipulated time with required quality. The equipment should either be owned by the Contractor or hired/leased. The deployment of equipment by Contractor shall be as decided by EPI and the same shall not be less than the minimum deployment stipulated, if any, for execution of “Works” and as per schedule agreed with EPI. The Contractor shall make arrangement for regular maintenance including preventive and breakdown maintenance and maintain stock of essential spares at site/near to site so as to ensure minimum breakdown time of equipment. The equipment once brought to site shall not be allowed to be removed without the consent of EPI. In case the Contractor fails to deploy sufficient equipment to the satisfaction of EPI or in case of prolonged breakdown of equipment, EPI at its sole discretion shall arrange the required equipment and debit all the related costs including ten percent overheads of EPI and shall recover the same from the due payments of Contractor, including from its bank guarantees available with EPI.

58) Contractor shall ensure compliance with all Central, State and Local Laws, Rules, Regulations etc. as applicable or may be applicable during the course of execution, maintenance etc. of the “Works” and shall indemnify EPI against any claim or damages whatsoever on such accounts. The Contractor shall keep EPI indemnified at all times against infringement of any Patent or Intellectual Property rights.

59) EPI is an ISO-9001 and ISO-14001 Company. The conditions of the ISO as applicable should be followed by the Contractor for implementation & maintaining the established procedures of EPI for this purpose. Following documents have been provided by EPI to Contractor & Contractor confirms receipt of the same:
   a. Quality, Environmental, OH & safety policy
   b. Environmental, Objectives & Targets
   c. Operational control – Noise
   d. Operational control – wastage
   e. Operational control – energy

60) The “Parties” shall make efforts to settle disputes, if any, amicably. Only if amicable settlement is not possible, the same shall be referred to the sole arbitration of the Chairman & Managing Director (CMD) of EPI or the person appointed by the CMD, EPI and the decision of the arbitrator shall be final and binding on the “Parties”. Arbitration will be according to “Conciliation & Arbitration” clause of GCC.

61) Project sign board to be supplied and erected at the site office as per the drawing enclosed.
62) The work executed by Contractor shall be subject to audit and quality control checks from Quality Control Division & Technical Audit of EPI, Client, Inspecting Agency of the Client and Chief Technical Examiner of Central Vigilance Commission, Govt. of India. In the eventuality of any defect/ sub standard works as brought out in the report or noticed otherwise at any time during execution, maintenance period etc., the same shall be made good by the Contractor. In case Contractor fails to rectify the defect/sub-standard work within the time period stipulated by EPI, EPI shall get it rectified at the risk and cost of Contractor and shall recover the amount from the dues of the Contractor.

63) EPI has agreed to award the work to the Contractor on the basis of details regarding experience profile, financial standing, credentials, fulfillment of statutory obligations, etc. of Contractor submitted by Contractor to EPI. In case, at a later stage if it is found that the Contractor has submitted incorrect, false details and credentials resulting in apprehensions on the capabilities of Contractor with regard to quality & timely completion of works, financial capabilities etc, EPI can terminate this order solely at its option. In this eventuality the Contractor shall be liable for the losses suffered by EPI and further Contractor shall have no claim on EPI, whatsoever.

64) **BARRICADING OF SITE**

The contractor has to make their own arrangements for barricading of proposed site of the 29th Battalion for ITBP at Jabalpur (M.P.) as per Site conditions. No payment shall be made on account of barricading the above mentioned work at site. The barricading of site shall be as per the directions of Engineer In-charge. The material used for barricading of work shall be taken back by contractor after completion of the work with written permission of Engineer In-charge.

65) **OPC Cement** only is to be used in this work.
FACILITIES TO BE PROVIDED BY PARTY TO EPI

Immediately on placement of LOI/Work Order (whichever is earlier) by EPI on the PARTY, the PARTY at its own cost shall provide furnished office, facilities etc. exclusively for the use of personnel of EPI as per details given below. The PARTY shall make his rates in their offer sufficiently comprehensive to cover the cost of the facilities as per details shown below and the PARTY shall not be entitled for any extra payment for the same:

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th></th>
</tr>
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<tbody>
<tr>
<td><strong>A) OFFICE ACCOMMODATION</strong></td>
<td>500 Sq.ft.</td>
</tr>
<tr>
<td>Furnished Office accommodation as per direction of EPI with basic amenities like Toilets, Drinking water arrangement, lights, fans etc. for exclusive use of EPI’s Engineers &amp; Staff and maintenance of the same till Defect Liability Period. The Specifications and Design of accommodation shall be as approved by EPI.</td>
<td></td>
</tr>
<tr>
<td><strong>B) VEHICLE (Brand New)</strong></td>
<td>1 No.</td>
</tr>
<tr>
<td>Brand New Four wheel drive Scorpio DX vehicle or equivalent with Driver and accessories valuing Rs. 40,000/- each vehicle</td>
<td>4000 Kms.</td>
</tr>
<tr>
<td>Monthly running shall be restricted to</td>
<td></td>
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</tbody>
</table>

The vehicles shall be brand new and shall be provided with driver on full time basis. Consumables like diesel/petrol/oil lubricants and spare parts etc. shall be provided by the PARTY at their cost. The vehicles shall be maintained in good working condition. In case of breakdown, replacement of vehicles shall be provided by PARTY immediately. The cost of registration, transportation etc. shall be borne by the PARTY. In case a vehicle is not required by EPI, a recovery of Rs. 40,000/- per month per vehicle shall be made from the PARTY for this purpose till the end of defect liability period. In case Driver, POL, maintenance of any vehicle is not required by EPI for any vehicle, a recovery of Rs. 20,000.00 per month per vehicle shall be made from the PARTY for this purpose till the end of defect liability period.

The above gadgets and facilities should be brand new and of reputed make and all facilities shall be provided and maintained properly (including payment of water & electricity bills etc.) by the PARTY at Project site or at any other office related with execution of this project till completion of work, handing over, defect liability period in all respect at his own cost. The PARTY shall also make stand-by arrangement for water &
electricity to ensure un-interrupted supply. The equipment/items shall be the property of PARTY at the end of contract. The PARTY shall be responsible for watch and ward of site office and other facilities etc. In case of theft/damage of any equipment/items, the PARTY shall immediately replace the same within a maximum period of two days.

The PARTY shall provide ‘Sign Board(s)’ (Mentioned at Annexure-II) as per design approved by EPI and/or Client.

In case the above facilities are not provided by the PARTY within 10 (ten) days of award of work or replacement is not provided within the specified period, EPI shall arrange the same at the risk and cost of the PARTY and make the recoveries from the bills of the PARTY for the same. The decision of EPI shall be final and binding on the PARTY in this regard.
TECHNICAL SPECIFICATIONS

All works shall be executed, measured and paid for as per latest Central Public Works Department (C.P.W.D.) Specifications, unless otherwise provided in the item detail / agreement.

The tenderers are requested to obtain the copies of the above documents directly from the office of Central Public Works Department (C.P.W.D.) as these Specifications are not being issued along with the tender documents. These specifications with up to date correction slips will form part of the contract agreement to be executed with the successful tenderer.
PARTICULAR TECHNICAL SPECIFICATIONS

FOR

CIVIL WORK

1. **EARTH WORK:-**

   The work shall be done in accordance with CPWD Specifications - 2009 - Vol.I & Vol. II with upto date correction slips.

2. **CONCRETE WORK:-**

   The work shall be done in accordance with CPWD Specifications - 2009 - Vol.I & Vol. II with upto date correction slips.

3. **R.C.C. WORK (DESIGN MIX CONCRETE):-**
   
   3.1 The RCC work shall be done with Design Mix Concrete. Wherever letter M has been indicated, the same shall imply for the Design Mix Concrete. The Design Mix Concrete will be designated based on the principles given in IS:456, 10262 & SP 23. The conditions & specifications stated herein shall have precedence over all conditions & specification stated in relevant I.S. Codes / C.P.W.D. Specifications. The concrete mix shall be designed for the specified target mean compressive strength in order to ensure that work test result do not fall below the acceptance criteria specified for the concrete mix. The Contractor shall design mixes for each class of concrete indicating that the concrete ingredients and proportions meeting requirements specified. The mix shall be designed with quantities of admixture / plasticizer proposed to achieve required workability & strength.

   3.2 The sources of coarse aggregate, fine aggregate, water, admixture & cement to be used in concrete work shall be identified by the contractor & he will satisfy himself regarding their conforming to the relevant specification & their availability before getting the same approved by the Engineer-In-Charge.


c) Water:- It shall conform to requirements laid down in IS:456-2000 / Para 5.4 or CPWD Specifications - 2009 - Vol.I & Vol. II with correction slips.

d) Cement:- OPC of grade 43 shall be used for design mix concrete and shall conform to IS-8112, IS-12269 or IS-12270. However, if higher grade of cement is used by the contractor nothing extra shall be paid on this account.

e) Admixture / Plasticizer – The admixture shall confirm to IS:9103. Whenever required, the admixture of approved quality & approved make only shall be used to attain the required workability.

3.3 Grade of Concrete:- The compressive strength of various grades of concrete with various parameters shall be as follows :-

<table>
<thead>
<tr>
<th>GRADE DESIGNATION</th>
<th>COMпрессIVE STRENGTH ON 15 Cm. CUBES Min. 7 DAYS (N/mm²)</th>
<th>SPECIFIED CHARACTERISTIC COMPRESSIVE STRENGTH AT 28 DAYS (N/mm²)</th>
<th>MINIMUM CEMENT CONTENT (Kg. Per Cub. Mtr.)</th>
<th>MAXIMUM WATER CEMENT RATIO</th>
<th>SLUMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-20</td>
<td>As per Design</td>
<td>20</td>
<td>350</td>
<td>0.50</td>
<td>25-75</td>
</tr>
<tr>
<td>M-25</td>
<td>As per Design</td>
<td>25</td>
<td>350</td>
<td>0.50</td>
<td>25-75</td>
</tr>
<tr>
<td>M-30</td>
<td>As per Design</td>
<td>30</td>
<td>400</td>
<td>0.45</td>
<td>25-75</td>
</tr>
<tr>
<td>M-35</td>
<td>As per Design</td>
<td>35</td>
<td>400</td>
<td>0.45</td>
<td>25-75</td>
</tr>
</tbody>
</table>

NOTE:–

a) In the designation of a Concrete mix letter M refers to the mix and the number of the specified characteristic compressive strength of 15 cm - Cube at 28 days expressed in N/mm².

b) It is specifically highlighted that in addition to the above requirements. The maximum cement content
for any grade shall be limited to 530 kg. / Cubic metre.

c) The minimum / maximum cement content for design mix concrete shall be maintained as per the quantity mentioned above. Even in the case where the quantity of cement required is higher than the minimum specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the contractor.

3.4 The Contractor shall engage one of the following approved laboratories / test house for designing the concrete mix in accordance with relevant IS Code and to conduct laboratory tests to ensure the target strength & workability criteria for a given grade of concrete.

a) Any State University


c) IITs.

The various ingredients for mix design / laboratory tests shall be sent to the lab / test houses through the Engineer-in-charge and the samples of such aggregates sent shall be preserved at site by the employer.

In the event if all the three laboratories are unable to carry out the requisite design / testing, the contractor may have it done from any other laboratory with prior approval of the Engineer-In-Charge.

3.5 The contractor shall submit the report on design mix from any of above approved laboratories for approval of Engineer-In-Charge within 30 days from the date of issue of letter of acceptance of the tender. No concreting shall be done until the design mix is approved. In case of white portland cement and the likely use of admixtures in concrete with ordinary portland/white portland cement, the contractor shall design and test the concrete mix by using trial mixes with white cement and / or admixtures also, for which nothing extra shall be payable.

3.6 In case of change of source or characteristic properties of the ingredients used in the concrete mix during the work, a revised laboratory mix design report conducted at laboratory established at site shall be
submitted by the contractor as per the direction of the Engineer-in-charge.

3.7 **TRIAL BATCHES**

a) The designed mix proportions shall be checked for target mean compressive strength by means of trial batches.

b) The quantities of materials for each trial mix shall be sufficient for at least six specimens (cubes) and the concrete required for carrying out workability tests.

c) The workability of trial mix No.1 shall be measured and mix shall be carefully observed for freedom from segregation, bleeding and its finishing characteristics. The water content, if required, shall be adjusted corresponding to the required changes in the workability.

d) With the modified water content, the mix proportions shall be recalculated by keeping with water cement ratio unchanged. The mix proportion, as modified, shall form the Trial Mix No.2 and tested for the specified strength and workability.

e) In addition, trial mix No.3 and 4 shall be designed by keeping water contents same as that determined for trial mix 2 but varying the water cement ratio by + 10 percent of the specified value and tested for their design characteristics.

3.8 All cost of mix designing and testing connected therewith including charges payable to the laboratory shall be borne by the Contractor including redesigning of the concrete mix wherever required & directed by Engineer-In-Charge.

3.9 **APPROVAL OF DESIGN MIX:**-

a) The mix design for a specified grade of concrete shall be done for a target mean compressive strength $Tck = Fck + 1.65s$

Where $Fck$ = Characteristic compressive strength at 28 days.
$s = \text{Standard deviation which depends on degree of quality control.}$
The standard deviation for different grades of concrete shall be as follows:-

<table>
<thead>
<tr>
<th>GRADE OF CONCRETE</th>
<th>STANDARD DEVIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-20</td>
<td>4.0</td>
</tr>
<tr>
<td>M-25</td>
<td>4.0</td>
</tr>
<tr>
<td>M-30</td>
<td>5.0</td>
</tr>
<tr>
<td>M-35</td>
<td>5.0</td>
</tr>
<tr>
<td>M-40</td>
<td>5.0</td>
</tr>
</tbody>
</table>

b) Minimum three sets of separate preliminary tests shall be carried out for each trial batch of concrete mix. Each test shall comprise of six specimens and only one test-set of six specimens shall be made on any particular day.

c) Out of the six specimen of each set, three shall be tested at seven days and remaining three at 28 days. The preliminary tests at seven days are intended only to indicate the strength to be attained at 28 days. While the design mix shall be approved only on the basis of test strength at 28 days.

d) The design mix shall be considered satisfactory and approved if at least three preliminary test-sets individually satisfy the following strength and workability criteria:

(i) The average strength of each test-set is not less than the specified target mean compressive strength (Tck).

(ii) The strength of any specimen cube is not less than 0.85 Tck.

(iii) The concrete mix is of required degree of workability and acceptable concrete finish.

3.10 BATCHING & MIXING:-

a) All concreting shall be done using computerised automatic concrete batching plant with automatic admixture dispenser which shall be installed by the contractor at site, calibrated & tested. The batching plant shall conform to IS: 4925. It shall have the facilities of data print-outs, presetting the quantity to be weighed with automatic cut-off when the same is achieved.
b) In case of non-availability of batched concrete, ready mix concrete (RMC) may be used. The concrete to site shall be transported by transit mixtures. All the precautions shall be taken during the transportation and handling of concrete to achieve the desired strength, durability, etc. as envisaged in the mix design. Contractor has to get the approval from Engineer-In-Charge regarding source of ready mix concrete. Nothing extra shall be paid for ready mix concrete instead of batched mixed concrete.

c) All measuring equipment shall be maintained in a clean and serviceable condition and their accuracy shall be checked atleast once a month.

d) Only single sized good quality stone aggregate shall be brought to site of work from the approved source. The grading of the stone aggregate shall be controlled by blending the aggregate of different sizes in the required proportions at site of work. The aggregate of different sizes shall be stock-piled separately, preferably a day before use. The grading of coarse and fine aggregates shall be checked as frequently as possible and as directed by the Engineer-In-Charge to ensure that the specified grading and quality of aggregate is maintained.

e) It is important to maintain the water cement ratio constant at its specified or approved value by making adjustment for the moisture contents of both fine and coarse aggregates. The moisture contents in the aggregate shall be determined as frequently as possible in keeping with the weather conditions and as per the provisions of IS:2386 (Part-III) 1963.

3.11 LAYING:

a) The concrete shall be placed in position using tower crane or concrete pumps of adequate capacity. Use of mechanical hoists shall not be permitted for lifting of concrete to various levels. For pumping of concrete the design of concrete mix shall be done separately. Nothing extra for laying concrete using concrete pumps or for extra concrete mix design shall be paid.
3.12 All other operations in concreting work like mixing, slump, laying, placing of concrete, compaction, curing etc. not mentioned in this particular specifications for Design Mix of Concrete shall be as per CPWD Specifications - 2009 - Vol.I& Vol. II with upto date correction slips.

3.13 **SAMPLING:**

a) Samples from fresh concrete shall be taken as per IS 1199-1959 and the test cubes shall be made, cured and tested in accordance with IS:516-1959.

b) Each test sample shall comprise of six test cubes (specimen), three of which shall be tested at 7 days and remaining for tests at 28 days.

c) **FREQUENCY OF SAMPLING:**

   (i) A random sampling procedure shall be adopted to ensure that the sampling is spread over the entire period of concreting and cover all mixing units.

   (ii) The concrete work shall be notionally divided into lots as under for the purpose of sampling conditions.

   - Footings, rafts etc.
   - Columns and walls at all levels.
   - Beams at all levels.
   - Slabs at all levels.

   (iii) At least one test sample shall be taken for each lot of concrete work.

   (iv) Each grade of concrete shall form different lot of testing.

   (v) The minimum frequency of sampling of concrete of each grade shall be in accordance with the following:

<table>
<thead>
<tr>
<th>QUANTITY OF CONCRETE IN THE WORK, CUBIC METRE PER DAY.</th>
<th>NUMBER OF SAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>1</td>
</tr>
<tr>
<td>6-15</td>
<td>2</td>
</tr>
<tr>
<td>16-30</td>
<td>3</td>
</tr>
</tbody>
</table>
### TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>31-50</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>51 &amp; above</td>
<td>4 Plus one additional sample for each additional 50 cubic meter or part thereof.</td>
</tr>
</tbody>
</table>

**NOTE:** At least one sample shall be taken from each shift.

d) The concrete work shall be assessed on day to day basis & samples shall be taken as specified.

3.14 Work strength test shall be conducted in accordance with IS:516 on random sampling.

3.15 **TEST RESULTS OF SAMPLES:**

The test results of the sample shall be the average of the strength of three specimen. The individual variation shall not be more than + 15% percent of the average. If variation is more, the test results shall be treated as invalid. 90% of the total tests shall be done at the laboratory established at site by the contractor and remaining 10% in the laboratory of Central Designs Organization, CPWD or in any other laboratory as directed by the Engineer-in-Charge.

3.16 **STANDARD OF ACCEPTANCE:**

a) In case the test results of all the samples are above the characteristic compressive strength, the concrete shall be accepted.

b) In case the test result of one or more samples fails to meet the requirement (a) above, it shall be accepted if both the following conditions are met:

   (i) Any individual test result is not less than 
   \[(F_{ck} - 3) \text{ N/mm}^2\].
   
   (ii) The mean of test results from any group of four consecutive samples is more than 
   \[(F_{ck} + 3) \text{ N/mm}^2\].
   
   (iii) Concrete of each grade shall be assessed separately.

c) Concrete is liable to be rejected, if it is porous or honeycombed, its placing has been interrupted without providing a proper construction joint, the reinforcement has been displaced beyond the tolerances specified, or construction tolerances have not been met.
3.17 Only M.S. centring / shuttering and scaffolding material unless & otherwise specified shall be used for all R.C.C. work to give an even finish of concrete surface. However, marine-ply shuttering in exceptional cases as per site requirement may be used on specific request from contractor as approved by the Engineer-In-Charge.

3.18 Nothing extra shall be paid for the centring and shuttering, circular in shape whenever the form work is having a mean radius exceeding 6m in plan.

3.19 In order to keep the floor finish as per architectural drawings and to provide required thickness of the flooring as per specifications, the level of top surface of R.C.C. shall be accordingly adjusted at the time of its centring, shuttering and casting for which nothing extra shall be paid to the Contractor.

As per general engineering practice, level of floors in toilet / bath, balconies, shall be kept 12 to 20mm as required lower than general floors shuttering should be adjusted accordingly. Nothing extra is payable on this account.


3.21 **Tolerances** - As per CPWD Specifications - 2009 - Vol.I & Vol. II with upto date correction slips.

3.22 **Rates:**

a) The rate includes the cost of materials, labour and T&P, including mixing, placing, transportation involved in all the operations described above except for the cost of centring, shuttering & reinforcement which will be paid for separately.

b) In case of actual average compressive strength being less than specified strength which shall be governed by para “Standard of Acceptance” as above the rate payable shall be worked out accordingly as per CPWD Specifications - 2009 - Vol.I & Vol. II with upto date correction slips.

c) In case of rejection of concrete on account of unacceptable compressive strength, governed by para “Standard of Acceptance” as above, the work for which samples have failed shall be redone at the cost of contractor. However, the Engineer-in-charge may order for additional tests (like cutting cores,
ultrasonic pulse velocity test, load test on structure on part of structure, etc) to be carried out at the cost of contractor to ascertain if the portion of structure wherein concrete represented by the sample has been used, can be retained on the basis of results of individual or combination of these tests. The Contractor shall take remedial measures necessary to retain the structure as approved by the Engineer-in-charge without any extra cost. However, for payment, the basis of rate payable to contractor shall be governed by the 28 days cube test results and reduced rates shall be regulated in accordance with relevant clause.

3.23 In respect of all projected slabs at all levels including cantilever, canopy, the payment for the RCC work shall be made under the item RCC slabs. The payment for shuttering at the edges shall be made under item of centering and shuttering for RCC slabs. Nothing extra shall be paid for the side shuttering at the edge of these projected balconies projected varandah slabs.

3.24 SHUTTERING:-

Steel shuttering as approved by the engineer-in-charge shall be used by the contractor. Minimum size of shuttering plates shall be 600mm x 900mm except for the case when closing pieces required to complete the shuttering panels.

Dented, broken, cracked, twisted or rusted shuttering plates shall not be allowed to be used on the work.

The shuttering plates shall be cleaned properly with electrically driven sanders to remove any cement slurry or cement mortar or rust. Proper shuttering oil or debonding compound shall be applied on the surface of the shutter plates in the requisite quantity before assembly of steel reinforcement.

3.25 REINFORCEMENT:-

a) The reinforcement shall be done as per CPWD Specifications - 2009 - Vol.I& Vol. II with up-to-date correction slips.

b) The rate of item of reinforcement of RCC work includes all operations including straightening, cutting, bending, welding, binding with annealed steel or welding and placing in position at all the floors with all leads and lift complete as per CPWD
4. **BRICK WORK:**

4.1 The brick work shall be carried out with good quality well burnt FPS bricks of 75 designations as per CPWD Specifications - 2009 - Vol.I & Vol. II with upto date correction slips or as specified. The rate shall also include for leaving chases / notches for dowels / cramps for all kinds of cladding to come over brick work.

5. **WOOD WORK:**

5.1 The wood work in general shall be carried out as per CPWD Specifications - 2009 - Vol.I & Vol. II with upto date correction slips.

5.2 All fittings and fixtures shall be got approved from the Engineer-in Charge before procurement well in advance and the approved samples shall be kept at site till completion of the work.

5.3 Glazing for toilets shall be of translucent type.

5.4 The shape and size of beading shall be as per drawings. The joints of beading shall be mitred.

5.5 **FLUSH DOOR SHUTTERS:**

a) It shall be manufactured as per nomenclature of the item & as per drawings.

b) Flush door shutters shall be procured from approved manufacturer only.

c) Teak wood lipping shall be fixed on all the edges with the help of approved adhesive & using headless nails.

d) Laminate of required thickness shall be fixed on the flush door shutter using the approved adhesive.
e) On the entire exposed wooden surface, spirit polishing as per C.P.W.D. specification should be done.

f) Rate - Length and breadth shall be measured to a correct a cm.

6. **STEEL WORK :-**

6.1 The work shall be done in accordance with CPWD Specifications - 2009 - Vol.I& Vol. II with upto date correction slips.

7. **FLOORING:-**

7.1 All work in general shall be carried out as per CPWD Specifications - 2009 - Vol.I& Vol. II with upto date correction slips.

7.2 Whenever flooring is to be done in patterns tiles / stone, the contractor shall get samples of each pattern laid and approved by the Engineer-in-charge before final laying of such flooring for which nothing extra shall be paid.

7.3 Different stones / tiles used in pattern flooring shall be measured separately as defined in the nomenclature of the item and nothing extra for laying pattern flooring shall be paid over and above the quoted rate. No additional wastage, if any, shall be accounted for any extra payment.

7.4 The proper gradient shall be given to flooring for toilets, veranda, kitchen, courtyand, etc. as per the directions of Engineer-in-charge.

8. **ROOFING:-**

8.1 The work shall be done in accordance with CPWD Specifications - 2009 - Vol.I& Vol. II with upto date correction slips.

9. **FINISHING:-**

9.1 The work shall be done in accordance with CPWD Specifications - 2009 - Vol.I& Vol. II with upto date correction slips.
9.2 All painting material shall bring to the site of work in the original sealed containers. The material brought to the site of work shall be sufficient for at least 30 days of work. The material shall be kept under the joint custody of contractor and representative of the Engineer-in-charge. The empty containers shall not be removed from the site till the completion of the work without permission of the Engineer-in-charge.

10. **WATERPROOFING WORK:**

The waterproofing work shall be done in accordance with the item description and with CPWD Specifications - 2009 - Vol.I & Vol.II with up to date correction slips.

11. **MISCELLANEOUS WORKS**

11.1 The work shall be done in accordance with CPWD Specifications - 2009 - Vol. I & Vol. II with upto date correction slips.

12. **NON SCHEDULE ITEMS:**

12.1 **Chicken Mesh**

Providing and fixing hexagonal chicken mesh having opening 20mmx20mm of 26 gauge at junctions of concrete & brick work or between different material etc. as directed by Engineer-in-charge

**Material and Workmanship:** As per item description and general specifications.

**Mode of measurement and Payment:** The item shall be measured in Sqm in plan area.

12.2 **Filling of sunken portions with Foam Concrete**

Filling of sunken portion of roof with foam concrete of required height including filling complete leveling and dressing the surface by 50mm thick cement concrete 1:2:4 as per specification.

**Material and Workmanship:** As per item description and manufacturer’s specifications.

**Mode of measurement and Payment:** The item shall be measured in Cum
12.3 Grooves in Plaster

Forming groove of uniform size from 12x12 mm and up to 25x15 mm in plastered surface as per approved pattern, using including wooden battens, nailed to the under layer including removal of wooden battens, repairs to the edge of plaster panel and finishing the groove complete as per specifications and direction of the Engineer-in-Charge.

Material and Workmanship: As per item description and CPWD specifications.

Mode of measurement and Payment: The item shall be measured in Rmt.

12.4 Full Height Storage Unit

Providing and fixing Full height cupboard: Providing and fixing storage unit height made out of 19 mm commercial board for verticals, top, bottom and intermediate vertical partitions as per drawing detail.

Shutters shall be in 25 mm commercial board with teak wood lipping all-round. The front to be finished with 1 mm thk laminate.

Shelves: Shelves are made of 19 mm BWR grade plywood with teak wood lipping a. The teak wood lipping shall be polished. 3 coat hooks and a hanging rod in CB shall be taken. All top of shelves shall be laminated with 1.0 mm thick laminate of white shade.

The top of storage unit also to be finished with a 1mm thk laminate.

The bottom/sides of shelves and other surfaces to be painted with enamel paint of approved shade.

Following hardware to be provided in cupboards:

Aluminum Handles of 125mm long for each shutter, 1 tower bolt of 150 X10 mm and 2 magnetic catchers with 1 chapka for locking.

All items having wooden content should be treated with Anti Termite emulsion of approved brand as per manufacturer specifications / standard practice before fitting.
Material and Workmanship: As per item description and standard CPWD specifications.

Mode of measurement and Payment: The item shall be measured in sqm of surface area.

12.5 SITC of Desert Coolers


Material and Workmanship: As per item description, manufacturer’s specifications and as per approval of Engineer - in - Charge.

Mode of measurement and Payment: The item shall be measured in Each.

12.6 Removing, stacking & relaying of existing onsite cement concrete blocks

Removing, stacking & relaying 60 mm thick factory made cement concrete interlocking paver block of M -30 grade made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50 mm thick compacted bed of coarse sand, filling the joints with fine sand etc. all complete as per the direction of Engineer-in-charge.

Material and Workmanship: As per item description and standard practice.

Mode of measurement and Payment: The item shall be measured in Sqm.

12.7 Removing, stacking & relaying of existing Kerb Stone

Removing, stacking & relaying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5 mm), including making drainage opening wherever required complete etc. as per direction of Engineer-in-Charge (length of finished kerb edging shall be measured for payment).
(Precast C.C. kerb stone shall be approved by Engineer-in-Charge).

**Material and Workmanship:** As per item description and standard practice.

**Mode of measurement and Payment:** The item shall be measured in Sqm.

**12.8 Providing and fixing solar water heating 500 lpd capacity of approved brand (arena or equivalent) and manufacturer included etc complete as per direction by Engineer-in-charge of following characteristics :-**

SWHs 500 LPD  
PX/OL  
Pressurized Direct  
Thermophysion system- 500 LPD  
No. of collectors- 05 Nos  
Pressurized - Yes  
Heat Exchanger - No

**Material and Workmanship:** As per item description and standard practice.

**Mode of measurement and Payment:** The item shall be measured in job. The work does not include piping from solar geyser to toilets.
Section I SANITARY FIXTURES

1. Scope of Work

1.1 Work under this section shall consist of furnishing all labour necessary and required to completely remove all existing sanitary accessories and install new sanitary fixture and accessories as required by the drawing and specified hereinafter.

1.2 Without restricting to the generality of the foregoing the sanitary fixture shall include fixing all sanitary fixture, fitting and accessories etc, necessary and required for the installation.

1.3 Whether specifically mentioned or not all fixture and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers, as required.

1.4 All exposed pipes within toilets and near fixture shall be chromium-plated brass or copper unless otherwise specified.

2. General Requirements

2.1 All fixture and fitting shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the specification and drawings.

2.2 All fixture and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per architectural/interior designer's requirements. Wherever necessary the fittings shall be centered to dimensions and pattern desired.

2.3 Fixing screws shall be half round head chromium plated brass with chrome plated washers wherever required.

2.4 All fittings and fixture shall be fixed in a neat workman like manner true to levels and heights shown on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all Intel and outlet pipes at correct positions. Faulty locations shall not be accepted.
and the Contractor shall rectify the same. Any consequential damages to the finished works shall also be made good by the Contractor at his own coat.

3. **Water Closet**
   3.1 Water cosset shall be floor mounted type European style or Indian style with P or S trap. The EWC shall be with plastic seat and lid and seat mounted flushing cistern or flush valve as called for in BOQ.

   3.2 Each WC seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the WC.

4. **Urinals**
   4.1 Urinals shall be semi stall lipped type glazed vitreous china.

   4.2 Urinals shall be provided with 15mm dia, chrome plated spreader, 23mm dia stainless steel domical waste and cast brass bottle trap with an wall flange and shall be fixed to wall by cast iron brackets as recommended by manufacturer complete.

   4.3 Urinals shall be fixed with chrome plated brass screws.

5. **Lavatory Basin**
   5.1 Lavatory basin shall be white glazed vitreous china.

   5.2 Each basin shall be provided with cast iron brackets and clips and securely fixed to wall. Placing of basins over the brackets without secure fixing shall not be accepted.

7. **Accessories**
   7.1 Contractors shall install all chromium plated and porcelain accessories as shown on the drawings or directed by Managers/Consultants.

   7.2 All CP accessories shall be fixed with CP brass half round head screws and cup washers in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by Managers/Consultants.

   7.3 Porcelain accessories shall be fixed in walls and set in cement mortar 1:2 (1cement:2 coarse sand) and fixed in relation to the tiling work.
Section II   SOIL, WASTE, VENT & RAIN WATER PIPES

1. Scope of Work

1.1 Work under this section shall consist of furnishing all labour, material equipment and appliances necessary and required to install all new soil, waste, vent and rainwater pipes as required by the drawings, specified hereinafter.

1.2 Without restricting to the generality of the foregoing, the soil, waste, vent, and rainwater pipes system shall include the following:-

a) Providing all new pipes, fitting & accessories

b) Vertical and horizontal Soil, Waste and Vent Pipes, Rainwater pipes and Fittings, Joints, Clamps and Connections to Fixtures.

c) Connection of all pipes to sewer and storm water lines as shown on the drawings at ground floor level.

d) Floor and urinal traps, cleanout plugs, inlet fittings and rainwater heads.

e) Waste pipe connections from all fixture e.g Wash basin, sinks, urinals kitchen equipment and plant room equipment.

2 General Requirements

2.1 All material shall be new of the best quality conforming to specifications and subject to the approval of Architect.

2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in passages etc.

2.4 Pipes shall be securely fixed to walls by suitable clamps at specified.
2.5 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

2.6 All work shall be executed as shown on the drawings.

Section III WATER SUPPLY PIPING & INSULATION

1. Scope of Work

1.1 Work under this section consists of furnishing all labour, material equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the Schedule of Quantities.

1.2 Without restricting to the generality of the foregoing the water supply system shall include the following:-
   a) Providing of all new pipes, fittings and accessories.
   b) Water distribution system to all parts of building.
   c) Hot water distribution system.
   d) Pipe protection and painting.
   e) Insulation of hot water pipe lines.
   f) Control valves, masonry chamber and other appurtenances.
   g) Connection to all plumbing fixtures, kitchen equipment, tanks and applications.
   h) Earth work.

2. Generals Requirements

2.1 All material shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Managers/Consultants.

2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

2.3 Short or long bends shall be used on all main pipe lines as far as possible. Use of As far as possible all bends shall be formed by means of hydraulic pipe bending machine for pipes upto 65mm dia.

2.4 Valves and other appurtenances shall be located as shown on the drawings.
Section IV  DRAINAGE (SEWERS & STORM WATER)

1.  Scope of work

1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install the drainage system as required by the drawings and specified hereinafter.

2.  General Requirements

2.1 All material shall be new of the best quality conforming to specifications and subject to the approval of the Managers/Consultants.

2.2 Drainage lines shall be laid to the required gradients and profiles.

2.3 All drainage work shall be done in accordance with the local municipal bye-laws.

2.4 Contractor shall obtain necessary approval and permission for the drainage systems from the municipal or any other competent authority.

2.5 Location of all new manholes, catch basins etc, shall be got confirmed by the Contractor from the Managers/Consultants.

SECTION V : PIPES

1. SWR PIPES AND FITTINGS:

1.1 All down take PVC Pipe ISI marked brand as per IS:13592-1992, type B ring fitted (for pipe size 110 / 75mm) & IS 4985 4 kg/sq. cm (for pipe size 50 / 40mm) complete with PVC Fittings conforms to IS: 14735-99 & fittings dimensions as per DIN 19531 & DIN 19534, Rubber ring conforms to IS:5382 with necessary clamps & hinges including cutting and making good the walls The pipes are provided with an integral rubber ring type socket at one end while the other end is kept plain, smooth and free from burrs. Rubber ring type socket ends provide easy push - fit type jointing. Simultaneously, allowance for thermal expansion can also be provided during installation.

1.2 All internal & external drainage SWR PVC PIPE TYPE-A (4 kg. cm. sq.) ring fit pipe shall be conforming to IS:4985
including all fittings such as bends, junctions, inspection doors, offsets, cowl, access pieces/plugs etc. jointing with Solvent cement (lubricant) with O-Ring joints including cutting holes in walls and making good the same.

1.3 **FITTINGS:**

Fittings shall conform to the corresponding Indian Standard as for pipes. Contractor shall use pipes and fittings of matching specification.

Access door shall be secured air and water tight with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal.

Fittings shall be of the same make as that of pipes, injection moulded and shall conform to Indian Standard.

1.4 **JOINTING:**

The jointing of the pipes to the fittings shall be done as per the manufacturer’s instructions / recommendation. The rubber ring socket fittings and pipes shall be jointed as follows:

Clean the outside of the pipes spigot end and the inside of the ceiling groove of the fitting.

Apply the lubricant uniformly to the spigot end, sealing ring and pass the spigot end into the socket containing sealing ring until fully home. Mark the position of the socket edge with pencil or felt open on the pipe, then withdraw the pipe from the socket by approximately 10 mm to make the pipe fully fitted to the fitting. The horizontal pipes on the wall shall be fixed with M.S. fabricated clamps with necessary provisions to take care the expansion and contraction in PVC pipes. The spacing of the clamps shall be at the intervals of 1.5 mtr to 2 meter depends on the requirement of the supporting arrangements. Solvent joints shall be used as per manufacturer recommendations.

Rubber Seal Rings for Joints & Access Doors: Manufactured in accordance with IS: 5382 for 75 mm / 90 mm / 110 mm sizes. These are made out of natural rubber with a shore ‘A’ hardness pf 40 x 5. Provide superior resistance to biological attack. Special design of cross section ensures perfect sealing. Lubricant: Available in 100 gms, 250 gms & 500 gms packing. Specially formulated for
compatibility with rubber seal as well as PVC which does not support the growth of bacteria or fungi.

2. PIPE, HANGERS, SUPPORT, CLAMP, BRACKETS ETC.:

2.1 Supports:
UPVC pipes require supports at close intervals. Recommended support spacing for unplasticised PVC pipes is 1200 mm for pipes 50 mm dia and above. Pipes shall be aligned properly before fixing them on the wooden plugs with clamps. Even if the wooden plugs are fixed using a plumb line, pipe shall also be checked for its alignment before clamping, piping shall be properly supported on, or suspended from clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. Pipe supports shall be primer coated with rust preventive paint.

2.2 TESTING:
Before the system is put into use, it should be tested for leakages by air test, hydraulic test or smoke test.

2.3 Laying and Jointing:
The pipes shall be laid and clamped to wooden plugs fixed above the surface of the wall. Alternatively plastic clamps of suitable designs shall be preferred. Provision shall be made for the effect of thermal movement by not gripping or disturbing the pipe at supports between the anchors for suspended pipes. The supports shall allow the repeated movements to take place without abrasion.

Jointing for UPVC pipes shall be made by means of solvent cement for horizontal lines and ‘O’ rubber ring for vertical line. The type of joint shall be used as per site conditions/direction of the Client’s Representative. Where UPVC pipes are to be used for rain water pipes, the pipe shall be finished with G.I. adopter for insertion in the R.C.C. slab for a water proof joint complete as directed by Client’s Representative.

2.4 Repairs:
While temporary or emergency repairs may be made to the damaged pipes, permanent repairs should be made by replacement of the damaged section. If any split or chip out occurs in the wall of the pipe, a short piece of pipe of sufficient length to cover the damaged portion of the pipe is cut. The sleeve is cut longitudinally and heated
sufficiently to soften it so that it may be slipped over the damaged hard pipe.

2.5 Testing
All lengths of PVC rain water pipes shall be fully tested for water tightness by means of water test maintained for not less than 30 minutes. All pipes shall be subjected to a test pressure of at least 1.5 meter head of water head. The test pressure shall, however, not exceed 6 meter head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

3. WASTE PIPE FROM APPLIANCES

3.1 Waste pipe from appliances e.g. wash basins, sinks, urinals, chrome plate where seen water coolers shall be of heavy duty GI pipes:

3.2 All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:-

3.3 Vertical Horizontal
G.I. Pipes 300 cms 240 cms
P.V.C. Pipes 180 cms 120 cms

4. PAINTING

4.1 Soil, waste vent and rainwater pipes in exposed location, in shafts and pipe spaces shall be thoroughly cleaned to remove dirt, rust and other contamination, and painted with two or more coats of synthetic enamel paint to give an even shade.

4.2 Paint shall be of approved quality and shade, where directed pipes shall be painted in accordance with approved pipe colour code.

4.3 Waste pipes in chase shall be thoroughly cleaned to remove dirt, rust and other contamination, and painted with two coats of bitumen paint, covered with polythene tape and a final coat of bitumen paint. Exposed pipes shall be painted with two or more coats of synthetic enamel paint.
5. **MEASUREMENTS:**

5.1 These pipes shall be measured along the center line of the pipe including all specials in Rmt. The quoted rate for respective items shall include the following:-

a) Cost of respective pipes and specials and jointing materials.
b) Laying, fixing and jointing with necessary clamps, brackets, screws, etc., and curing.
c) Making good all damages to the parts of the building to suit the surroundings.
d) Testing and making good the defects, if any

6. **TRAPS**

6.1 **NAHANI TRAP OR FLOOR TRAPS**

Nahani traps or floor traps shall be SWR deep seal with an effective seal of 50 mm.

The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:3 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size) mixed with waterproof compound and extended to 40 mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30 x 30 cms of the required depth. The trap shall be installed at lowest point ensure no pending occurs at perimeters of the drain.

6.2 **FLOOR TRAP INLET**

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, the Contractor shall provide a special type galvanised iron inlet fitting without or with one, two or three inlet sockets to receive the waste pipe. Joint between waste and fitting shall be connected to a C.I. 'P' or 'S' trap with at least 50mm seal (Hopper and traps shall be paid for separately). Floor trap inlet fittings and the trap shall be set in cement concrete blocks.

6.3 **C.P./STAINLESS STEEL GRATINGS**

Floor and Urinal traps shall be provided with 100-150mm square or round C.P./Stainless steel grating as approved by Client’s Representative with rim, of approved design and shape. Minimum thickness shall be 4-5mm or as specified in the Bill of Quantities.
7. CLEANOUT PLUGS

Contractor shall provide cast brass cleanout plugs in all horizontal run more than 15 meter length required one cleanout plugs shall be threaded and provided with key holes for opening. Cleanout plugs shall be fixed to the pipe by a G.I. socket and lead caulked joint.

8. PIPE SLEEVES

Pipe sleeves 50mm larger diameter than pipes shall be provided wherever pipes pass through walls and slabs and annular space filled with fire proof materials like putty, fire seal etc. All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burs removed before laying. Open ends of the pipe shall be closed as the pipe is installed to avoid entrance of foreign matters. Vertical sleeve shall finish 50mm above finish floor level.

9. CPVC PIPES

9.1 Chlorinated Polyvinyl Chloride (CPVC) Pipes

CPVC pipes & fittings used in hot & cold potable water distribution system shall conform to requirement of IS 15778. The material from which the pipe is produced shall consist of chlorinated polyvinyl chlorides. The polymer from which the pipe compounds are to be manufactured shall have chlorine content not less than 66.5%.

The colour of the pipes shall be off-white. Slight variations in the appearance of the colour are permitted.

The internal and external surfaces of the pipe shall be smooth, clean and free from grooving and other defects. The pipes shall not have any detrimental effect on the composition of the water flowing through it.

9.2 Fittings

The fittings shall be as follows:

a) Plain CPVC solvent cement fittings from size 15 mm to 160 mm.

b) Brass threaded fittings.

c) Valve from size 15 mm to 160 mm

d) Brass Threaded Fittings: All types of one end brass threaded male/female adaptors in various fittings like coupler, socket, elbow, tee are available for transition to other plastic/metal piping and for fixing of CP fittings. Ball, Gate valves in CPVC are available in all dimensions.
All fittings shall carry the following information:
(i) Manufacturer’s name/trade mark.
(ii) Size of fitting

9.3 Laying and Jointing of Pipes and Fittings

a) Concealed Piping: Pipes can be concealed in chases. The pipes and fitting are to be pressure tested prior to concealing the chases. To maintain alignment of CP fittings while joining, all alignment of fittings and pipe shall be done correctly. DO NOT USE NAILS FOR HOLDING OF PIPES IN THE CHASES.

b) External Installations: For pipes fixed in the shafts, ducts etc. there should be sufficient space to work on the pipes. Pipes sleeves shall be fixed at a place the pipe is passing through a wall or floor so as to allow freedom for expansion and contraction. Clamping of the pipe is done to support it while allowing the freedom for movement.

c) Exposed Pipes: All pipes exposed to sunlight shall be painted with a water based acrylic paint emulsion to enhance UV protection. Pipes in trenching shall be laid in accordance to the Good Plumbing practices followed for Metal piping.

9.4 All other specifications shall be as per relevant IS code of C.P.W.D. Specification with upto date corrections slips.
TECHNICAL SPECIFICATIONS
FOR
INTERNAL ELECTRICAL WORK

1.0  WIRING:

1.1  Scope:
1.1.1  The scope of this section covers the supply, erection, testing and commissioning of conduits & wiring for lighting and power. Wiring shall be carried out in accordance with relevant I.S. rules and regulations.

1.2  System of wiring:
1.2.1  All lights and power wiring shall be carried out in surface conduits or recess wiring in conduits or floor ducts as specified.
1.2.2  I.E.E. regulations shall be applicable for all material and workmanship.
1.2.3  The wiring to be carried out in such a manner that specified 'Power' wiring shall be kept separate and distinct from 'Lighting' wiring. The wiring shall be done on the distribution system with main and branch distribution boards at convenient physical and electrical centers as shown in drawings. All conductors shall be run as far as possible along the walls and ceiling and above false ceiling so as it can be easily accessible and capable of being thoroughly inspected. In all types of wiring, due consideration shall be given for neatness and good appearance.
1.2.4  The balancing of load in three wire or poly phases installations shall be arranged before hand to the satisfaction of Engineer-in-charge. In large or important areas, light and socket outlet points shall be distributed over more than one circuit as directed.
1.2.5  Medium pressure wiring and associated apparatus shall comply in all respects with the requirements of IEE rules.
1.2.6  No wiring shall be carried out until the appropriate tests required in Section “Inspection and Testing” have been done and the Engineer-in-Charge has given his clearance for wiring to commence.
1.2.7  At expansion joints, adequate slack shall be left in the cables.
1.2.8  Where conduits are installed for wiring by others, a draw wire shall be provided between each draw-in position.
1.2.9  Cables forming part of communication circuits shall have identification sleeves at their terminations. Identification shall be consistent with the relevant wiring diagrams.

1.3  Joints & Looping Back:
1.3.1  The wiring shall be done in a 'looping System'. Phase or live conductors shall be looped at the switch box and neutral conductor can be looped either from the light, fan or socket outlet.
1.3.2  No bare or twist joints shall be made at intermediate points in the through run of cables, unless the length of final sub circuit or sub-main or main is more than the length of the standard coil given by the manufacturer of the cable.
1.3.3  Termination of multistrand conductors shall be done using suitable crimpling type thimbles.

1.4  PVC Conduit and Conduit Accessories:
1.4.1  All non-metallic conduit pipes and accessories shall be of suitable material complying with IS:2509-1973 and IS:3419-1976 for rigid conduits and IS:6946-1973 for flexible conduits. The interior of the conduits shall be free from obstructions. The rigid conduit pipes shall be ISI marked.
1.4.2  The conduits shall be circular in cross-section. The conduits shall be designated by their nominal outside diameter. The dimensional details of rigid non-metallic conduits are given in Table-III.
1.4.3  No non-metallic conduit less than 20 mm in diameter shall be used.
1.4.4  The conduit wiring system shall be complete in all respect including accessories.
1.4.5  Rigid conduit accessories shall be normally of grip type.
1.4.6  Flexible conduit accessories shall be of threaded type.
1.4.7 Bends, couplers etc. shall be solid type in recessed type of works, and may be solid or inspection type as required, in surface type of works.

1.4.8 Saddles for fixing conduits shall be heavy gauge non-metallic type with base.

1.4.9 The maximum number of PVC insulated cables conforming to IS: 694-1990 that can be drawn in one conduit is given size wise in Table-1. And the number of cables per conduit shall be exceeded. Conduit sizes shall be selected accordingly in each run.

1.4.10 The erection of conduits of each sections shall be completed before the cables are drawn in.

1.5 Installation-Common aspects for both recessed and surface conduit works:-

1.5.1 Conduit Joints

(i) All joints shall be sealed/cemented with approved cement. Damaged conduit pipes/ fittings shall not be used in the work. Cut ends of conduit pipes shall have no sharp edges nor any burrs left to avoid damage to the insulation of conductors while pulling them through such pipes.

(ii) The Engineer-in-charge, with a view to ensuring that the above provision has been carried out, may require that the separate lengths of conduit etc. after they have been prepared shall be submitted for inspection before being fixed.

1.5.2 Bends in Conduit

(i) All bends in the system may be formed either by bending the pipes by an approved method of heating, or by inserting suitable accessories such as bends, elbows or similar fittings, or by fixing non-metallic inspection boxes, whichever is most suitable. Where necessary, solid type fittings shall be used.

(ii) Radius of bends in conduit pipes shall not be less than 7.5 cm. No length of conduit shall have more than the equivalent of four quarter bends from outlet to out-let.

(iii) Care shall be taken while bending the pipes to ensure that the conduit pipe is not injured, and that the internal diameter is not effectively reduced.

1.6 Installation-Additional requirements for surface conduit work

(i) Conduit pipes shall be fixed by heavy gauge non-metallic saddles with base, secured to suitable approved plugs with screws in an approved manner, at an interval of not more than 60 cm, but on either side of couplers or bends or similar fittings, saddles shall be fixed at a closer distance from the centre of such fittings. Slotted PVC saddles may also be used where the PVC pipe can be pushed in through the slots. The minimum width and thickness of the ordinary clips or the girder clips for different sizes of conduits shall be as given in Table-II.

(ii) Where the conduit pipes are to be laid along the trusses, steel joists etc. the same shall be secured by means of saddles or girder clips as required by the Engineer-in-charge. Where it is not possible to use these for fixing, suitable clamps with bolts and nuts shall be used.

(iii) If the conduit pipes are liable to mechanical damage, they shall be adequately protected.

1.7 Installation-Additional requirements for recessed conduit work

1.7.1 Make Chase

(i) The chase in the wall shall be neatly made, and of ample dimensions to permit the conduit to be fixed in the manner desired.

(ii) In the case of buildings under construction, the conduits shall be buried in the wall before plastering, and shall be finished neatly after erection of conduit.

(iii) In case of exposed brick / rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

1.7.2 Fixing Conduit in Chase

(i) The conduit pipe shall be fixed by means of staples, or by means of non-metallic saddles, placed at not more than 60 cm apart, or shall be fixed by any other approved means of fixing.

(ii) At either side of the bends, saddles/staples shall be fixed at a distance of 15 cm from the centre of the bends.

1.7.3 Erection in RCC work

(i) The conduit pipes shall be shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent taming of the same.
Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors.

Location of inspection/ junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

**1.7.4 Fixing of Inspection Boxes**

(i) Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.

(ii) These shall be mounted flush with the wall or ceiling concrete. Minimum 65 mm depth junction boxes shall be used in roof slabs and the depth of the boxes in other places shall be per IS: 2667-1977.

(iii) Suitable ventilating holes shall be provided in the inspection box covers if directed.

**1.8 Routes and Segregation:**

1.8.1 In case the routes of conduit and ducting are not shown on the drawings, they shall be determined by the Contractor and approved by Engineer-in-Charge before work is started. This requirement shall apply where the conduit or duct is concealed within the building fabric as well as where they are on the surface.

1.8.2 Conduit and ducting shall be parallel with lines of building construction and properly aligned except where conduit is permitted in floor screeds. Conduit buried in wall finishes shall run vertically only, unless Engineer-in-Charge gives approval to deviate from this requirement.

1.8.3 A minimum clearance of 150 mm between conduits shall be allowed from any equipment/ Low current services conduit like Telephone/Computer/CCTV/ pipe work or duct work. Distance shall be measured from the external surface of any lagging. In event of difficulty in achieving this requirement, Engineer-in-Charge shall be informed.

**1.9 Wires:**

1.9.1 The type and size of wires shall be as indicated in the BOQ / Drawings. All the material supplied and used by the contractor shall be new. Wires shall have copper conductors unless otherwise specified, and the size shall be as per IS standards unless specified.

1.9.2 All wires shall comply with relevant IS. Type of wire to be used shall be as specified in the BOQ / Drawings.

1.9.3 The colour identification of wires shall comply with the IEE wiring regulations for all category of circuits. Core identification colors shall extend throughout the length of PVC insulated wires. Core identification for sound distribution or public address systems shall be in grey colour.

1.9.4 Wires shall be protected throughout their length by trunking, ducting, conduit and equipment enclosures. Framework or partitions may be used, but only where indicated or with the approval of Engineer-in-Charge.

1.9.5 Wires carrying direct current may, if desired, be bunched whatever their polarity, but wires carrying alternating current, if installed in metal conduit shall always be bunched so that the out going and return wires are drawn into the same conduit.

1.9.6 Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.

1.9.7 In case of three phase loads, separate conduits for separate phase shall be run from the distribution boards to the load points, or outlets as the case may be.

1.9.8 Wires shall comply with relevant IS for LV & ELV circuits.

1.9.9 Where conduits cross expansion and settlement joints in the building structure, suitable provision shall be made to allow for movement of the structure. The Contractor shall submit his proposals for the approval of the Engineer-in-Charge.

1.9.10 Conduits entering voids shall terminate not less than 22 mm clear of the building fabric. Open ends of conduit shall be temporarily plugged immediately after they are installed to prevent ingress of water and solid materials.

1.9.11 Where wires pass through joints, the number and size of holes shall allow for easy withdrawal and replacement of cables. The diameter of holes shall not exceed 1/6th the depth of the joints. They shall be approximately on the centre line and shall be not less than 75 mm between centres. Joints shall not be notched.

1.9.12 The method to be used for forming fire barriers at fire resistant structural elements such as floors and walls shall be submitted for the Engineer-in-Charge's approval.

1.9.13 Where wires enter a metal enclosure, they shall be protected by grommets or secured by wires clamps.

1.9.14 Wires shall be looped between outlet points and as far as practicable, intermediate joints shall not be used.

1.9.15 Wires fixed to the surface, except in ducts, shall be protected up to a height of 1500 mm by high impact PVC channel.
1.9.16 Wires shall have identification sleeves at their terminations.

1.9.17 Identification shall be consistent with the relevant wiring diagrams.

1.10 **Modular Switches:**
1.10.1 Switches shall be single pole unless otherwise indicated. Their current ratings shall be as indicated, allowance being made for any inductive or capacitive load.

1.10.2 Wall mounted switches located inside buildings shall have rocker type actuating members unless otherwise indicated. Where mounted adjacent to one another, they shall be grouped in a multi gang box with a common front plate.

1.10.3 Pull cord operated switches shall be fixed to white moulded plastic mounting blocks, which in turn shall be fixed to a circular conduit box. Where the conduit boxes are flush with the finish, mounting block shall overlap them. Pull cords shall be white or natural colour and the lower end shall terminate in a moulding of rubber or plastic material.

1.11 **Modular Socket Outlets:**
1.11.1 Socket outlets shall be of modular type and rating as indicated. Pilot contacts shall be provided where indicated.

1.11.2 Socket outlets shall be switched where indicated. On socket outlets rated at 16A and located inside buildings, the switches shall be single pole and have rocker type actuating members unless otherwise indicated.

1.11.3 Socket outlets for wet locations shall be provided with covers, which shall be screwed on. Any cover required to achieve total enclosure and to ensure the required degree of protection against moisture shall be securely fixed to socket outlet.

1.11.4 Sockets/ Telephone/ Computer/ CCTV/ Socket outlets shall be of the type as mentioned in the BOQ.

1.12 **Plugs:**
1.12.1 ISI marked Plugs shall be provided as indicated. Plug bodies shall be of metal, plastic or other material as indicated.

1.12.2 Plugs rated at 16A shall be of a non-resilient material unless otherwise indicated.

1.13 **Terminal Blocks:**
1.13.1 Conductors shall be clamped between metal surface and no screws shall make direct contact with conductors.

1.13.2 The design shall be such as to maintain sufficient contact pressure to ensure connections on negligible impedance at all times.

1.13.3 Metal in contact with conductors shall be 85% copper alloy and any screws shall be of metal that is electrolytically compatible with the copper alloy. The moulded housing shall be an insulating material suitable for the maximum operating temperature of the conductor.

1.14 **Mounting Heights:**
1.14.1 Mounting heights shall be as follows unless otherwise indicated in the drawings, where decision shall be obtained by contractor before start of work.

**MOUNTING HEIGHTS** (for accessories and equipment)

1. Bracket Light  
2. Mirror light  
3. Switch board  
4. 5/15A light/power sockets  
5. 5/15A switch for sockets  
6. D Bs  
7. 15A socket in toilet  
8. 15A switch in toilet  
9. 15/5A power points in Pantry  

**NOTES:**

1. Heights are from finished floor level to the center of the accessory or equipment, except in the case of worktops when the measurement shall be from the worktop surface.

2. If the specified height of an accessory coincides with the top of tiling, the accessory shall be mounted above the tiling, leaving a clear gap of 50 mm.
3. Where apparatus is located underneath a worktop, the accessory shall be mounted 100 mm below the underside of the worktop.

1.14.2 Where difficulty in locating accessories or equipment occurs the Engineer-in-Charge shall be informed.

1.15 **Supports And Fixings:**

1.15.1 Support shall be positioned within 300 mm of each bend and conduit box. Conduit boxes shall be fixed to fabric of building independent of the conduit. Where the conduit boxes have a minimum degree of protection of IP44, the fixing shall not reduce that protection.

1.15.2 Conduits shall be fixed in accordance with the undermentioned Table. No shot firing shall be used and no drilling or welding of structural steel work shall be done without the approval of Engineer-in-Charge.

### TABLE CONDUIT FIXING

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<th>Type of fixing</th>
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<td>Floor screeds</td>
<td>Saddles</td>
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<tr>
<td></td>
<td>Buried in plaster</td>
<td>Crampets or saddles</td>
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<td></td>
<td>Or render</td>
<td></td>
</tr>
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<td></td>
<td>Above false ceilings</td>
<td>Spacer bar saddles</td>
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<tr>
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<td>Surface</td>
<td>Distance Saddles</td>
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<table>
<thead>
<tr>
<th>2. Fixing of Saddles, Conduit Boxes</th>
<th>Building Fabric</th>
<th>Type of fixing</th>
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<tr>
<td>Structural steelwork</td>
<td>Purpose made clamps</td>
<td>(Type to be approved by Engineer-in-Charge)</td>
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<tr>
<td>Non-Structural steelwork</td>
<td>Sets screws and nuts.</td>
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<td>Concrete, brick or Blocks</td>
<td>Fiber plugs &amp; screws</td>
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</tr>
<tr>
<td>Hollow blocks &amp; pot</td>
<td>Butterfly spring toggle bolts</td>
<td>or gravity bolts.</td>
</tr>
<tr>
<td>Floors</td>
<td>Wood screws</td>
<td></td>
</tr>
</tbody>
</table>

1.15.3 Screws and nuts shall be cadmium or zinc electroplated or passivated.

1.16 **Protective Conductor:**

1.16.1 Protective conductor shall be drawn through ducting and non-screwed metallic conduit.

1.16.2 Where live conductors terminate at or loop into terminals adjacent to an appliance or accessory, the protective conductor shall be terminated. Properly using earth studs, earth terminal block etc. so the case may be.

1.16.3 A protective conductor shall be installed within each length of steel conduit and connected to an earthing terminal at each end of the conduit.

1.17 **Outlet Boxes**

1.17.1 16 SWG MS/G.I. boxes of the required sizes shall be provided to house the Switch/sockets/Telephone/TV/Computer outlets as may be required/mentioned in BOQ. These shall be so designed that there is ample space at the rear and at the sides to accommodate conductors at the conduit entries. These shall be completely concealed leaving edges flush with wall surface unless mentioned otherwise.

1.18 **Draw Boxes/Inspection Boxes**

1.18.1 16 SWG Mild Steel/G.I. draw/inspection boxes of adequate dimensions minimum size 75 mm x 75 mm shall be provided at convenient points on walls to facilitate long runs of conductors. They will be completely concealed with 3 mm Perspex/hylam covers flush with plate work. These boxes will, as far as possible, be located where found suitable by the Engineer-in-Charge.

1.19 **Protection of Conduits**
1.19.1 To safeguard against filling up with plaster etc. all the outlet and switch boxes will be provided with temporary covers and plugs within the tendered cost which shall be replaced by sheet / plate covers as required. All screwed and socketed joints shall be made fully water tight by the use of white lead for steel conduits.

1.20 **Cleaning of Conduit Runs**

1.20.1 The entire conduit system including outlets and boxes shall be thoroughly cleaned after completion of erection and before drawing in of cables.

1.21 **Laying Of Dummy Conduit**

1.21.1 The dummy conduits shall be the same as conduits for Electrical work and as specified before. The minimum size shall be 20 mm dia. Junction boxes shall be provided at distance not exceeding 10 m. The Contractor must make such modifications as the system designer / manufacturer desires in consultation with the Owners / Architects. These conduits shall be provided with steel draw boxes of at least 14 SWG.

1.22 **Fish Wires**

1.22.1 To facilitate drawing of wiring through conduits/ G.I / Steel pipes etc., G.I. fish wire of 14 SWG, wherever needed, shall be provided along with recessed conduit / pipes, without any extra cost.

### Table –I

**Maximum number of PVC insulated 650/1100 V Grade Aluminum/Copper conductor cable conforming to IS:694/1990**

<table>
<thead>
<tr>
<th>Nominal Cross sectional area of cond. in sq. mm</th>
<th>20mm</th>
<th>25mm</th>
<th>32mm</th>
<th>38mm</th>
<th>51mm</th>
<th>64mm</th>
</tr>
</thead>
<tbody>
<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>1.5</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>2.5</td>
<td>12</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>10</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>25</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>35</td>
<td>2</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>50</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>70</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE:**

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cable.

2. The columns headed ‘S’ apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns headed ‘B’ apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.

3. Conduit sizes are the nominal external diameters.
### TABLE-II
Girder Clips or Clamps

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Size of conduit</th>
<th>Width</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20 mm</td>
<td>19mm</td>
<td>0.9mm (20 SWG)</td>
</tr>
<tr>
<td>2</td>
<td>25 mm</td>
<td>19mm</td>
<td>0.9mm (20 SWG)</td>
</tr>
<tr>
<td>3</td>
<td>32 mm &amp; above</td>
<td>25mm</td>
<td>1.2mm (18 SWG)</td>
</tr>
</tbody>
</table>

### TABLE-III
Dimensional details of rigid non-metallic conduits. (All dimensions in mm)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Nominal Outside Diameter (in mm.)</th>
<th>Maximum outside-diameter (in mm.)</th>
<th>Minimum inside-diameter (in mm.)</th>
<th>Maximum permissible eccentricity (in mm.)</th>
<th>Maximum permissible quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>20+0.3</td>
<td>17.2</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>25+0.3</td>
<td>21.6</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
<td>32+0.3</td>
<td>28.2</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>40+0.3</td>
<td>35.8</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>50+0.3</td>
<td>45.0</td>
<td>0.4</td>
<td>0.6</td>
</tr>
</tbody>
</table>
2.0 MCB DISTRIBUTION BOARDS:

2.1 Scope:

2.1.1 The scope of this section covers Supply, installation, testing and commissioning of Miniature circuit breaker boards and Miniature Circuit breakers. Miniature circuit breaker boards shall comply with BS 5486 part 12 a clause 3.2 and 3.3. They shall have a fault withstand classification of class 1 unless otherwise indicated.

2.2 MCB Distribution Boards

2.2.1 These distribution boards shall be used for control of all lighting/power circuits and shall consist of single pole/ single/double/TP & N/ triple/four pole miniature circuit breakers mounted in double cover design, dust tight, heavy gauge sheet steel enclosures preferably zinc coated with powder coating finish.

2.2.2 Distribution Boards shall be flush or surface pattern according to the requirements of their location and shall incorporate isolators/MCB and circuit switches as specified in bill of quantities.

2.2.3 All MCBs shall be connected to the electrolytic copper bus bars with direct bolted connections.

2.2.4 Earthing bar and neutral bars shall be provided having sufficient ways to enable each cable to be connected to a separate terminal. Neutral connections shall be corresponding in position to phase connections.

2.2.5 Distribution boards shall have phase barriers and PVC ducts for all interior wiring. All distribution boards shall have removable end plates at top and bottom and handles with provision for locking.

2.2.6 Phase barriers shall be provided in the 3-phase distribution Boards.

2.2.7 In TP&N distribution boards, neutral bus bars shall have one outgoing terminal for each outgoing circuit.

2.2.8 Size of SDB shall be selected to cater to extra space on the bus for mounting ELCBs in addition to number of outgoing MCBs specified in the BOQ / Drawings.

2.2.9 A multi-terminal bar for the circuit protective conductors shall be provided for both insulated and metal cased boards, with one terminal for each outgoing circuit. It shall be directly connected to the earthing terminal without dependence on the exposed conductive parts of the enclosure.

2.2.10 Identification of each MCB way shall be by numbering. Identification in the neutral bus bar and protective conductor bar shall clearly relate each terminal to its respective MCB way.

2.2.11 Spare MCB ways shall be provided as indicated in BOQ / Drawings. Where specific ratings are indicated, MCB shall be incorporated otherwise the ways shall be left blank but suitable for future additions. Suitable number of blanking plates shall be fixed in the DB if the space for MCB is left blank.

2.2.12 A separate Junction box of min. height of 150 mm shall be provided for extra lengths of outgoing circuit wires on Top/Bottom (as required) to avoid jumbling of wires within the main section of SDB. The junction box will be properly earthed along with the SDB.

2.3 Miniature Circuit Breakers

2.3.1 Miniature circuit breakers shall be designed and tested strictly in accordance with the relevant parts of Indian standards and shall consist of spring accelerated quick-make and quick break action mechanism fitted in moulded cases of high di-electric strength plastic or urea. Fixed and moving contacts shall have silver tungsten contacts.

2.3.2 Miniature circuit breakers used shall be of “B” Series for Normal lighting circuits and Normal Power/Geyser Loads. For AC loads, Tungsten lamps fittings, Sodium/Mercury Discharge lamps “C” Series shall be used unless otherwise mentioned.

2.3.3 Miniature circuit breakers shall have a minimum breaking capacity of 10 KA at 415 V.

2.4 ELCBs

2.4.1 ELCBs shall be designed and tested strictly in accordance with the relevant parts of Indian standards. Fixed and moving contacts shall have silver tungsten contacts.

2.4.2 ELCBs used shall be of Rating and sensitivity as specified in the BOQ.

2.4.3 ELCBs shall have a breaking capacity of 10 KA at 415 V and shall be ordinarily be for Earth Leakage protection unless mentioned otherwise.
3.0 **LUMINAIRES AND LAMPS:**

3.1 **Scope:**

3.1.1 The scope of this section comprises of Supply, erection, testing and commissioning of lighting fixtures for internal lighting wherever required of the specified models as per IS:3646 (part-I) 1992 for interior lighting.

3.1.2 Without restricting to the generality of the foregoing, this section shall include luminaires, lamps and accessories necessary and required for the installation.

3.1.3 Whether specifically mentioned or not, the luminaires and lamps shall be provided with all fixing devices, terminal blocks, holders etc. as required.

3.2 **General Requirements:**

3.2.1 All the luminaires and lamps shall be of best quality and as per approved makes. Wherever alternative makes are specified the choice of selection shall remain with the Engineer-in-Charge.

3.2.2 The luminaries and lamps shall be fixed in a neat workman like manner, true to level and in accordance with manufacturer's instructions.

3.2.3 The luminaries and lamps shall be provided with such accessories as are required to complete the item in working condition whether specifically mentioned in the specifications, drawings or not.

3.3 **Luminaires:**

3.3.1 Luminaires shall comply with relevant IS and with clauses 3.3.2 to 3.3.7 both inclusive.

3.3.2 Unless otherwise indicated, enclosure of luminaires shall provide a minimum degree of protection of IP20 when located within buildings and IP 44 when located outside buildings, but luminaires mounted externally; and less than 2 M above finished ground or paved level shall be IP 46.

3.3.3 Unless otherwise indicated, luminaires, both with and without built-in ballast or transformers shall be suitable for direct mounting on normally flammable surface.

3.3.4 Where specific requirements related to flame propagation and flammability of translucent covers are indicated, certificates of tests shall be submitted to the Engineer-in-Charge. The tests shall comply with relevant IS.

3.3.5 Terminal blocks for connection of the supply cables shall be of adequate size for the size of conductors forming the loop in wiring unless separate tails are required. Wherever indicated, the terminal block shall incorporate a fuse of suitable type and rating.

3.3.6 Ballasts for tubular fluorescent lamps shall have a maximum value of harmonics complying with the colour headed “without H Marking” in Table VII of BS 288. Power factor correction shall be provided and this shall not be less than 0.85 lagging unless otherwise indicated.

3.3.7 Translucent covers and reflective surfaces shall be clean at the completion of the works.

3.4 **Lamps:**

3.4.1 Lamps shall be of the type and ratings as indicated.

3.4.2 All lamps shall be supplied and installed by the contractor unless otherwise directed.

3.4.3 Lamp caps shall be suitable for the lamp holders listed socket by means of a locking ring.

3.5 **Support and Fixings:**

3.5.1 Where fluorescent luminaries 1200 mm or more in length are supported directly by the conduit system, they shall be fixed to two circular conduit boxes both of which shall form an integral part of the conduit system.

3.5.2 Where the weight of a luminaire is supported by a conduit box or cable trunking, the fixing of the conduit box or trunking shall be adequate for the purpose and approved by Engineer-in-Charge.

3.5.3 Luminaries fitted with tungsten filament lamps and having metal back plates shall not be fixed directly to conduit box in which thermoplastic material is the principal load bearing member.

3.5.4 Support of luminaires from cable trunking shall be by means of proprietary clamps or brackets.

3.5.5 Where luminaries are supported from the structure other than by the conduit system, the supports shall be adequate for the purpose and approved by Engineer-in-Charge.

3.5.6 Luminaries mounted on or recessed into suspended ceilings shall not support luminaires unless specifically shown and approved.

3.5.7 For wall mounted luminaires, the mounting height shall be 1900 mm above finished floor level or as mentioned in the drawing, measured to the center of the conduit box, unless otherwise indicated.

3.6 **Wiring Connections:**
3.6.1 Where luminaires, other than those covered by clause 3.6.2 are fixed direct to circular conduit boxes or are supported by pedants or chains, the final circuit wiring shall terminate at a terminal block in the conduit box.

3.6.2 Where luminaries having fluorescent tubes are fixed direct to circular conduit boxes, the final circuit wiring may be terminated within the luminaire unless otherwise indicated. The wiring shall enter each luminaries at the conduit entry nearest to the terminal block and where a loop in wiring system is used, leave by the same entry; wiring shall not pass through a luminaire unless the approval of the Engineer-in-Charge.

3.6.3 Where luminaries are mounted on or recessed into a suspended ceiling, connection shall be by flexible cord from a plug-in ceiling rose unless otherwise indicated. The plug-in ceiling rose shall be located not more than 500 mm from the access in the ceiling and shall be firmly supported, unless otherwise approved by the Engineer-in-Charge.

3.6.4 Cables and flexible cords for final connections to luminaries shall be suitable for the operating temperature of the luminaire.

3.6.5 The size of final connection cables or flexible cords shall be as indicated.

3.6.6 Cables and cords passing close to a ballast within a luminaire shall be suitable for the operating temperature of the ballast.

3.6.7 A protective conductor shall connect the earthing terminal or earthing contact of each luminaire to an earthing terminal incorporated in the adjacent conduit box. Where the final connection is by flexible cord, the protective conductor shall form part of the cord.
4.0  TELEPHONE SYSTEM WIRING & CONDUITING

4.1.0  Intent of Specification

4.1.1 These specifications are intended to cover the Conducting & Cabling and under floor raceway work for Telephone & Intercom System. It is not the intent to specify completely herein all aspects of design, constructional features of equipment and details of the work to be carried out, but nevertheless the intent of the specification is to ensure that the equipment and work shall conform in all respects to the relevant Bureau of Indian Standard Specifications, Codes of Practice, and other statutory regulations as may be applicable and to high standards of engineering, design and workmanship. The equipment and work shall perform in continuous operation in a manner acceptable to the Employer who will interpret the meaning of the specifications and drawings and shall have the right to reject or accept any equipment or work which in their assessment is not complete to meet the requirements of these specifications and / or applicable Codes and Standards.

4.2.0  Scope of Work

4.2.1 The scope of work under these specifications shall include the design, manufacture, work’s testing, supply, storage, erection, site testing and commissioning of the following:-

a) All conduit work including Junction Boxes, outlet boxes and wiring & cabling of telephone & intercom system etc.

b) Boxes & cover plates for telephone outlets.

c) Supplying and laying/fixing of main Telephone cables and Tag Blocks as per line diagram.

d) Connecting of Electronics earthing for EPABX system.

e) To do the ferruling and identification of all multi core cables at both the ends of each cable.

f) To do the testing of existing telephone cables & tag blocks (if already existing) before the start of work and intimate the condition of the same to the employer.

The scope of work shall also include all civil works associated with erection of the equipment and making good and painting the civil works as required.

The Contractor shall include for the supply of entire materials in accordance with these specifications and the whole of the work of fixing necessary material for the complete installation as set down in these specifications and with the accompanying schedules of work and drawings. Materials and components not specifically stated in the specifications and / or bill of materials or noted on the drawings but which are necessary for satisfactory installation and operation of the system shall be deemed to have been included in the scope of work.

4.3.0  Specifications and Schedules

4.3.1 The Specifications and Schedule of quantities shall be considered as part of this contract and any work or materials shown in schedule and not called for in the specifications or vice versa, shall be executed as if specially called for in both.

The drawings indicate the extent and general arrangement of telephone point outlets, Tag Block etc. and are essentially diagrammatic.

4.3.2 The work shall be installed as indicated on the drawings. However, any minor changes found essential to coordinate the installation of this work with other trades shall be made without any additional cost of the employer. The data given herein and on the drawings is as exact as could be secured, but its complete accuracy is not guaranteed. The drawings are for the guidance of the Contractor. Exact locations, distances and levels will be governed by the site conditions.

4.4.0  Departure from Specifications

4.4.1 Should the tendered wish to depart from the provisions in these specifications, such departure shall be listed in a separate schedule with full particulars and reasons for the same. No conditions or departures from specifications etc. will be accepted after decisions are communicated by the Engineer-in-charge.

4.5.0  Materials and Equipment

All materials and equipment shall be of the approved make and design. Only the best quality materials and equipment shall be used. The materials and equipment shall conform to relevant Standards.
4.5.1 **Approved Makes of Material**
Approved makes of material are indicated in the annexure to the Specifications / BOQ. Only such material shall be used. Alternative makes shall be used only with the specific written approval of the Engineer-in-charge.

4.5.2 **Samples**
A list of items of materials and equipment, together with a sample of each shall be submitted to the Engineer-in-charge within 15 days of the award of the Contract.

Samples and drawings of equipment shall not be departed from without the written instructions of the Engineer-in-charge. Approvals given by the Engineer-in-charge to any samples or drawings submitted by the Contractor shall not in any way exonerate the Contractor from his liability to carry out the work in accordance with the terms of the contract.

4.5.3 **Substitute Materials**
Any item which is proposed as a substitution shall be accompanied by all technical data given sizes, particulars of materials and the manufacturer’s name. At the time of the submission of proposed substitution the Contractor shall state the credit, if any, due to the Client. In the event the substitution is approved, changes and substitutions shall be requested in writing and approvals obtained in writing from the Engineer-in-charge.

4.5.4 **Manufacturers Instructions**
Where manufacturers have furnished specific instructions, relating to the materials used in this covering points not specially mentioned in these documents, manufacturers instructions shall be brought to the notice of the Engineer-in-charge for further instructions in the matter.

4.5.5 **Interchangeability**
All similar parts and / or equipments shall be interchangeable with one and other.

4.5.6 **Material Testing**
The Employer shall have full powers to require the materials of work to be tested by an independent agency at the Contractor’s expense in order to prove their soundness and adequacy.

4.6 **Drawings**
4.6.1 Prior to the laying and fixing of the conduits, the Contractor shall submit to the Engineer-in-charge detailed shop drawings of the conduit network and get the same approved. The shop drawing shall indicate number, size and route of the conduits, location of junction/inspection/pull boxes, location and size of outlet boxes and number and size of wires carried in each conduit.

4.6.2 The Contractor shall prepare and submit for the approval of Engineer-in-charge detailed shop drawings of all Junction Boxes, special pull boxes and any other requirement to be fabricated by the Contractor within 10 days of signing of the contract.

4.6.3 General Arrangement drawing giving details of cable, size and type of cables, number of cables, mode of installation etc.

4.7 **Cleaning, Final Painting And Marking**
4.7.1 All exposed steel work not actually embedded will be painted as instructed. All tag blocks shall be properly labeled and numbered. The scope of work shall include the same without any extra charge. The Contractor shall be required to clean all equipment under erection as well as the work area and site at regular intervals to the satisfaction of the Engineer-in-charge. In case the cleaning is not to the satisfaction of Engineer-in-charge the same will have to be done again at the Contractor’s Cost.

4.8 **Completion Certificate**
4.8.1 On completion of the telephone & computer wiring & cabling, a certificate shall be furnished by the Contractor countersigned by the Licensed Supervisor, under whose direct supervision, the installation was carried out. The contractor shall get the certification of the Competent authority for the complete system after commissioning.

4.9 **Works Inspection**
4.9.1 Prior to shipment of equipment, the Engineer-in-charge reserves the right to inspect the same at the manufacturers works and the Contractor shall provide and secure for the Engineer-in-charge and his authorized representative every reasonable access and facility at the manufacturers works for inspection.

4.10 **Co-Ordination Of Work At Site**
4.10.1 The Contractor shall work in co-ordination with other agencies at site and shall arrange to place the conduits/inserts etc. in the masonry and concrete as required, as other works proceed. Any hold up of the building or other works because of delay in placing the conduits / inserts etc. or otherwise shall be the
responsibility of the Contractor and shall make him liable for damages as may be considered and levied by the Engineer-in-charge.

4.11 **Partial Occupation of Premises**

4.11.1 During progress of the work completed portions of the building/ floor may be occupied and put to use by the Client. The Contractor shall however remain fully responsible for the maintenance of the installations till the entire work covered by this Contract is satisfactorily completed by him and taken over by the Institute.

4.12 **Appointment Of Sub Contractor & Supplier For Telephone Work**

4.12.1 The main contractor shall get the name of the telephone wiring sub contractors approved from the Engineer-in-charge before the work is taken up in hand. The sub contractor shall be licensed electrical contractor and shall be registered Contractor of P&T/DOT.

4.12.2 The Supplier of EPABX should be an OEM authorized distributor/ dealer/ re-seller of the offered equipments. An authorization letter in this effect from the OEMs must be enclosed. The Supplier shall provide technical brochures from OEM to support the technical specification of all the offered items. The Supplier shall offer 1-year comprehensive on-site warranty and shall also quote rate for 3-year comprehensive on-site warranty.

4.13 **Conduit**

Conduits shall be done as per the specification mentioned in Wiring Section.

5.0 **T.V. Master Antenna System**

5.1 The contractor shall supply, install and test T.V. master antenna system according to bill of quantities. The system shall consist of the following parts as specified herein. Proper operation of equipment and material shall be guaranteed by the contractor. The scheme of MATV system shall be prepared and got approved by the Architect.

The system shall be based on CCIR regulations and 625 lines, PAL system. They shall be suitable for colour as well as monochrome transmission and distribution. The colour will be based on PAL system.

The supplied and ambient conditions will be as follows:

- Supply Voltage: -220 V.
- Supply Frequence: -50 Hz.
- Maximum Ambient Temp: -59°C
- Minimum Ambient Temp: -20°C
- Maximum relative humidity: -90%
- Altitude above seal level: -250M

5.2 **Splitter / Tap Off / Outlets / Attenuators.**

The system shall comprise of the required number of splitters. Tap Off s and Wall outlets.

The system should be provided with Attenuators wherever necessary to bring the signal level within the permissible limits of 67-80 dB.

The tap off s will have a VSWR(less than 1.3) Outlet shall be of 75 ohms with F type connectors. The loss of the through type wall socket should be as follows:

- Insertion loss: 0.8dB
- Tap loss: less than 11 dB.

Each outlet shall be provided with one 75/300 balanced matching transformer in neat moulded plastic case with push plug at the other and with 1.5 meters of 75 ohm coaxial cable. The system should comprise of F type connectors for better contract.

5.3 **Cable**

Whenever applicable LAN / DATA VOICE cable shall be CAT 6E & CAT 5 coaxial cables for high frequency application.

The complete system shall be drawn in steel conduits except for GI pipe for external routing. The cable shall be coaxial type. PVC sheathed, with attenuation as under:

70 dB/KM at 90 MHz.
130 dB/KM at 200 MHz.

5.4 Testing

All system shall be tested and adjusted for proper operation after the installation. Each outlet shall be tested for proper reception by the contractor in presence of the consulting engineer / architect representative. Any defect shall be rectified at no extra cost to the Client.
6.0 **FIRE ALARM SYSTEM**

**GENERAL**

6.1 **Work Included**

a) The scope of work under this head shall include design (if required) supply and installation of Analogue Addressable Fire Detection Cum Alarm System. The work under this system shall consist of furnishing all materials, equipments and appliances and labour necessary to install the said system complete with Detectors, Hooters and Manual Push Button Stations and Fire Alarm Panel etc.

The Design consists of providing Analogue Addressable Detectors, Hooters, Manual Call Points, Response Indicators and Fire Alarm Panel as per specifications.

It shall include laying of wiring and conduits etc. necessary for installation of the system with supply of detectors as indicated in the specification and schedule of quantities. Any openings/ chasing in the wall/ ceiling required to be made for the installation shall be made good in appropriate manner.

b) **Related Work and Obligations**

i) The general requirements apply to work specified in this section.

ii) To examine all the other sections of the specification for requirements which may affect work of this section.

iii) Co-ordinate works with all other trades affecting, or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under the Contract.

c) **General Requirements**

This specification covers requirements for supply, erection, testing and commissioning of Analogue Addressable Fire Alarm System.

d) **Codes and Standards**

The design, supply, installation and testing of the entire fire alarm system shall conform to BS : 5839 or NFPA 72. The detectors shall conform to relevant codes for Fire Alarm Systems.

e) **Quality Assurance**

The Contractor shall ensure that all materials furnished and installed by him under the Contract shall meet the requirements of relevant International and Indian Standards. The Contractor shall also verify all test results and ensure that these are in accordance with the requirements as mentioned in the specifications.

f) **Guarantee**

Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the Contract document.

The Fire Alarm System shall be guaranteed against trouble free operation, defective workmanship and materials for a period of 18 months from the date of supply or 12 months from the date of erection and commissioning whichever is earlier. In case of any defects during this period detectors etc. shall be replaced free of cost by the Contractor.

g) **Delivery, Handling and Storage**

All Detectors, Hooters, MCPs, RIs and Fire Alarm Panel shall be carefully handled and stored at site in a neat and orderly manner for fixing the same at a later date.

6.2 **Products**

a) **General Detail**

The Fire Alarm System shall conform to BS : 5839 or EN 54 or NFPA 71/ 72 or Under writer’s Laboratory in respect of design and installation and it shall give Audio / Visual Alarm Signals when the temperature in case of Heat Detector or smoke density in case of Photo Electric Detector exceeds the pre-set limit. The system shall give pin point location of fire with warning system and voice communication for commands and instruction if required.

b) **Photo Electric Type Smoke Detector Combined with Class ‘A1’ Thermal Sensor**

The Photo Electric Smoke Detector has an optical sensing chamber that operates on the light scattering principle and responds to those particles that exit from optically dense smoke. When Smoke enters the sensing chamber it scatters light which is received by a photo cell. The signal is amplified and digitised for reception by the Panel. The Detector shall activate on receiving smoke particles in the 0.5 to 10 micro meter range. The detector shall be completely solid state with LED indication at the base.

The Photo Electric Smoke Detector shall be combined with Class ‘A1’ thermal sensor. Each element shall have monitoring possible for measuring actual levels, as well as temperature rate of rise. When required it shall be possible to isolate smoke sensing while retaining thermal sensing.
The Detector shall be able to sense incipient fire by detecting the presence of visible and invisible products of combustion. The detector shall be suitable for low voltage (24 volts DC) two wire supply. The detector shall be provided with response indicator (LED) and the sensitivity of the detector shall not vary with change in ambient temperature, humidity, pressure of voltage variation.

Neither its performance shall be got affected by air circuit upto 10 Mtr. Per second. The detector shall be suitably protected against dust accumulation/ ingress and it shall be free from maintenance and functional test at intervals. All detectors shall be identical in construction design and characteristic to facilitate easy replacement. The detector housing shall be damage resistant made of polycarbonate or proprietary self extinguishing material.

The coverage per smoke detector shall be upto a minimum of 70 Sq.M. This coverage area will reduce depending upon structural configurations or partitions etc. It shall be possible to connect Smoke Detector with Heat Detector or Manual Push Button in the same circuit. The sensitivity of detector shall be set / adjusted by the supplier to suit the site requirement.

It shall have in-built safety device to monitor the removal and pilferage of the detector. The detector also must have facility for remote indication. The quiescent current flow must not exceed 50 milli amps and alarm condition current shall be maximum 60 milli amps.

The Photo Electric type Smoke Detector combined with Class ‘A1’ thermal sensor shall be intelligent Analogue Addressable detector with its own manually set digital code and be able to give analogue output to the Fire Alarm Panel regarding its condition. It shall be able to communicate with the Fire Alarm Panel by the pulses emitted from the Panel.

The base of the Detector shall be interchangeable with other Smoke or Heat Detectors. The enclosure shall meet IP 22 protection grade.

It shall be able to withstand temperature variation from 0 Degree Centigrade to 50 Degree Centigrade. Relative Humidity (non Condensing type) upto 95% shall not hamper its performance. The voltage rating shall be from 24 Volts DC, though the voltage may be changed depending upon the working voltages of a proprietary Fire Alarm Panel.

c) **Rate of Rise Type Heat Detector**

The Heat Detector shall be intelligent Analogue Addressable detector with its own manually set digital code and be able to give a single digitised output to the Fire Alarm Panel regarding its condition. The Detector shall employ the thermistor principle for heat sensing and the fixed temperature setting shall be at 60° Centigrade. It shall be able to communicate with the Fire Alarm Panel by the Electrical pulses emitted from the Panel.

The Base of the Detector shall be interchangeable with other Smoke Detectors and the Construction shall be of poly carbonate or any approved proprietary flame retardant material. LEDs shall be provided to indicate locally alarm condition. The enclosure shall meet IP 22 protection grade.

It shall be able to withstand temperature variations from 0° Centigrade to 50° Centigrade. Further, Relative Humidity (non Condensing type) upto 95% shall not hamper its performance. The Voltage rating shall be 24 Volts DC, though the voltage may be changed depending upon the working voltages of a proprietary Fire Alarm Panel.

The detector shall meet the requirements of either EN 54/ FM/ UL and shall be specifically approved by FM/ UL/ LPCB. It shall be possible to test the Detector's working both from the Panel as well as locally by means as designed by the Bidder. The approved coverage per Detector for unhampere areas shall not be less than 30 M²

d) **Manual Call Box.**

Manual Push Button shall be of Break Glass or Pull Down type units, completely encased in cast aluminium housing or in 16 gauge MS with provision for cable or conduit coupling. The manual Push Button shall have the word prescribed in clear bold letters on facial window “In case of Fire Break Glass/ Pull Down”.

The Manual Call Box station shall be fully addressable with its own set code and operated by digitized signals sent from the Panel. The voltage range shall be from 24 Volts. It shall have protection as per IP 33. The Operating temperature range shall be from 0 Degree Centigrade to 50° Centigrade. Relative Humidity (non condensing) range for performance parameters shall be between 0 to 95%. Further it shall confirm to BS 5839 or EN 54/ FM/ UL/ Vds/ LPC. In case the manual call box is indigenous and an Input Card is connected to it then the Manual Call Box with Micro Switch shall be approved by the Consultant.

e) **Hooter**

The Hooter shall be of electronic type and shall give discontinuous / intermittent audible alarm whenever any detector or call box operates. It shall be possible to control the hooter audible alarm in case it is not required to sound the alarm except for the panel.
It shall be complete with electronic oscillations, magnetic coil (sound coil) and accessories, ready for mounting (fixing).

The sound output from the Hooter should not be less than 100 decibels at the source point. Hooter shall be 4 W each and enclosed in an acoustically lined MS box.

f) **Fault Isolator**

The Fault Isolator shall be able to detect wire short circuit/ loose wiring/ partial earth fault and similar conditions and shall be able to isolate that segment from the circuit, so that the rest of the circuit continues to operate.

Fault Isolator shall operate in pairs in any loop and whenever any short circuit occurs between any two of them, both immediately shall switch to an open circuit state and isolate the length of wiring between them. The Isolators should automatically return to the closed circuit as soon as the short circuit is corrected.

The Fault Isolator shall be addressable so as to provide indicate of its changed state. It shall also have an inbuilt LED to give local alarm.

g) **Fire Alarm Control Panel**

1) The fire Alarm Control Panel shall be micro processor based fully Addressable Analogue Control Unit which shall control all addressable detectors, Manual Call Stations, Interface Units and Switching Systems (for disconnecting AHU and power supply) connected to it.

2) All addressable units shall be connected to the Panel through the Loop Cards and shall be addressed through individualized numbers. The Panel shall be able to obtain analogue value for all detectors in the Circuit through a pulsed digitalized current data. The Panel shall be able to analyze all analogue inputs from all addressable units and through its own software and ambient level screening it shall be able to identify Fire, possible Fire or Fault conditions. The unit shall be dynamic and continuous.

3) The Fire Alarm Panel shall itself have all Zone Cards in it. No isolated mother board or transponder is being considered. Each Loop shall be able to access a minimum of 90 addressable units. The Design has been based on the basis of 90 units per Loop.

4) The Panel shall also give adequate warning signal whenever there is dust accumulation in detectors, and up to the point of its replacement it should be possible to change the level of ambient alarm calibration condition either by the use of software programme operable by the Client or by resetting the detector.

5) Short circuiting, loose wiring or missing units shall also be reported at the Panel with pin point location. In such cases the system through the use of Fault Isolators shall be able to isolate that segment between the two fault isolators.

6) The Panel shall have a Liquid Crystal Display Alpha – Numeric type on it to indicate immediately all conditions. In case of testing of the system from the Panel, the Display shall be able to give readouts of analogue value of all detectors being tested. The Panel shall also be able to carry out continuous self monitoring when in normal condition. The Mother Board shall be of Modular Construction.

7) The Panel shall have either an in-built or external printer coupled to the Panel which shall log all events with time. The printout shall clearly indicate the event – Fire / Pre Alarm / Fault etc. the Unit address and time.

8) The Panel shall also be able to discriminate between false alarms and fire conditions, as well as priority selection of alarm address in case alarm activities in tow or more remotely located units simultaneously. In such cases, the Manual Call Box shall be reported first, group of sequentially laid detectors (in one room for example) second and a detector with the greatest obscuration over a period of time third.

9) The Panel shall also be able to actuate Switches automatically in case of Fire condition, that of AHUs and Power Supply or other Systems such as piped pressurized gas supply. The Bidder will be required to design and install the system in operation in coordination with the relevant Contractors. The Bidder will not be allowed to charge extra on this account, and such charges shall be included in his package.

10) In this respect the Bidder is required to take note of the specifications mentioned above. The Bidder shall indicate in his Bid what facilities shall need to be provided by the Client for completion of this mechanism.

11) The System should be fully safe and adequate safe guards should be under taken that in the event of a failure of a part of the System it shall not handicap the complete system.

12) The Bidder shall undertake the responsibility of the complete installation, commissioning, user trials, training and maintenance of the system as required. The Bidder shall take all responsibility for preparation and installation of system Software into the Panel. The Software shall be such as to be easily operated by the Client’s Personnel, is secured against Software errors, ability to be upgradable so as to incorporate more Detector units or replacement/ changing of Detector units, can incorporate more features at a later date such as Illumination Control, Security etc.

13) The Panel shall be able to address individual Interface Cards which shall be connected to conventional detectors.
14) The Panel shall have its own Battery Back up of a minimum of 12 hours run. The Battery shall be of Nickel Cadmium or as per Manufacturers Standard of capacity as required and accepted by the Client.

15) The Panel shall also have its own Annunciation System either inbuilt or by external source. The Microphone shall have a selector switch to tune onto the required speaker / speakers and give the necessary voice announcement.

16) It shall be able to withstand temperature variations from 0 Degree Centigrade to 50°C Centigrade. Further, Relative Humidity (Non Condensing type) upto 95% shall not hamper its performance. The Voltage rating shall be 24 V DC, though the voltage may be changed depending upon the working voltages of a proprietary Fire Alarm Panel.

17) The Panel shall be totally enclosed dust and vermin proof type made of minimum 16 gauge dust inhibited sheet with even baked finish. The panel shall be of completely solid state design.

18) The logic circuits shall be based on high noise immunity solid tasted hardware employing modular construction. Logic cards shall be of epoxy fibre glass construction.

19) The System shall meet the BS 5839/ EN 54/ NFPA 71 & 72 standards and all equipments excluding cabling and wiring shall be listed with Under writers Laboratory or Factory Mutual.

20) Further, the system shall be expandable and be able to add atleast 200 more units in the Panel through additional Loops.

21) The Panel shall have an extra Zone/ Loop Card to serve as Standby in case of burn out of or malfunctioning of any operating Zone/ Loop Card. If the Bidder envisages two numbers of 2 Loop cards to serve the 4 Loops of the proposed System, then the extra Loop Card shall also be a 2 Loop Card.

22) The Panel shall have software to cater to the change over of any of the operating Loop Cards to the extra Loop Card. Other Software necessary to actually change the terminals of a Loop from an existing Loop Card to the extra Loop card shall be carried out at site as and when required. Charges for such software, loading, test run etc. shall be indicated when required.

6.3 Exit Sign
1) Exit Sign : Photo Luminescent Type
2) Size : As per site requirements
3) Indications : As per site requirements

6.3.1 Cable / Wire & Conduit
This shall be as per the detailed specifications in Wiring Sub head.

6.4 Installation
6.4.1 Manual Stations
Manual Stations shall be mounted with the base of 1.50 m above the Finished floor level unless otherwise noted.

6.4.2 Evacuation Alarm Bells
Evacuation Alarm Bells shall be mounted at least 2.10 m above the floor level unless limited by ceiling height or otherwise noted.

6.4.3 Detectors
Detectors shall be mounted at the underside of ceilings or roof decks.

6.4.4 Main Fire Alarm Panel
It shall be installed in the Main Security Room.

6.5 Examination of Work
Upon completion of the installation, the Contractor shall test the entire Fire Alarm System to the satisfaction of the Engineer-in-charge. The Contractor and Fire Alarm Technician shall be in attendance to make necessary adjustments and perform electrical work related to the test. The installation shall be got approved from the competent Government authorities after testing & commissioning if required.
7.0 **EARTHING**

7.1 **Scope:**
7.1.1 The scope of this section covers supply installation and testing of earthing system for all non-current carrying metal parts of electrical installation.

7.1.2 The type and number of earth electrodes shall be as indicated and shall comply with clauses as appropriate.

7.1.3 Dedicated earthing shall be provided for the Server Room equipments.

7.2 **Earthing System & Equipment Bonding:**
7.2.1 Unless otherwise indicated, earth plates shall be 600 mm x 600 mm minimum, of solid or lattice copper not less than 3.15 mm thick and of GI not less than 6.3 mm.

7.2.2 Earthing system shall comprise of earth electrode near sub-station. Test link boxes shall be provided at each electrode for periodical resistance measurement. All such earth electrodes shall be interconnected forming a main grid.

7.2.3 Where the earth electrodes are formed with tape, the tape shall be to relevant IS, of the size, length, depth below ground level and layout as indicated.

7.3 **Conductors:**
7.3.1 Earthing conductors, main earthing bars and main equipotential bonding conductors shall be of the type, size and conductor material as indicated and shall comply with clauses 15.3.2 to 15.3.5.

7.3.2 Tapes shall comply with relevant IS. Where used to interconnect copper electrodes the tape may be bare, but for interconnecting pipe electrodes and for all other purposes the tape shall have an extruded PVC sheath.

7.3.3 Main earthing bars shall comply with IS 3043 and shall be bare.

7.3.4 Cables shall comply with IS 3043, without sheath, unless otherwise indicated.

7.4 **Joints and Connections:**
7.4.1 Joints in conductors shall be kept to a minimum.

7.4.2 All contact surfaces shall be thoroughly cleaned and coated with an anti-corrosive electrical jointing compound suitable for the conductor materials. For bi-metallic joints, a separate abrasive shall be used to clean each metal.

7.4.3 Connections shall be made as follows:
- to main earthing bars by phosphor bronze set screws and nuts;
- to earth rods by bronze, gunmetal or copper clamps with phosphor bronze. Edges of clamps shall be rounded;
- to earth pipes by phosphor bronze bolts and nuts, direct to the flange of the pipe;
- to earth plates by bolting, riveting or welding.

7.4.4 Termination of cables shall be by connectors jointed to the cable conductor by the thermit welding process or by compression joints complying with BS 4579.

7.4.5 Joints which are indicated as test points shall be bolted or clamped. Joints in tape, other than at test points shall be made by the riveting and sweating. Overlap of conductors shall be not less than 100 mm.

7.4.6 Joints and connections shall be protected by a coating which will form a seal and exclude moisture in all weather conditions. At connections to earth electrodes, the coating shall cover all exposed conductors and in the case of earth pipes, to top surface of the flanges. Protective coatings shall be of a waterproof, inert, tenacious material and of one of the following forms:

1. solvent cutback thyrotrophic corrosion preventative forming a film of resilient matt petroleum wax;
2. a fast drying durable rubberized sprayed coating;
3. a heat shrink clear sheathing.

7.4.7 Screws, nuts, washers and rivets for copper conductors shall be of phosphor bronze, naval brass or copper silicon; for aluminum conductors, they shall be of stainless steel. The minimum provision shall be

1. For flat strip--- two M8 bolts or four 5 mm diameter rivets;
2. For sheet metal--two M8 bolts; where the sheet metal is less than 2 mm thick, it shall be backed for an area of at least 1000 mm².

7.5 **Inspection Pits:**

7.5.1 Unless otherwise indicated, connection between an earth conductor and its associated earth electrode system shall be in an enclosure.

7.5.2 The enclosure shall have a removable top cover which shall be flush with finished ground level. The enclosure shall be a purpose made concrete inspection pit, a galvanized steel inspection pit embedded in concrete, an earthenware pipe or similar, as indicated. The earth electrode connection shall be just below the lid of the inspection pit with adequate access for testing purposes.

7.6 **Supports and Fixings:**

7.6.1 Cables shall be supported and fixed in accordance with Section Cable laying.

7.6.2 Tapes and bars shall be fixed by spacer bar saddles which shall be of non-metallic material or corrosion resistant alloy compatible with the conductors. Fixing of saddles shall comply with relevant clauses in Cable Laying section. The maximum spacing off fixings shall not exceed 600 mm unless otherwise indicated.

7.6.3 Main earthing bars shall be supported on insulators; they shall be not less then 25 mm clear of the building fabric.

7.6.4 For general areas inside buildings, screws and nuts shall be of cadmium electroplated steel or stainless steel; outside buildings, in plant rooms or other locations as indicated, they shall be of stainless steel.

7.6.5 No shot firing shall be used and no drilling or welding structural steelwork shall be done without the approval of the Engineer-in-Charge.

7.7 **Installation:**

7.7.1 Electrodes shall be installed in undisturbed ground. The distance between any two electrodes shall be not less than 1.25 times the depth of the longer electrode.

7.7.2 Excavations shall be carried out in accordance with BS 6031 and shall comply with the construction (General Provisions) Regulations, 1961. Excavations shall be kept free of water and protected against damage or collapse. The safety of persons and the protection of structures, buildings, roads, sewers and services from damage shall be ensured; all necessary sheeting, timbering, strutting and shoring shall be supplied, erected and subsequently removed.

7.7.3 Trenches shall be backfilled in layers and each layer shall be rammed. The first two layers shall be 100 mm deep and rammed by hand the remaining layers shall be not more than 200 mm deep and power ramming may be used. Warning tapes and covers shall be included as specified in relevant clauses in Cable laying section. Where applicable, top soil and turf shall be replaced and the final level shall be level with or not more than 25 mm above the adjacent ground level.

7.7.4 The earth resistance should be less than 5 Ohms. Earth Pits shall be treated with salt, charcoal/chemicals to be achieved the required result.

**PLATE EARTHING**

The earthing electrode shall consist of GI plate (60cm x 60cm x 6mm/tinned copper plate 60cm x 60cm x 3mm) as specified in item of work. Galvanizing of the plate shall conform to relevant Indian Standard. The plate electrode shall be buried in the ground with its faces vertical and top not less than 4.5m below GL. The earth plate pipe shall be buried in the ground below the permanent moisture level but not less than 4.5m below ground level. The plate shall be filled with charcoal dust and common salt filling extending up to 15cm around it on all sides. There shall be a 20mm dia, medium class GI pipe running from top plinth plate up to the ground level for watering pipe. The top of the pipe shall be provided with a funnel and a GI mesh screen for washing the earth. This will be housed in a masonry sump with cement plastering not less than 30cm deep. M. S. Frame heavy duty with hinged cover and locking arrangement shall be suitably provided over the sump. The earthing leak from electrode onwards shall be suitably protected from mechanical injury by GI pipe. The portion of this protection pipe within the ground shall be buried at least 30cm deep (to be increased to 60cm in case of road crossing and pavements).

The portion within the building shall be recessed in walls and floors to adequate depth. In the case of plate earth electrode, the earthing load shall be securely bolted to the plate with two bolts, nuts check nuts and washers. In case of pipe earth electrode, it should be counted by means of a ‘through’ connection with the earth lead with electrode shall be GI brass in case of copper plate electrode.

The electrical resistance of earthing conductors shall be low enough to permit passage of fault current necessary to operate the fuse or circuit breaker and shall not exceed 2 Ohms.
8.0 **INSPECTION AND TESTING:**

8.1 **General:**

8.1.1 Inspection and testing shall be done in accordance with the IEE Wiring Regulations, the requirements of this Section and as indicated.

8.1.2 Inspection shall include a physical check that all equipment has been securely fixed and that all electrical connections are mechanically sound.

8.1.3 In addition to the test at the completion of each installation, certain tests shall be done during the progress of the Works as required by clauses 17.4 to 17.7 both inclusive.

8.2 **Information:**

8.2.1 For equipment supplied under the contract, the Contractor shall obtain from manufacturers the time/current characteristics of all protective devices for automatic disconnection of supply and provide copies to the Engineer-in-Charge and to the person or persons carrying out the inspection and testing, in addition to meeting the requirements of clause.

8.3 **Testing Methods:**

8.3.1 The Engineer-in-Charge shall be notified of the method to be used for each type of test and the notification shall be given not less than 28 days before the final tests are to be made. The tests shall be carried out in accordance with the methods set out in the IEE Wiring Regulations, subject to the requirements of clauses 17.3.2 to 17.3.6 inclusive.

8.3.2 For testing, continuity of protective conductors and equi-potential bonding AC source shall be used unless the Engineer-in-Charge agrees otherwise.

8.3.3 The method used to verify the effectiveness of the protection afforded by a residual current-operated device shall give the operating time and the current used shall not exceed 100% of the nominal setting of the device. For a fault voltage operated device, the test voltage between the exposed conductive part and earth shall not exceed 50 volts. In addition to the tests simulating an appropriate fault condition, any test facility incorporated in the device shall be operated to test its effectiveness.

8.3.4 High Voltage tests on LV cables and factor assemblies shall comply with the requirements for site testing in the appropriate British Standards.

8.3.5 Alternative methods to those set out in the IEE Wiring Regulations may be proposed for the approval of the Engineer-in-Charge, but they shall be not less effective than those in the Regulations.

8.3.6 Where necessary to prevent damage to components of equipment, the equipment shall be disconnected for the duration of the relevant tests.

8.4 **Power Cables:**

8.4.1 Tests shall be made immediately on completion of the installation of power cables to demonstrate that the phase sequence is correct at all end connections.

8.4.2 Where indicated, LV cables shall be tested at high voltage in accordance with clause 17.3.4 as soon as their installation is complete.

8.4.3 LV cables not required to be high voltage tested, shall be tested for insulation resistance as soon as their installation is complete. The test voltage shall be 500V DC for installations rated up to 500V and 1000V DC for installations rated up to 1000V. Tests shall cover all permutations between each conductor, screen, metallic sheath, armour and earth.

8.4.4 The over sheaths of cables laid under ground shall be given a voltage withstand test after backfilling of the trenches is complete but before termination.
8.5 Control and Communication Cables:

8.5.1 Cables shall be tested as soon as their installation is complete to ensure that the cores are continuous and they have not been crossed and the insulation resistance is satisfactory. Insulation tests shall cover all permutations between each conductor, screen, metallic sheath, armour and earth.

8.5.2 For polyethylene and dry paper-insulated communications cables, the insulation resistance for each conductor shall be not less than 1500 L mega ohms, where L is the cable length in Kilometres. The measured resistance of each conductor shall not exceed the calculated resistance by more than 5%; the calculated value will be made available by the Engineer-in-Charge.

8.6 Conduit and Trunking:

8.6.1 Where conduit is cast in situ in reinforced concrete, it shall be checked for freedom from blockage and steel conduit shall be tested for electrical continuity as soon as the shuttering has been removed.

8.6.2 Steel conduit and bus duct systems shall be inspected and tested before any wiring is installed; under floor ducting shall be inspected and tested before screeding.

8.7 Earth Electrodes:

8.7.1 The resistance of each earth electrode, whether for earthing of protective conductors, lightning protection or an electrical system, shall be checked immediately after installation of the electrodes and the results submitted to the Engineer-in-Charge.

8.8 Earth Fault loop impedances:

8.8.1 The measured earth fault loop impedance for each circuit shall be checked against the maximum value as indicated.

8.8.2 Where the maximum value is exceeded the Engineer-in-Charge shall be informed.

8.9 Records and Certificates:

8.9.1 Inspection and test results shall be recorded on the forms provided by the Authority. Two copies shall be submitted to the Engineer-in-Charge within 7 days of each test.

8.9.2 When all inspections and tests results are satisfactory, a Completion Certificate and an Inspection certificate shall be given to the Engineer-in-Charge not later than the date of completion of the works. The certificates shall be given in the form laid down in the IEE Wiring Regulations for electrical installations and BS 5266 for emergency lighting systems.

8.9.3 The values of prospective short-circuit current and earth fault loop impedance at the origin of the installation shall be recorded on the Inspection certificates.
9.0 DRAWINGS AND DOCUMENTS BY CONTRACTOR:

9.1 Extent of Provision:

9.1.1 Unless otherwise indicated, the Contractor shall provide the shop drawings and documents specified in following clauses.

9.1.2 The numbers of sets of drawings and documents to be supplied shall be as indicated.

9.2 Shop Drawings and Documents:

9.2.1 Shop drawings and documents including diagrams and schedules shall show the details of the Contractor's proposals for the execution of the works and shall include everything necessary for the following purposes:

a. To illustrate in details, the arrangement of the various sections of the works and to identify the various components;

b. To integrate the works with the detail of the building and other installations.

9.2.2 Shop drawings shall include:

a. General layout drawings showing the location of all equipment including cable; cable tray, conduit ducting and earth electrodes;

b. Detailed layout drawings showing the location of all equipment including cable, cable tray, conduit and ducting in switch rooms and plant rooms;

c. Assembly drawings of factory Built equipment and site built assemblies;

d. Detailed layout drawings showing the connection of cable and conduit to equipment;

e. Detailed layout drawings showing the connections through ceiling voids and vertical shafts;

f. System diagrams, circuit diagrams and wiring diagrams for all installations and equipment.

9.2.3 Diagrams shall comply with relevant IS. Interconnection diagrams shall indicate the type of cable, conductor size and terminal numbering.

9.4 As Built Drawings:

9.4.1 As-built drawings, including diagrams and schedules shall show all the information necessary so that each installation can be operated, maintained, inspected and tested so as to prevent danger, as far as is reasonably practicable. They shall incorporate the information necessary for the identification of the devices performing the functions of protection, isolation and switching, and their locations. The value of prospective short-circuit current and earth fault loop impedance at the origin of the installation shall be recorded on the appropriate system diagram.

9.4.2 Circuit details including loading, route, and destination and where buried, the depth below finished ground level shall be shown for each cable, conduit, and ducting. Conductor size and material and the type of insulation of all cables shall be shown together with the number of cores in each cable, the number of cables in each conduit, trunking or ducting. Where identification is by colour of insulation or sheath, this shall be shown. Joints and draw boxes shall be shown.

9.4.3 Where incoming supply cables are installed by others, they shall also be shown as described in clause 17.4.2.

9.4.4 Drawings shall indicate whether conduit or ducting is surface mounted, concealed in ceiling, spaces in wall chases, in floor screeds or cast in mtu.

9.4.5 All earthing conductors, main equi-potential bounding conductors, main earthing terminal or protective conductors and supplementary equi-potential bonding conductor shall be identified with function, origin route, destination, conductor size and material, type of insulation and where buried, the depth below finished ground level test points shall be indicated.

9.4.6 Earth electrodes shall be identified to their types, dimensions, material and depth below finished ground level. The nature of the soil and any treatment that has been given to it or special fill that has been used in the installation shall be identified.

9.4.7 Details of each item of equipment including luminaires shall include electrical characteristics, classification, degree of protection against ingress of solids and liquids, class of protection against corrosion and manufacturer's name and reference.
9.4.8 Diagrams shall comply with 17.2.3 and they shall be supplemented with physical arrangement drawings to assist the location and identification of component parts of equipment.

9.4.9 During the course of the works, the contractor shall maintain a fully detailed record of all changes to ensure that the as-installed drawings are in all respects accurate.

9.4.10 Each drawing shall be in accordance with relevant IS to ensure suitability for micro-filming and shall be on durable translucent material, other than paper, of a standard size A0 to A4 in accordance with relevant IS. The words ‘AS-BUILT’ shall be place in 19 mm block letters adjacent to the title block of each drawing together with the name of the site and the section of the works, the title of the installation, the date of completion of the works, the Authority's contract number and the name of the Contractor.

9.4.11 A draft of each as built drawing shall be submitted to the Engineer-in-Charge before final issue is made.

9.5 Maintenance and Operating Instructions:

9.5.1 For each electrical installation, system and individual equipment forming part of the works, the maintenance and operating instructions shall include:

a) A description of the extent and manner of operation, including duration periods of standby systems;

b) A description of the method used for compliance with Regulation 413-3 of the IEE wiring Regulations together with time/current characteristics for all protective devices or automatic disconnection of supply.

c) A copy of the inspection certificate and all the test records.

d) A copy of any certificates of compliance with relevant standards or schemes as may be required.

e) Comprehensive instructions for the switching on, operation, switching off and isolation, and for dealing with emergency conditions.

f) Instructions for any precautionary measures necessary.

g) Instructions for servicing, including frequency and materials to be used, to maintain the equipment in good and safe condition.

h) The names and addresses of suppliers of all major components together with the type and model reference, serial number, duty rating and the order number and date.

9.5.2 Maintenance and operating instructions shall be indexed and contained in ring binders with stiff covers. The name of the site and the Authority's contract number shall be printed on the front and spine with, where more than one volume is necessary, a suitable identification title. The date of completion of the works shall be included on a flyleaf.

9.5.3 Copies of manufacturer's data may be incorporated to supplement the descriptions and instructions required in clause 17.5.1 but shall not replace them. Only data relevant to the works shall be included. Where non relevant data appears on the same sheet, it shall be cleared marked to show that it is not applicable. The data shall be cross referenced within the text and included in the index; if possible, it shall be contained in the ring binders, but where this is not possible, suitably protected box files or folder shall be provided, identified in accordance with clause 17.5.1.

9.5.4 A draft of the maintenance and operating instruction shall be submitted to the Engineer-in-Charge before the final documents are issued.

10.0 SAFETY REQUIREMENTS:

10.1 Scope:

10.1.1 Safety procedures as laid down in Indian Standards shall be strictly followed during erection and commissioning.

10.1.2 The safety provisions required under the IEE Rules shall be provided for which no extra payment shall be made.
**LIST OF PREFERRED MAKES**

1. PVC Conduit & Accessories : AKG / BEC / POLYCAB
2. FRLS Copper Conductor Wire : POLYCAB / SKYTONE / KEI
3. Modular Switch Sockets : LEGRAND / ANCHOR / CRABTREE
4. MCB / ELCB / Double Door DB : LEGRAND / ANCHOR / HAGER
5. Industrial Sockets in Enclosure : LEGRAND / NEPTUNE /
6. Light Fixtures : HPL / HAVELLS / WIPRO
7. Telephone Wire : POLYCAB / SKYTONE / KEI
8. Telephone TAG Block : KRONE
9. CAT-6 Cable : D-LINK / LEGRAND
10. RJ-45 Data Sockets : D-LINK / LEGRAND
PARTICULAR TECHNICAL SPECIFICATIONS

(FIRE FIGHTING SYSTEM)

1. PUMP:

The Proposed Fire fighting system is extension of existing fire fighting system of school building having fire pumps, UG tank, terrace pump, etc.

2. PIPES:

Pipes of the following types are to be used:

a) G.I. / Mild steel black pipes as per IS : 1239, heavy grade (for pipes of sizes 150 mm N.B. and below) suitably lagged on the outside with fiber tissue to prevent soil corrosion as per IS : 10221.

b) Technical Specifications

G.I./Steel pipe lines upto 150 mm dia shall have all fittings as per IS : 1239, Part II (heavy grade) while pipelines above 150 mm dia shall be fabricated from IS : 3589 Gr. 320 pipes as applicable or from steel plates.

c) For G.I./steel pipelines upto 50 mm dia screwed jointing shall be adopted, while for pipelines above 50 mm dia welded or flanged construction is to be carried out.

d) Hangers and supports shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. All guides, anchor, braces, dampener, expansion joint and structural steel to be attached to the building / structure trenches etc. shall be provided. Hangers and components for all piping shall be approved by the Architects.

e) The piping system shall be capable of withstanding 150% of the working pressure including water hammer effects.

f) Flanged joints shall be used for connections to vessels, equipment, flanged valves and also on suitable straight lengths of pipeline of strategic points to facilitate erection and subsequent maintenance work.

g) Pipes shall be buried at-least one meter below ground level and shall have 230 mm x 230 mm masonry supports.
TECHNICAL SPECIFICATIONS

at-least 300 mm high at 3 m intervals. Masonry work to have plain cement concrete foundation (1 cement: 4 coarse sand: 8 stone aggregate) of size 380 x 380 x 75 thick resting on firm soil.

3. FITTINGS:
Mild Steel but welded heavy grade (above 50 mm). For 50 mm and below 50 mm heavy grade screwed G.I. fittings will be used.

4. BUTTER FLY VALVES:
The Butter Fly Valve shall be made of Cast Iron to IS: 210, grade FG 260 body, in circular shape and of high strength to take the minimum water pressure of 16 Kg/cm². The disc shall be heavy duty C.I with anti corrosive epoxy or nickel coating. All Butter Fly Valves shall be full lug with internal threading. The rating of valves should be PN 1.6 with flange drilling as per IS: 1538.

5. HYDRANT SYSTEM
a) The hydrant system shall comprise of terrace Pump, ms pipe network etc. as specified in schedule of quantities with all required accessories including valves, appurtenances, instrumentation and controls etc. complete in all respects. The system shall cover the entire area from independent pipe work from the fire water pump set. The hydrant work shall remain pressurized through the proposed Jockey Pump taking care of any leakages in the system pipelines and valve glands. All pumps/ motors/ engines to be of makes approved by T.A.C.

b) The hydrant system shall be kept charged by pressurized water at all times. In the event of fire when any of the hydrant valve in the net work is opened, the resultant fall in header pressure should operate pressure switches automatically. Apart from the automatic starting of the pump sets, provisions shall be kept for manual starting also. However shutting down of the pump sets shall be manual.

c) The hydrant system in the yard shall be furnished with external hydrants consisting of landing valves(positioned approx. one meter above ground level) fitted G.I.. (Heavy) flanged single headed stand pipes installed on pipe mains as marked on the plan.

d) To compensate for slight losses of pressure in the system and to provide an air cushion for
counteracting pressure surges whenever the pumping set comes into operation and prevent water hammer in the underground pipe work, air vessels conforming to IS: 3844 shall be furnished in the fire water pump house.

6. LANDING VALVE:
Landing valves shall be 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 gunmetal and fitted with instantaneous coupling conforming to IS : 901. The valve body, stop valve, check valve, nut instantaneous female outlet and blank cap shall be of leaded-tin bronze conforming to Grade -II of IS : 318-1962. The valve spindle shall be of brass rod conforming to IS;320- 1962. The hand wheel shall be mild steel or cast iron washers. gaskets shall be of rubber conforming to IS : 638-1965 or leather conforming to IS :581 :1969.

7. FIRE HOSE COUPLING:
Hoses pipes shall be of non-percolating type 100 % synthetic Pyroprotect as per IS : 636 Type B and or flax canvas ISI marked 4927, with nominal size of 63 mm and lengths of 15 meter or 7.5 meter, as per quantities specified for each. All hose pipes shall carry ISI marking on the body of the hose.

The hose shall have instantaneous spring lock-type coupling on ends. The instantaneous coupling shall be as per IS : 901. It shall be fixed to each other by copper rivets and galvanized M.S. wires and leather bands.

All coupling shall be interchangeable with each other, and shall bear ISI markings.

8. BRANCH PIPE:
Branch pipe shall be of either gunmetal or aluminium and should conform to IS:903. One end of the branch pipe will receive the coupling while the other end shall have a nozzle screwed to it. It shall bear ISI marking.

9. HOSE BOX:
Each hydrant shall be housed in a Hose cabinet of suitable size. The Hydrant Cabinet shall hold single headed hydrant 2 hoses and one branch pipe as required. Internal hydrants shall normally fit the niche made for
it or shall be suitable for wall mounting. The cabinet shall be of minimum 14 SWG M.S. sheet double coated with P.O. Red paint after single coat of Red Oxide primer with center opening glazed doors (clear glass of 4 mm thickness). The glass shall be firmly fixed by means of steel clips and screws with rubber beading. Hinges shall also be screwed and not welded. The corner members (frame) shall be of 25 x 25 x 3 mm thick angle. The hose box shall be firmly fixed to the wall / support by means of brackets and dash fasteners. The steel work shall have one coat of primer and two coats of red paint. The words "Yard Hydrant", "Hydrant" etc., should be painted in white or red on the glass in 75 mm high letters, The Hose Box shall be lockable.

10. FIRE HOSE REEL:
Fire Hose Reel consists of 20 mm dia. High pressure rubber hose of 30 mtr. Length with Gun Metal nozzle of 5 mm bore. Rubber Hose is connected with wall mounted circular hose reel of heavy duty Mild Steel construction and Cast Iron brackets. Hose Reel shall conform to IS: 884 -1969. The Hose Reel shall be connected directly to the M.S. pipe riser through an independent connection with 25 mm dia. ball valve.

11. FIRE BRIGADE INLET CONNECTION:
A fire brigade inlet connection with a non-return valve shall be provided to facilitate the fire brigade to pump water into the installation by the use of their own equipment. Four way or 150 mm dia connection to the system shall comprise of four instantaneous pattern 63 mm dia. male inlets shall be with caps and chains complete with 150 mm dia. sluice valves, no-return valve housed in a M.S. cabinet with glass fronted door. The cabinet shall be suitable for recess mounting.

12. PRESSURE TYPE FLOW SWITCHES:
Switches shall be UL & ULC LISTED & FM approved of make given in BOQ.

Switches shall be provided with 1/2" NPT polysulfone male pressure connection and shall be into alarm, check valve of a wet sprinkler system constant pressure line on the system side of any shut off valve or check valve.

Repeatability shall be + 0.5% of full scale range.
Over-range shall be 150% of range without any deformation / damage to the sensing element.

13. TESTING OF THE HYDRANT SYSTEM:
   a) Flushing of underground connections Underground mains and lead-in connections to system risers shall be flushed before connections made to piping in order to remove foreign materials which may have entered underground during the course of installation. For hydrant system the flushing operation shall be continued until water is clear.
   b) Underground mains and connections shall be flushed at a flow rate of not less than 1620 ltrs. Per minute.
   c) Provision shall be made for the disposal of water issuing from test outlet to avoid property damage.
   d) Acceptance Test
      At the time of taking over, the hydrant system shall fulfil the following acceptance tests:
      (i) Starting up of the pressurization (Jockey Pump) The pressure switch shall be set at 7 kg/cm\(^2\) at the lower limit and 7.5kg/cm\(^2\) at the upper limit. The system drain shall be opened to cause a drop in the pressure. The Jockey Pump shall start as soon as the pressure gauge needle falls down to 7 kg. The Jockey Pump shall also automatically stop when the system has been pressurized again upto 7.5 kg/cm\(^2\).
      (ii) The terrace pump The pump shall be set to start at 6.5kg/sq.cm An external hydrant valve using a single length of hose and branch pipe shall be fully opened to cause a drop of pressure in the system. when the pressure drop to 5 kg. should be allowed to test automatic start-up of the terrace pump. The terrace pump shall continue to run at-least for 5 minutes and register rise in the pressure upto 7.5kg. The terrace pump shall be stopped manually by pressuring the stop button.
      e) All these tests mentioned above shall be repeated after one hour interval. The result of all the tests shall be identical again. After the system has satisfactorily withstood the above tests, it can be taken over from the contractor.

14. TESTING OF PIPES:
   All piping in the system shall be tested to a hydrostatic pressure of 14 Kg/ sq.cm without drop in
pressure for 24 hours. Rectify all leakages, make adjustments and retest as required and directed.

15. **MEASUREMENT:**

Mild steel pipes shall be measured per linear meter of the finished length and shall include all fittings (including flanges), welding joint, clamps for fixing to walls or hangers, anchor fasteners and testing.

Flanges shall include 1.5 mm thick compressed asbestos gasket, nuts, bolts and testing.

Butter Fly Valves, check valves shall be measured by numbers and shall include all items necessary and required for fixing and as given in the specifications/schedule of quantities.

Landing valves, hose cabinets, rubberized fabric linen fire hose pipes, first-aid fire hose reels (with gun metal full way valves) and gun metal branch pipes shall be measured by numbers and shall include all items necessary are required for fixing as given in the specifications/schedule of quantities.

Suction and delivery headers shall be measured per linear meter of finished length and shall include all items as given in the schedule of quantities.

Painting/wrapping shall be included in the rate for pipes and no separate payment shall be made.

No additional payment shall be admissible for cutting holes or chases in walls or floors, making connections to pumps, equipment and appliances.

After completion of the work contractor has to take clearance from concern authorities of fire Department in the state and no expenditure on this account will be paid separately.
PARTICULAR TECHNICAL SPECIFICATIONS

(CCTV)

As per item description, manufacturer’s specifications and as per approval of Engineer - in - Charge.
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<td><strong>Lifts</strong></td>
<td>Kone, Otis, Mitsubishi</td>
</tr>
</tbody>
</table>

**ELECTRICAL**

A. **ELECTRICAL HIGH SIDE EQUIPMENT**

1. **SOLAR POWER PANEL**

   THEME SOLAR SYSTEM/ SOLAR HART/ KL SOLAR COMPANY/ APOLLO SOLAR/ AVANTE GLOBAL

2. **UPS SYSTEM**

   EMERSON/ PCI/ SOCOMAC

3. **INVERTOR**

   LUMINOUS / MICROTEK / SU-KAM
<table>
<thead>
<tr>
<th></th>
<th>B. <strong>ELECTRICAL SYSTEM/ PANELS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>FUSES &amp; SWITCH FUSE UNIT</strong></td>
</tr>
<tr>
<td>2</td>
<td><strong>ACB / MCCB / CONTROLLER</strong></td>
</tr>
<tr>
<td>3</td>
<td><strong>METAL CLAD SOCKET</strong></td>
</tr>
<tr>
<td>4</td>
<td><strong>RISING MAINS / BUS DUCT</strong></td>
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<tr>
<td>5</td>
<td><strong>LED'S LIGHT</strong></td>
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<tr>
<td>6</td>
<td><strong>ISOLATORS FOR MOTORS</strong></td>
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<tr>
<td>7</td>
<td><strong>CHANGE OVER SWITCH</strong></td>
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<tr>
<td>8</td>
<td><strong>CONTACTOR, TIMER, SINGLE PHASE PREVENTOR &amp; OVER LOAD RELAY</strong></td>
</tr>
<tr>
<td>9</td>
<td><strong>METERS - DIGITAL TYPE</strong></td>
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<td>10</td>
<td><strong>PROTECTIVE &amp; APFC RELAYS</strong></td>
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<tr>
<td>11</td>
<td><strong>CT's / PT's- DRY TYPE-EPOXY</strong></td>
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<tr>
<td>12</td>
<td><strong>INDICATING LAMP / PUSH BUTTON ACTUATORS - LED CLUSTER TYPE</strong></td>
</tr>
<tr>
<td>13</td>
<td><strong>ROTARY SWITCHES</strong></td>
</tr>
<tr>
<td>14</td>
<td><strong>TERMINAL BLOCK</strong></td>
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<td>15</td>
<td><strong>LT PANELS</strong></td>
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<tr>
<td>16</td>
<td><strong>LIGHTNING ARRESTER</strong></td>
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<td>17</td>
<td><strong>GAS FIRE SUSPERSION SYSTEM</strong></td>
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<tr>
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<th>C. <strong>CABLES/ TERMINATIONS/ ACCESSORIES</strong></th>
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<tbody>
<tr>
<td>1</td>
<td><strong>LUGS</strong></td>
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<tr>
<td>2</td>
<td><strong>BRASS CABLE GLANDS</strong></td>
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<tr>
<td>3</td>
<td><strong>LT POWER CABLE (ALUMINIUM/ COPPER)</strong></td>
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<td><strong>CONTROL CABLE (COPPER)</strong></td>
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<td>5</td>
<td><strong>HT XLPE CABLE</strong></td>
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<td>6</td>
<td><strong>H.T. CABLE END TERMINATION</strong></td>
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<td><strong>Fire Survival Cable</strong></td>
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<tr>
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<th>D. <strong>CONDUITING &amp; WIRING ACCESSORIES</strong></th>
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<tbody>
<tr>
<td>1</td>
<td><strong>MS CONDUIT / GI CONDUIT (ISI MARKED)</strong></td>
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<tr>
<td>2</td>
<td><strong>PVC CONDUIT (ISI MARKED)</strong></td>
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<tr>
<td>3</td>
<td><strong>PVC INSULATED COPPER CONDUCTOR FRLS WIRE</strong></td>
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<td>PLATE TYPE - SWITCHES / SOCKETS / TV &amp; TELEPHONE SOCKETS AND ALL OTHER</td>
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<td>WIRING ACCESSORIES</td>
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<td>5</td>
<td>ACCESSORIES FOR METALIC / GI CONDUIT (ISI MARKED)</td>
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<td>6</td>
<td>PVC INSULATION TAPE</td>
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<td>PHENOL LAMINATED SHEET</td>
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<td>RACEWAYS &amp; CABLE TRAY</td>
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<td>E. LIGHTING DBs &amp; MCBs</td>
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<td>2</td>
<td>DISTRIBUTION BOARD</td>
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<td>ELCB / ELMCB / RCCB</td>
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<td>F. LIGHTING FIXTURES &amp; FANS</td>
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<tr>
<td>1</td>
<td>BULK HEAD FITTINGS</td>
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<tr>
<td>2</td>
<td>EXHAUST FANS / CEILING FAN / WALL MOUNTED FAN</td>
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<td>3</td>
<td>LIGHTING FIXTURES</td>
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<td>4</td>
<td>LIGHTING CONTROL SYSTEM</td>
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<td>G. ELV- TELEPHONE/ CCTV/ DOOR ACCESS/ FIRE ALARM/ PUBLIC ADDRESS &amp; MISC.</td>
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<td>SYSTEMS</td>
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<td>1</td>
<td>SMOKE DETECTORS</td>
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<td>2</td>
<td>HEAT DETECTORS</td>
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<td>MANUAL CALL BOX</td>
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<td>4</td>
<td>HOOTER/ SOUNDER</td>
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<td>5</td>
<td>RESPONSE INDICATOR</td>
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<td>6</td>
<td>FIRE PANEL</td>
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<td>7</td>
<td>PA AMPLIFIER</td>
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<td>8</td>
<td>PA SPEAKERS</td>
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<td>9</td>
<td>LINE MATCHING TRANSFORMER</td>
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<tr>
<td>10</td>
<td>GOOSE NECK MIKE</td>
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<tr>
<td>11</td>
<td>INVERTER</td>
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<td>12</td>
<td>CAMERA WITH ALL ACCESSORIES</td>
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<td>13</td>
<td>ROAD BARRIER</td>
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<td>14</td>
<td>CARD READER</td>
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<td>PROXIMITY CARD</td>
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<td>TELEPHONE TAG BLOCK</td>
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<td>TELEPHONE CABLES</td>
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<td>CO-AXIAL CABLES</td>
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<td>22</td>
<td>EPABX</td>
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<tr>
<td>23</td>
<td>CCTV SYSTEM</td>
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<td>24</td>
<td>IT &amp; TELECOM SYSTEM</td>
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<td>25</td>
<td>FIRE ALARM SYSTEM</td>
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<td>26</td>
<td>ACCESS CONTROL SYSTEM</td>
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<td>27</td>
<td>Fire Survival Cable</td>
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<td>28</td>
<td>Feedback Suppressor</td>
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<td>29</td>
<td>Mixer Band Equalizer</td>
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<tr>
<td>30</td>
<td>Projector</td>
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<td>31</td>
<td>Ceiling mounting kit for projector</td>
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<tr>
<td>32</td>
<td>Fixed screen</td>
</tr>
</tbody>
</table>

H. MISCELLANEOUS SYSTEMS

1. BATTERIES                         | EXIDE/ STANDARD
2. BATTERY CHARGER                  | KELTRON/ NELCO/ EXIDE/ HBL NIFE

I. DG/PANAL/TRANSFORMER

1. ALTERNATOR                       | STAMFORD/ CATERPILLAR/ KIRLOSKER/CROMPTON
2. ENGINE                           | CUMMINS/ CATERPILLAR/ KIRLOSKER
3. HT PANELS                        | ABB/ GE/SPC ELECTROTECH
4. TRANSFORMER                      | VOLTAMP/ ABB/ AREVA / KIRLOSKER/SUDHIR
5. UNITISED / COMPACT SUB-STATION   | ABB/SIEMENS/ SCHNIEDER/SUDHIR

J. PLUMBING SYSTEM

1. VITREOUS CHINA SANITARYWARE       | PARRYWARE,ROCA, HINDWARE/ JAQUAR
2. PLASTIC W.C.SEATS & COVERS        | PARRYWARE,ROCA, HINDWARE/ JAQUAR
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>C.P. FITTINGS: BIB COCK (LONG BODY/SHORT BODY), PILLAR COCK, SINGLE HOLE</td>
<td>JAQUAR /ESS ESS /GROHE</td>
</tr>
<tr>
<td></td>
<td>BASIN MIXTURE, WALL MIXER, SHOWER MIXER, ANGLE VALVE, CONCEALED STOP COCK,</td>
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<tr>
<td></td>
<td>SHOWER WITH WALL FLANGE, C.P. WASTE 32-40 mm DIA, BOTTLE TRAP, HEALTH</td>
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<tr>
<td></td>
<td>FAUCET WITH STEEL BEDED CONNECTING PIPE.</td>
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<tr>
<td>4</td>
<td>AUTOMATIC WATER TAPS, AUTOMATIC URINAL FLUSHING SYSTEM</td>
<td>JAQUAR /ESS ESS /GROHE</td>
</tr>
<tr>
<td>5</td>
<td>TOWEL RING, TOWEL ROD, TOWEL RACK, COAT HOOK etc. (304 Grade S.S.)</td>
<td>JAQUAR /ESS ESS /GROHE</td>
</tr>
<tr>
<td>6</td>
<td>CHROMIUM PLATED / STAINLESS STEEL / POLY VENIEL CHLORIDE GRATING</td>
<td>Cummun, Neer, Chilly</td>
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<td>7</td>
<td>STAINLESS STEEL SINK</td>
<td>JAINA /NEELKANT/ANUPAM</td>
</tr>
<tr>
<td>8</td>
<td>SAND CAST IRON SPUN PIPE, CENTIFUGALLY CASTED S &amp; S AS PER IS: 3989</td>
<td>NECO / RAJ IRON FOUNDRY/RIF/SKF</td>
</tr>
<tr>
<td>9</td>
<td>CAST IRON PIPE, HORIZONTALLY / VERTICALLY CASTED S &amp; S AS PER IS: 1729</td>
<td>NECO / RAJ IRON FOUNDRY/RIF/SKF</td>
</tr>
<tr>
<td>10</td>
<td>G.I. &amp; M.S. PIPES PART-I IS: 1239 UPTO 150 mm AND M.S. PIPES PART-II IS:</td>
<td>TATA STEEL (TUBE DIVISION)/ JINDAL PIPES LIMITED</td>
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<tr>
<td></td>
<td>3589 ABOVE 150 mm</td>
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<td>11</td>
<td>G.I. AND M.S. FITTINGS</td>
<td>UNIQUE./ ZOLOTO / KENT</td>
</tr>
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<td>12</td>
<td>uPVC PIPES &amp; FITTINGS 4 kg./sqm, 6 kg./sqm, 10 kg./sqm, PRESSURE.</td>
<td>SUPREME INDUSTRIES LIMITED/ FINOLEX INDUSTRIES/ PRINCE PIPES &amp; FITTINGS PRIVATE LIMITED</td>
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<td>13</td>
<td>cPVC PIPES SDR12.5 SCHEDULE-40</td>
<td>ASTRAL POLYTECHNIC PRIVATE LIMITED/ ASHIRVAD ENTERPRISES PRIVATE LIMITED/ JAIN PLASTICS &amp; CHEMICALS LIMITED /FINOLEX INDUSTRIES</td>
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<tr>
<td>14</td>
<td>HDPE PIPE</td>
<td>JAIN PLASTICS &amp; CHEMICALS LIMITED/ CHEMI PLAST INDUSTRIES STUROY POLYMERS LIMITED/ Kisan GROUP OF COMPANIES /FINOLEX INDUSTRIES</td>
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<tr>
<td>15</td>
<td>C.I. CLASS LA PIPES</td>
<td>KESORMA SPUN PIPE &amp; FOUNDRIES, CALCUTTA/ SUPER ENTERPRISES/ INDIAN IRON &amp; CO. LTD. CALCUTTA.</td>
</tr>
<tr>
<td>16</td>
<td>R.C.C. PIPES</td>
<td>PRAGATI CONCRETE UDYOG/ K.K. SPUN PIPES/ J.K. SPUN PIPES/ SOOD &amp; SOOD</td>
</tr>
<tr>
<td>17</td>
<td>STONEWARE PIPES &amp; GULLY TRAP</td>
<td>DEVRAJ ANAND CERAMIC (P) LIMITED./ PERFECT POTTERI JABAL P (MP)/ BURN POTTERIES, JABALPUR</td>
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<tr>
<td>18</td>
<td>GUNMETAL VALVES (FULLWAY, CHECK, GLOBE AND NON RETURN VALVES)</td>
<td>LEADER VALVES LIMITED/ ARKAY SALSE CORPORATION DELHI</td>
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<tr>
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<td>Product Description</td>
<td>Supplier(s)</td>
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<tr>
<td>19</td>
<td>BALL VALVE</td>
<td>TBS ENGINEERS PVT. LTD. / VIRGO ENGINEERING LTD. / GOOJARMAL GANPATRAI / AUDCO INDIA LIMITED</td>
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<tr>
<td>20</td>
<td>BUTTERFLY VALVE (LEVER TYPE)</td>
<td>LEADER VALVES LIMITED / CASTLE VALVES LIMITED / AUDCO INDIA LIMITED</td>
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<tr>
<td>21</td>
<td>BUTTERFLY VALVE (GEAR TYPE)</td>
<td>LEADER VALVES LIMITED / CASTLE VALVES LIMITED / AUDCO INDIA LIMITED / GOOJARMAL GANPATRAI</td>
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<tr>
<td>22</td>
<td>C.I.DOUBLE FLANGED SLUICE VALVE &amp; GATE VALVES</td>
<td>KIRLOSKAR BROTHERS LIMITED / AARKO MANUFACTURING COMPANY / ARROW ENGG. LTD</td>
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<tr>
<td>23</td>
<td>FLOAT VALVE (GUNMETAL) UPTO 40M</td>
<td>SANT INDUSTRIAL CONTROLS (P) LIMITED / BOMBAY METAL &amp; ALLOYS / LEADER VALVES LIMITED</td>
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<tr>
<td>24</td>
<td>FLOAT VALVE (CI) 50M AND ABOVE</td>
<td>LEADER VALVES LIMITED / INDIAN VALVE CO. LTD.</td>
</tr>
<tr>
<td>25</td>
<td>FOOT VALVE / CHECK VALVES (BRASS)</td>
<td>LEADER VALVES LIMITED / INDIAN VALVE CO. LTD. CALCUTTA / ADVANCE VALVES (P) LIMITED / GOOJARMAL GANPATRAI / AARKO MANUFACTURING COMPANY</td>
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<tr>
<td>26</td>
<td>AIR RELEASE VALVES (BRASS / CAST IRON)</td>
<td>LEADER VALVES LIMITED / ADVANCE VALVES (P) LIMITED / AARKO MANUFACTURING COMPANY / GOOJARMAL GANPATRAI</td>
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<tr>
<td>27</td>
<td>C.I. MANHOLES COVER &amp; G.I. GRATING</td>
<td>K. K. MANHOLE &amp; GRATING CO. PRIVATE LIMITED / BANGLAL IRON COMPANY WEST BANGLAL / SHINING ENGINEERING WORKS (FOUNDRY) AGRA.</td>
</tr>
<tr>
<td>28</td>
<td>HAND DRIER (304 Grade S.S.)</td>
<td>THE VEERA TRADING COMPANY / KOPAL ENGG. CORPN. NEW DELHI / ASKON ENGINEERS BOMBAY</td>
</tr>
<tr>
<td>29</td>
<td>LIQUID SOAP DISPENSER (304 Grade S.S.)</td>
<td>THE VEERA TRADING COMPANY / ASKON ENGINEERS BOMBAY</td>
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<td>30</td>
<td>STORAGE TYPE WATER HEATER</td>
<td>VENUS / RACOLD/BAJAJ OR EQUIVALENT</td>
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<td>31</td>
<td>INSULATION</td>
<td>THERMAFLEX OR EQUIVALENT</td>
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<tr>
<td>32</td>
<td>SOLAR HOT WATER EQUIPMENT</td>
<td>TATA -BP / SOLAHART</td>
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<td>33</td>
<td>ELECTRICAL HOT WATER HEATER</td>
<td>VENUS / KINGSTON</td>
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<td>34</td>
<td>PVC FOOT REST &amp;SFRC COVERS</td>
<td>KK MANHOLES OR EQUIVALENT</td>
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**FIRE FIGHTING SYSTEM**

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<th>Product Description</th>
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<td>1</td>
<td>ELECTRIC DRIVEN MOTOR AND PUMPS</td>
<td>GRUNDFOS / MATHER PLATT / EBARA / WILO / EMU / DP</td>
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<td>2</td>
<td>ELECTRIC DRIVEN MOTOR AND PUMPS (INDIAN STANDARD)</td>
<td>GRUNDFOS / MATHER PLATT / EBARA / WILO / EMU / DP</td>
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<td>3</td>
<td>DIESEL ENGINE</td>
<td>KIRLOSKAR / ASHOK LEYLAND / CUMMINS</td>
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<td>4</td>
<td>G.I. AND M.S. PIPES</td>
<td>TATA / JINDAL HISAR / PRAKASH</td>
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<td>5</td>
<td>FIRE HOSE PIPES / R R.L. HOSE PIPE</td>
<td>NEWAGE / CRC / PADMINI / G. TECH / INDIAN RAYON. / SUPEREME</td>
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<tr>
<td></td>
<td><strong>FIRST AID FIRE HOSE REEL WITH BRACKET, DRUM AND NOZZLE</strong></td>
<td><strong>JYOTI / TIGER / PADMINI</strong></td>
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<td>7</td>
<td><strong>G.I. AND M.S. FITTINGS</strong></td>
<td><strong>R / KS / UNIK / DRP / ZOLOTO</strong></td>
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<td>8</td>
<td><strong>C.I.DOUBLE FLANGED SLUICE / GATE VALVE / NON-RETURN VALVES</strong></td>
<td><strong>H.SARKAR / KIRLOSKAR / SANT / LEADER / KALPANA / KARTAR</strong></td>
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<td>9</td>
<td><strong>SLIM SEAL BUTTERFLY VALVES (PN-1.6)</strong></td>
<td><strong>AUDCO / SANT / C&amp;R / KSB / INTERVALVE / CASTLE / ARROW</strong></td>
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<td>10</td>
<td><strong>C. I. BODY BUTTERFLY VALVE</strong></td>
<td><strong>AUDCO / SANT / INTERVALVE / CASTLE / ARROW / DANFOSS</strong></td>
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<td>11</td>
<td><strong>GUN METAL BODY BUTTERFLY VALVE</strong></td>
<td><strong>AUDCO / SANT / INTERVALVE / CASTLE / ARROW / DANFOSS</strong></td>
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<td>12</td>
<td><strong>ALARM GONG</strong></td>
<td><strong>HD OR EQUIVALENT</strong></td>
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<td><strong>QB. SPRINKLER</strong></td>
<td><strong>TYCO / GRINNEL / KIDDE / CENTRAL / GTECH</strong></td>
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<tr>
<td>14</td>
<td><strong>WRAPPING AND COATING</strong></td>
<td><strong>PYPECOAT / RUSTECH / COALTEK</strong></td>
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<tr>
<td>15</td>
<td><strong>FABRICATED FIRE HOSE CABINET</strong></td>
<td><strong>STEEAGE / NEWAGE / G. TECH</strong></td>
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<tr>
<td>16</td>
<td><strong>BRANCH PIPE / NOZZLES (GUN METAL / BRASS / COPPER &amp; BRASS / ALUMINIUM)</strong></td>
<td><strong>MINMAX / NEWAGE / G. TECH</strong></td>
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<td>17</td>
<td><strong>FIRE EXTINGUISHERS</strong></td>
<td><strong>MINIMAX / NEWAGE / G. TECH</strong></td>
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<td>18</td>
<td><strong>FIRE BRIGADE CONNECTION</strong></td>
<td><strong>NEWAGE / MINIMAX / G. TECH / SUPEREX</strong></td>
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<td>19</td>
<td><strong>SUCTION STRAINER</strong></td>
<td><strong>JATPEE / GRANDPRIT / DASHMESH</strong></td>
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<td><strong>VIBRATION ELIMINATOR CONNECTORS</strong></td>
<td><strong>RESISTOFLEX / KHANWAL / D. WREN</strong></td>
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<td>21</td>
<td><strong>SINGLE PHASING PREVENTOR (CURRENT OPERATED)</strong></td>
<td><strong>L &amp; T / SIEMENS / MINILEC</strong></td>
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<tr>
<td>22</td>
<td><strong>FLOW METER</strong></td>
<td><strong>SCIENTIFIC EQUIPMENT. (P) LTD. SHALI BANDA HYDRABAD – 500263</strong></td>
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<tr>
<td>23</td>
<td><strong>ELECTRICAL SWITCHGEAR &amp; STARTERS</strong></td>
<td><strong>SIEMENS / L &amp; T / ABB</strong></td>
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<tr>
<td>24</td>
<td><strong>CABLES</strong></td>
<td><strong>SKYTONE / GLOSTER / NICCO / ASIAN / (RPG) UNIVERSAL / POLY CAB</strong></td>
</tr>
<tr>
<td>25</td>
<td><strong>FLOW SWITCH</strong></td>
<td><strong>POTTER / SYSTEM SENSOR / JHONSON CONTROL</strong></td>
</tr>
<tr>
<td>26</td>
<td><strong>MAIN CONTROL PANEL (POWDER COATED)</strong></td>
<td><strong>SPC ELECTROTECH/ABB/SCHNEIDER/EATON</strong></td>
</tr>
<tr>
<td>27</td>
<td><strong>PRESSURE SWITCHES</strong></td>
<td><strong>INDFOSS / SWITZER</strong></td>
</tr>
<tr>
<td>28</td>
<td><strong>PRESSURE GAUGE</strong></td>
<td><strong>H.GURU / FIEBIG</strong></td>
</tr>
<tr>
<td>29</td>
<td><strong>BATTERY</strong></td>
<td><strong>EXIDE / PRESTOLITE</strong></td>
</tr>
<tr>
<td>30</td>
<td><strong>PAINT ENAMEL OF PIPES ETC.</strong></td>
<td><strong>J&amp;N / ASIAN / NEROLAC / BERGER</strong></td>
</tr>
<tr>
<td>31</td>
<td><strong>ANNUNCIATION PANEL FOR SPRINKLER SYSTEM</strong></td>
<td><strong>PCD / SAFEWAY / AGNI (INDIA)</strong></td>
</tr>
<tr>
<td>32</td>
<td><strong>ALARM VALVE &amp; HYDRAULIC ALARM MOTOR WITH COVERING</strong></td>
<td><strong>MATHER &amp; PLATT / HD</strong></td>
</tr>
<tr>
<td>33</td>
<td><strong>CONTACTOR</strong></td>
<td><strong>L&amp;T / SIEMENS / SCHNEIDE / GE / ABB</strong></td>
</tr>
<tr>
<td>34</td>
<td><strong>THIMBLES / FERRULES (TINNED COPPER)</strong></td>
<td><strong>DOWEL OR EQUIVALENT</strong></td>
</tr>
<tr>
<td>35</td>
<td><strong>CABLE GLANDS</strong></td>
<td><strong>COMMEX / POWER / GRIPWELL</strong></td>
</tr>
<tr>
<td>No.</td>
<td>Item Description</td>
<td>Approved Makers</td>
</tr>
<tr>
<td>-----</td>
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<td>----------------------------------</td>
</tr>
<tr>
<td>36</td>
<td>POWER CAPACITOR</td>
<td>L&amp;T / CROMPTON / ASIAN / DUCATTI</td>
</tr>
<tr>
<td>37</td>
<td>MEASURING METER (DIGITAL)</td>
<td>L&amp;T / SIEMENS / AE / ENERCON</td>
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<tr>
<td>38</td>
<td>DASH FASTENER</td>
<td>HILTI / FISHER</td>
</tr>
<tr>
<td>39</td>
<td>PAINT PRIMERS</td>
<td>ASIAN / JENSON NICHOLSON</td>
</tr>
<tr>
<td>40</td>
<td>WELDING ELECTRODES</td>
<td>ADVANI / ESAB / VICTOR</td>
</tr>
<tr>
<td>41</td>
<td>PIPE HANGERS</td>
<td>CHILLY / GMGR</td>
</tr>
<tr>
<td>42</td>
<td>MCB, DBs</td>
<td>MDS / LEGRAND / SPC ELECTROTECH</td>
</tr>
</tbody>
</table>

Note: Contractors have to take approval from Engineer in charge / Consultants before placing of order of any required materials from the above mentioned approved makes. If any required materials (as per BOQ / Extra items) not available in above list Engineer in charge / Consultants can add the make / Brand in list at any stage, decision will be final and binding on contractors. If any doubt about listed makes / Brand Engineer in charge may amend the list at any stage, decision will be final and binding on contractors.