AN ISO 9001 & 14001 COMPANY

TENDER DOCUMENT

TENDER No: DLI/ CON/ ITBP/ 522

FOR

‘Construction of 105 nos. Residential Quarters (Type-II/56, Type-III/40, Type-IV/08 & Type-V/01) at 29th Battalion, ITBP, Jabalpur, MP.’

VOLUME – II

ADDITIONAL CONDITIONS OF CONTRACT, TECHNICAL SPECIFICATIONS & 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 105 nos. Residential Quarters (Type-II/56, Type-III/40, Type-IV/08 & Type-V/01) at 29th Battalion, ITBP, Jabalpur, MP”.

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 105 nos. Residential Quarters (Type-II/56, Type-III/40, Type-IV/08 & Type-V/01) at 29th Battalion, ITBP, Jabalpur, MP.

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 29th Battalion, ITBP, Jabalpur, MP.

SCOPE OF WORK

The brief scope of work included in this tender shall include (but not limited to) Civil, Structural, Sanitary & Sewerage, Electrical Works for Construction of 105 nos. Residential Quarters (Type-II/56, Type-III/40, Type-IV/08 & Type-V/01) at 29th Battalion, ITBP, Jabalpur, MP. 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 (NIT)

b) Instructions to tenderer General Conditions of Contract, Addendum to GCC, Addendum to ITT, Form of tender, Letter of Undertaking, Memorandum (Volume-I)

c) Additional Conditions of Contract (ACC), bidders information, Technical specification, Drawing (Volume-II)

d) Bill of Quantities (Price Bid) (Volume-III)

5) 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>3 months</td>
</tr>
<tr>
<td>2</td>
<td>RCC framed structure</td>
<td>7 months</td>
</tr>
<tr>
<td>3</td>
<td>Misc, finishing work like cement Plaster, flooring, painting electrical work etc..i/c handing over.</td>
<td>3 months</td>
</tr>
<tr>
<td>4</td>
<td>External Development &amp; Bulk Services (Civil &amp; Electrical)</td>
<td>2 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>3 Months</td>
<td>25%</td>
</tr>
<tr>
<td>2</td>
<td>7 Months</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>3 Months</td>
<td>75%</td>
</tr>
<tr>
<td>4</td>
<td>2 Months</td>
<td>100%</td>
</tr>
</tbody>
</table>

6) 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.

7) 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.

8) 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.

9) 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

10) 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.

11) 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.

12) 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, EPIIL shall provide the same and necessary expenditure shall be deducted from the bills for documents.

13) 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.

14) 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.

15) 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.
16) **WITNESSING OF TESTS BY THE ENGINEER-IN-CHARGE**

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.

17) **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.

18) 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.

19) 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.
20) **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 plants & machinery shall be deployed at site.

1) Batching plant -1 Nos
2) Water tanker - 4 Nos
3) Weigh batcher mixture machine - 4 nos.
4) Earth rammer - 4 nos.
5) Excavator - 2 nos
6) Dumper - 4 nos.
7) Tractor with trolley - 5 nos.
8) De-water pump - 2 nos.
9) Vibrator - 10 nos.
10) Vibrator breaker
11) Megger - 1000 V, for measuring of 3000 M Ohms - 1 no.
12) Crimping tool - 1 no.
13) Tong tester - 1 no.
14) Multimeter - 1 no.

21) **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 contactor at his own cost. The following minimum laboratory equipments shall be set up at site office laboratory:

(i) Cube testing machine : 1 No.
(ii) Slump Cone : 3 Nos.
(iii) Tensile Briquette testing machine : 1 No.
(iv) Vicats apparatus : 1 No.
(v) Moisture Meter : 1 No.
(vi) Megger & earth resistance tester : 1 No.
(vii) Pumps and pressure gauges for hydraulic testing : 1 No.
(viii) Drying Oven : 1 No.
(ix) Weighing scale with pan type weight : 2 Nos.
(x) Graduated glass cylinder : 6 Nos.
(xi) Sets of sieves for coarse aggregate [40; 20; 10; 4.75mm] : 2 Nos.
(xii) Sets of sieves for fine aggregate [4.75; 2.36; 1.18; 0.600; 0.300 & 0.150 micron] : 2 Nos.
(xii) Core cutter for soil compaction with accessories : 1 No.
(xiii) Cube Moulds 15 x 15 x 15cm : 18 Nos.
(xiv) Smoke Test Equipments : 1 Nos.
(xv) Efflorescence Test Tray : 2 Nos.
(xvi) Multimeter : 1 Nos.
(xvii) Vernier Callipers - Digital Type : 2 Nos.
(xviii) Screw Gauge - Digital Type : 2 Nos.
(xv) Any other equipment for site tests as outlined in BIS and as directed by the Engineer-in-charge.
(xvi) Tong Tester : 1 No.

22) 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.

23) 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.
24) **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.

25) **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.
26) MOBILIZATION ADVANCE:

Mobilization Advance up to a maximum amount as mentioned in the "MEMORANDUM" to the "Form of Tender" i.e. 10% of contract value shall be paid to the contractor on submission of non-revocable and unconditional Bank Guarantee for an amount equal to 110% of the Mobilization advance from a Nationalized Bank/Scheduled Bank as per the enclosed proforma after signing of agreement.

The mobilization advance shall be paid as per clause no.8.00 of GCC

27) 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.

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

29) 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.

30) 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.

31) 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.

32) 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.

33) 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.

34) The contractor shall engage a specialized agency for execution of, lift 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.

35) 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.

36) 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.

37) 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 + 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 + 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.

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

39) 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.

40) 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.

41) 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.

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

43) 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.
44) 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.

45) 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.

46) 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.

47) 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.

48) Payments for the work done shall be released to Contractor within Fifteen working days of receipt of RA Bill duly certified by EPI's representative including mobilization advance and secured advance etc. and after deducting recoveries if any. Recovery / Adjustment of the Mobilization advance and secured advance shall be as per the terms of contract / CPWD norms.

The final bill payment to the Contractor shall be released 30 days after receipt of corresponding payment from client and after submitting Sales Tax clearance certificates, EPF clearance certificate, all other clearances, approvals, certificates etc. as per agreement for the "Works" and as per statutory requirement.

All payments including RA bills, Final bills be made to the contractor upon received of correspondence payment received from client.

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 to this work, however in case any crisis for OPC cement, the party shall submit the documentary proof in support in such case the difference of cost of OPC and PPC cement shall be recovered from the party.
Annexure - I

**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>
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<tbody>
<tr>
<td>A) OFFICE ACCOMMODATION</td>
</tr>
<tr>
<td>Furnished Office accommodation at one or more locations 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>
</tr>
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<tr>
<th>DESCRIPTION</th>
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<tr>
<td>B) FURNITURE OF TOTAL VALUE</td>
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<tr>
<td>Rs. 40,000/-</td>
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<thead>
<tr>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>C) OFFICE EQUIPMENT</td>
</tr>
<tr>
<td>a) Fax machine</td>
</tr>
<tr>
<td>b) Computer (Latest version, Windows 8.1) with minimum 500 GB HDD along With UPS &amp; Operator (In case Computer Operator is not provided by the PARTY, recovery of Rs. 8000/- per month / per computer shall be made from the PARTY’s bills in this regard) and Latest version of Software like MS Project, MS Office etc.</td>
</tr>
<tr>
<td>c) Laser or any other Printer of equiv. Amount of A3 size</td>
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<tr>
<td>d) Internet Facilities (If available in location of Site)</td>
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</table>
**e) Refrigerator (180 ltr.) or any other gadget of equivalent cost as decided by EPI**

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**f) Air Conditioner with cooling & heating (1.5Ton Capacity)**

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**g) RO (Drinking Water) or any other gadget of equivalent cost as decided by EPI**

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**h) Photocopy Machine ((CANON NP 3050 or equivalent model) or any other gadget of equivalent cost as decided by EPI**

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**i) Digital Camera of 10.1 pixel**

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</table>

**D) CONSUMABLES**

- **a)** All consumables like Stationary, ink etc. shall be provided by PARTY till end of defect liability period. (Stationary items are inclusive of visiting cards, rubber stamps, letter pads, photocopies, photocopy papers & other items of daily office use). Amount shall be restricted to: Rs. 3000/- per month

- **b)** Running & Maintenance of the equipment mentioned above are to be done by the PARTY at his own cost. As per Actual

**E) TELEPHONE WITH STD FACILITY AND INSTRUMENT**

- **a)** Office Telephone (Fixed Line) 1 No.

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- **b)** Mobile Phone 2 Nos.

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<tbody>
<tr>
<td></td>
<td>2 Nos.</td>
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</tbody>
</table>

Monthly operational expenditure on account of all telephones shall be restricted to: Rs. 4,500/- per Month

The cost of each Mobile Phone Instrument shall be restricted to Rs 6, 000/-

**F) VEHICLE (Brand New)**

Brand New Four wheel drive Scorpio DX vehicle or equivalent with Driver and accessories valuing Rs. 40,000/- each vehicle

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Monthly running shall be restricted to 3000 Kms. (each vehicle)

**G) OFFICE BOY CUM COOK** on Full time basis for EPI

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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)’ 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.
PARTICULAR SPECIFICATIONS

CIVIL WORKS

General: The work shall be carried out strictly in accordance with particular specifications and drawings. The drawings, specifications BOQ etc. shall be taken complementary and also supplementary to each other and shall form part this contract. Any work or material shown on drawings and not specifically included in BOQ/specification or vice versa shall be executed and deemed to be included in the scope of work of Item rate. **However, the steel for reinforcement work shall be TMT-BARS of Fe-500.**

In case there are no specifications for items shown on the drawings or where items are not exhaustively described, the general specifications of CPWD shall be followed for which nothing extra shall be paid. In case, no details are available even in CPWD specification, then decision of owner/EPIL is final & binding on the contractor.

Scope of works: The scope of work for buildings under this contract includes for full & final and entire completion of all works including all internal and external services in all respects described in particular specification and as shown on drawings forming part of the contract.

Although all the details of construction have been by and large covered in these documents, any item or details of construction not specifically covered but obviously implied and essential to consider Civil works and all internal and external services complete and functional, shall be deemed to have been covered in the rates quoted. The cost of external development works pertaining to a particular contract shall also be carried out on a final lump sum price based on the rates quoted for each item. The tenderer may however, consider a minimum level of specifications conforming to IS code or National Building Code to cover any missing details.

Sample of Materials: The Contractor shall produce samples of all materials and shall obtain approval of these in writing from Architect/ Project Engineer before he places bulk order for the materials for incorporation in the works. The samples must be produced atleast six week before they are to be incorporated in sample dwelling units. Materials to be incorporated in the work shall conform to latest relevant ISI. The items should be ISI marked where manufactured.

Slopes: Adequate slope shall be provided in areas where there is likelihood of ingress of water such as toilets, balconies, verandah, kitchens, terraces, top of chajjas, window cills, plinth protections etc. though these may not be expressly shown in drawings.

Curing: Exposed surfaces of all cement works viz. cement concrete, brick work, flooring, plastering, pointing and the like shall be cured by keeping the surface adequately and continuously wet as directed by Architect and Project Engineer for at least seven days where ordinary portland cement has been used.
TECHNICAL SPECIFICATIONS

NON-SCHEDULE ITEMS

Earth for Filling

The earth used for filling shall be free from salts, organic or other deteriorous matter. Highly expansive soils like black cotton soil shall not be used, unless so specified. All clods of earth exceeding 50mm shall be broken or removed. Earth obtained from borrow pits and surplus earth from excavation, if any, shall be directly used for filling and avoid double handling.

Flush shutters for doors & cupboards:

Flush shutter for doors & cupboards shutters shall be solid core types with block board core as indicated in Bill of Quantity and shall conform to IS-2202 and ISI marked with blockboard (conforming to the requirements as per IS-1659 -1969 with frame of 1st class Hardwood and well matched commercial 3 ply veneering with vertical grains or cross bands and both faces decorative lamination 1mm thick.

Ceramic Designer (Highlighter) Tiles

Ceramic Designer tiles of 1st Quality conforming to IS-15622 (thickness to be specified by the manufacturer) & of approved make/colour as approved by the Project Manager/Architect having compressive strength of 350kg/cm sq., water absorption 10% maximum by weight and Abrasion resistance 2mm average,2.5mm individual specimen. Dimensional tolerance maximum 1mm.

a. Laying instructions for Floor:

Prepare base mortar with cement and sand in the ration of 1:4

Set the levels for floor (i.e dead level or slope as specified by the Project Engineer/Architect ).

Prepare cement slurry i.e mixture of cement and water to form a thick paste and spread it on the levelled base mortar.

Wet the backside of the tile with water. Complete immersion of tile in water is not required.

If tiles are square or rectangular in shape, set the right angles for the area and place the first tile along the right angle line and place it in on base mortar .Tap gently only with a rubber or wooden mallet to obtain perfect levels.

Clean the surface of the tile with clean water immediately after laying with wet sponge. Ensure that the base mortar cement which squeezes through the joints, does not settle on the tile. Also ensure that the water used is not hard of brackish.

Do not use the area laid for at least 24 hours.

Fill in the joints with pointing material which is mixture of white cement and desired colour pigment. For higher quality of finishes, you could use. If required, a polymer based cementitious tilling joint filler like Roffe rainbow. To get the desired colour/shade. Mix the same with water to form a smooth paste which should be applied to the joints, preferably with the use of rubber squeeze or rubber sheet. Donot apply the pointing material all over the surface.

Allow pointing material to set for 15 minutes and then clean the surface of the tile with a clean wet sponge, removing the excess pigment on tile surface.
Wash the surface with soap water or mild detergent to obtain a clean surface and wipe it.

b. Laying instruction for walls

1. Plaster the surface to be tiles with mortar (Cement and sand in the ration of 1:3)
2. Prepare cement mortar i.e mixture of cement sand and water to form a thick past and spread it on the back side of the tile after wetting the tile with sponge.
3. Instructions given for Floor (Nos 4,5,6,7,8,9,10 above) should be followed.

c. Desired site conditions for laying of Ceramic Designer Tiles

The following works are to be completed prior to commencing laying of Ceramic Designer Tiles.

- Final painting of ceiling in rooms.
- Two coats of wall painting in all rooms (the final painting should be done only after laying of floor tile).
- Wiring and Fixing of all electrical components.
- Plumbing work.
- Fixing of grills for windows.
- Fixing and Polishing of windows/windows frames /door frames and doors.
- Bathrooms floor and wall tiles should be laid after all the work in the bathroom is completed.
- Fixing of wall and platform slabs.

If mosaic/marble/any other natural stone which needs machining and polishing is being used in any other part of the floor, it is necessary that this work be completed before commencing the laying of Ultra Tiles.

If all the above precautions are taken and the instructions followed, your Ultra Tiles will give you decades of trouble-free services.

4. Chicken Wire Mesh:

Chicken Wire Mesh shall be of galvanized mild steel wire cloth conforming for IS 1568-1970. Wire Cloth shall be regularly woven wire with a number of equally spaced parallel wire in both warp and weft direction for produce uniformly openings. The wire cloth shall be properly selvedge by one or more wires in each edge.

5. Antitermite Treatment

Chemical Chlorpyriphos /Lindane emulsifiable concentrate 20% conforming to relevant IS specification in water emulsion shall be applied uniformly at the prescribed rate in all stages of treatment. Concentration of the chemical as emulsifiable concentrate is indicated on the sealed containers. For obtaining the specified concentration. Chemical shall be diluted with water in the required ‘quantity before it is used. Graduated containers shall be used for the dilution of the chemical.

6. ACOUSTICAL SUSPENDED CEILING SYSTEM

Mineral Fibre acoustical suspended ceiling system with Fire Fissured Tiles having MICRO LOOK XL 15MM in modules size of 600mm x 600mm x 15mm with B10 Block Casting laid on grid system of hot dipped galvanised steel suspension system with 15mm wide T-Section
Flanges colour white having rotary stitching on the main runners spaced at 1200mm & 600mm cross tees fixed to the soffit by approved hangers [G.I wire 4.0mm dia] at 1200mm max. centre all as per nomenclature.

**INSTALLATION:**
To comprise main runner spaced at 1200mm centres securely fixed to the structural soffit using suspension system (specifications below) at 1200mm maximum centre. The First/Last suspension system at the end of each main runner should not be greater than 450mm from the adjacent wall.
Flush fitting 1200mm long cross tees to be interlocked between main runners at 600mm centre to form 1200 x 600 mm module. Perimeter trim wall angles of size 3000x19x19mm, secured to walls at 450 mm maximum centres.

7. **STRUCTURAL GLAZING**
Structural glazing at Façade of ground plus three buildings using glazing section on direct stick mullion & transom system of which mullion shall be of 80x50x.8 mm with notch & transom to be of 50x50x1.8 mm with notch, Aluminum Glazing sections shall be powder coated with heat treatment on three surfaces in Ivory/Black colour using 6mm thick SSG EVO Star ET 425 AURA GREEN HEAT REFLECTIVE GLASS ULT -24%, Solar Factor – 0.25% and U-Value-3.72 W Sq.M of approved colour of Make Saint Gobain to be pasted with 12mm x 6 mm both side adhesive Spacer foam tape & structural silicon of Dow Corning 995 grade or it's equivalent.
The Weather /water sealing of glass joints shall be done with 10 mm wide Dow Corning make weather sealant of grade 789 or its equivalent. The Mullion of Aluminum structure is to be fastened with R.C.C. Slab/beam with help of Powder coated/ Galvanized MS Brackets of 75 mm length with help of M10 x 100 mm Mechanical tempered Dash Fasteners. The job Includes all necessary hardware, cleat, Screws, nut washers etc. Complete job with as per direction of Engineer-in-charge and the job should be water tight.

8. **ALUMINIUM WORK**
A) **ALUMINIUM GRILL**
Anodized Aluminium Grill of 7.5 mm thick of approved pattern (Pan type) (minimum thickness of powder coating 50 microns) shall be fixed as per manufacturer instructions.

B) **ALUMINIUM DOORS, WINDOWS AND VENTILATORS:**
Aluminium work for doors, windows, ventilators and partitions with extruded built up standard tubular and other sections of approved make conforming to IS: 733 and IS : 1285, fixed with rawl plugs and screws or with fixing clips, or with expansion hold fastners including necessary filling up of gaps at junctions, at top, bottom and sides with required PVC/neoprene felt etc. Aluminium sections shall be smooth, rust free, straight, mitered and jointed mechanically wherever required including cleat angle. Aluminium snap beading for glazing / paneling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing and paneling to be paid for separately).
Powder coated aluminium (minimum thickness of powder coating 50 micron).

All Sections of Aluminium work being used in the work will be Powder coated minimum thickness of powder coating 50 micron

Codes and Standards:
The Codes and standards generally applicable to the work of this section are listed herein under:

IS: 733 Wrought aluminium and aluminium alloy bars, rods and sections (for general engineering purpose).
IS: 1285 Wrought aluminium and aluminium alloy extruded round tube and hollow sections (for general engineering purpose).
IS: 1362 Dimension for screw thread for general purpose.
IS:1761 Transparent sheet glass for glazing and framing purposes.
IS:1948 Aluminium doors, window and ventilators.
IS:1949 Aluminium windows for industrial buildings.

The following clauses are intended to amplify the requirements of the references/documents listed above and the contractor shall comply with these clauses.

**SAMPLES AND SHOP DRAWINGS**

All aluminium doors, windows and ventilators shall be furnished by an approved manufacturer and shall be conforming to IS:1948. Before placing their order, the contractor shall submit shop drawings and samples for the approval of the Engineer. If required, the contractor shall also submit the necessary engineering calculations. Shop drawings shall clearly show all work including mechanical systems, the arrangement of components, the sequence and details of fabrications, assembly and erection. These drawings shall also give full size details, all dimensions and thickness anchoring devices and accessories.

**TOUGHENED GLASS**

**GENERAL**

Toughened glass is 4 to 5 times stronger than its equivalent thickness of normal annealed float of sheet glass. It offers great resistance to sudden temperature changes and sudden impacts. Toughening, which shall be carried out horizontally (without tong-marks), shall conform to ASTM 1048.

All works such as cutting, grounding, drilling etc. On glass shall be carried out prior to toughening. Once tempering is done, no work will be allowed on the glass.

SGG(SAINT GOBIN GLASS) Antelio-Plus is an advanced solar control glass that is manufactured by depositing layers of metallic nitrides on to clear or body tinted float glass by magnetically enhanced cathodic sputtering under vacuum conditions.

SGG Antelio-Plus is manufactured to meet the most exacting standards in order to deliver high performance with ease in processing.

SGG Antelio-Plus is versatile and satisfies several designer criteria including solar control (to reduce the cooling cost) and optimum light transmittance (to reduce glare).

Glass Application- Façade Glazing

**SPECIFICATION**

<table>
<thead>
<tr>
<th>Performance</th>
<th>SGG Antelio Plus Blue Green ST 450</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass Name</td>
<td></td>
</tr>
<tr>
<td>Processing</td>
<td>Single Glazed Toughened</td>
</tr>
<tr>
<td>Light Transmission/LT</td>
<td>42</td>
</tr>
<tr>
<td>Reflection External %</td>
<td>0.14</td>
</tr>
<tr>
<td>Reflection Internal</td>
<td>0.16</td>
</tr>
<tr>
<td>UV %</td>
<td>10</td>
</tr>
<tr>
<td>Solar Factor</td>
<td>0.41</td>
</tr>
<tr>
<td>Shading Coefficient</td>
<td>0.48</td>
</tr>
<tr>
<td>Relative Heat Gain W/sqm K</td>
<td>5.67</td>
</tr>
</tbody>
</table>

Values in accordance with ISO 9050
Values have been certified by the Institute of Solar Energie of Farunhofer Corporation

**PATCH FITTING GLASS DOOR**

Patch Fitting Glass door Cum Fixed window with 12mm thick toughened glass and PSS/SSS finish of Dorman equivalent make approved make as per manufacturer's/ drawing and as approved by Architect/ Engineer-in-charge.
11. SURFACE TEXTURE PAINT

Application Process/Methology

Acrylic Primer (Duracoat) added with water 1:1 ratio and than applied with Roller and Brush. The purpose of pure acrylic primer is to reduce the absorption of the plaster, act as a water proof agent and highlight the repairs.
Minor Repair check or a coat (As required) With Exterior grade Putty.
One Coat of Duracoat with spray & Pressed (As a base Coat),
Two coats of Pure acrylic emulsion, Ultrashield in desired shade.

The above product has salient features:

- Anti Fungal
- Breaths out trapped moisture
- Flexibility and elasticity
- Long shade Life
- Dust Repellent
- Water Repellant

ALUMINIUM COATED METAL SHEET ROOFING

LYZAC High Rib Baregal volume 0.5mm thick zink Aluminium coated metal roofing sheet in longest joint system to be fixed with hilti make shelf. Drilling and topping screen with EPDM metal bonded washer including all flashing & ceiling joints with silicon/epoxy as directed by Engineer-in-charge.

13. WOODEN FLOORING

Wooden flooring of 25mm thick with pre laminated flat pressed three layer Engineered Hard Wood Flooring on Stage exterior grade including edge profiles as may be required in desired shape and size of approved colour and texture including front cladding of stage riser laid over leveled floor surfaces as per manufacturer’s instructions.

STAINLESS STEEL BUILDERS HARDWARE FITTINGS/ FIXTURES

Builder’s Hardware such as sliding Door Bolts, Tower Bolts Handles, Door Stopper shall be of stainless Matt finish fixed with necessary screws etc. complete.

VITRIFIED TILE FLOORING

Vitrified Tiles 200/300x200x10mm thick of Décor Series as shown on drawings of Johnson make or equivalent of any other makes as mentioned in Appx “A” of makes here in before shall be provided at locations indicated. The tiles shall be fixed with adhesive “FAIR FIX” STP laid on 20mm thick CM 1:4 [1cement: 4 coarse sand] including pointing the joints with White cement and matching pigment etc. complete.

STAINLESS STEEL RAILING

Stainless Steel Railing of SS 304 grade railing made of 38mm baluster and 38mm top rail of 1.6mm thickness with 3 mid rails of 12 OD tube connected with CNC machine made. Modular connectors fixed with dash fastners. All as per manufacturer’s specification.

STAINLESS STEEL RAILING WITH TOUGHENED GLASS

Stainless Steel Railing with ozone Baluster Model - OZ-BF-SS-44 Stainless Steel 304 grade in 1.6 mm thickness made of CNC components and modular system accessories along with SS Grade 304 Pipe Top Rail - 50 mm of 1.6 MM THICK NESS IN Matt Finish along with 2 Nos. Glass Holders OZ-BF-SS-ACC-GH-22 on each Baluster which are to be installed with C2C distance of 1mt. and 10mm Toughened Glass of 600 ht. with required holes fixed all as per manufactured instructions.
CRYSTALLINE BASED WATER PROOFING TREATMENT

Cementitious crystalline based waterproofing treatment for concrete wall and flooring with krystal T1 system. The application to be done from +ve (positive) side on a wet open pore concrete surface with brush @ 1 kg/sqm. In accordance with manufacturer's specification, drawing and directed by project Manager.

DRAPERY RODS.

Drapery rods 30mm dia of M.S Pipe of thickness 1.6mm with powder coating (wooden finish) including metal brackets, rings and ends all as specified. Fixed to brick walls/RCC lintels with dash fasteners.

MULTICELL POLYCARBONATE SHEET ROOFING

16mm thick multicell polycarbonate sheet (with minimum1040mm wide) with standing seam on both sides & double tooth snap on locking system to ensure maximum uplift capability. The panels will be UV protected and antiglare/softlight. The cross section of one cell should not be more than 4mmX4mm & weight of single panel shall not be less than 3250 per square metre. The system will be fitted on purlins with spacing as specified by manufacturer.

ALUMINIUM COMPOSITE PANELS

Fabricating and fixing in position wall cladding with 4mm thick (0.5mm +3.0mm + 0.5mm) with virgin polyethylene core, belonging to the 3xxx H24 Alloy series, 0.5mm aluminium skins (Front side: stove lacquered, PVDF quality with peel-off protective film - back side: wash coat without peel-off protective film, composite panels of Alucobond make as detailed in structural and architectural concept drawings and approved in shop drawing; aluminium cladding to be of sizes and panels as per conceptual Architectural drawings and finished in approved shade and colour, including required fixtures and fittings anchor fasteners and sealing with approved silicon sealant, finishing junctions with steel, concrete, stone, timber, aluminium, glass, MS structural steel all complete. Further include required preparation of shop drawings with structural consultants, providing samples, mockups, taking actual site measurements and modifying and coordinating with site and (Measurement and payment shall be made on the actual finished area).

EXTERIOR WOOD HIGH PRESSURE LAMINATE WALL CLADDING

Reznoclad HPL Panel for Exterior or equivalent, Exterior Decorative Panels meeting European norm compliance of CE mark having standard dimensions of 3050mm x 1300 x 6mm, to be installed on aluminium framework using matching-colour coated rivets complete as per the manufacturer's specification. Aluminium tube 75/50/38x25x1.6mm to be fixed on 'L' clamps in only vertical directions should be fixed in interval on max 600mm. Panels cut to size to be fixed on aluminium tube along with rivets, leaving 6mm expansion joint between two panels in both horizontal and vertical direction. The product to conform to highest quality level meeting the following values / parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>a) Flexural Strength as per EN438-6/7</td>
<td>80 Mpa</td>
</tr>
<tr>
<td>b) Flexural modulus as per EN438-6/7</td>
<td>9000 Mpa</td>
</tr>
<tr>
<td>c) Tensile Strength as per EN438-2</td>
<td>60 Mpa</td>
</tr>
<tr>
<td>d) Resistance against wet conditions as per EN438-2</td>
<td>Rating 4</td>
</tr>
<tr>
<td>e) Flame reaction as per EN13501-1</td>
<td>B-s2-d0</td>
</tr>
<tr>
<td>f) Resistance against climatic conditions as per EN438-6</td>
<td>Contrast 3</td>
</tr>
<tr>
<td></td>
<td>Appearance 4</td>
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</table>
GENERAL:

The work shall be carried out in accordance with the drawings and design as would be issued to the Contractor by the Design Consultant duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications etc. not bearing Design Consultant signature and stamp. Similarly the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Client’s Representative in writing.

The work shall be executed and measured as per metric dimensions given in the Bill of Quantities, drawings etc.

The Contractor shall acquaint himself fully with the partial provisions for supports that may or may not be available in the structure and if are available then utilize them to the extent possible. In any case the Contractor shall provide all the supports regardless of provisions that they have been already made. Nothing extra shall be payable for situations where insert plates (for supports) are not available or are not useful.

Shop coats of paint that may be damaged during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with paint to match the finish over the adjoining shop painted surface.

The Contractor shall protect / handle the material carefully and if any damage occurred while handling by the Contractor then the sole responsibility shall be of the Contractor. Such damages shall be rectified/recovered by the Contractor at no extra cost whatsoever.

The Contractor shall, within twenty one (21) days of receipt of the Notice of Award for the Project, where applicable, complete the submission of shop drawings to the Client’s Representative for approval by the Design Consultants in order to conform to the contract schedule.

Preparation of shop drawings and approvals authorized body prior and after the execution of works as required.

This is the GMP contract, all the tenders should be sealed and the summary of quantities shall be based on Tender drawings, recheck and confirm. Nothing shall be paid extra to complete the work after the award of tenders. The vendor shall comply to all the documents of NBC/ IS/ TAC/ Local Fire Authority while quoting the tender.

Contractor to comply with the waste management plan (attached).

**Measurements:**

All measurements shall be taken in accordance with relevant IS codes, unless otherwise specified.

**APPLICABLE CODES AND STANDARDS:**

All equipment, supply, erection, testing and commissioning shall comply with the requirements of Indian Standards and code of practice given below as amended upto the date of submission of Tender. All equipment and material being supplied shall meet the requirements of BIS and other relevant standard and codes.

**Plumbing Works:**

<table>
<thead>
<tr>
<th>Item</th>
<th>IS Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitreous Chinaware</td>
<td>IS:2556 - 1974 (Part - I)</td>
</tr>
<tr>
<td></td>
<td>IS:2556 - 1981 (Part - II)</td>
</tr>
<tr>
<td></td>
<td>IS:2556 - 2556 (Part - III)</td>
</tr>
<tr>
<td>Ball Valve</td>
<td>IS:1703 - 1977</td>
</tr>
<tr>
<td>Cistern Brackets</td>
<td>IS: 775 - 1970</td>
</tr>
<tr>
<td>Toilet Seat Cover</td>
<td>IS:2548 - 1983</td>
</tr>
<tr>
<td>Vitreous China Cistern</td>
<td>IS:2326 - 1987</td>
</tr>
<tr>
<td>Sand Cast Iron Pipes and Fittings</td>
<td>IS:1729 - 1979</td>
</tr>
<tr>
<td>Spun Cast Iron Pipes and Fittings</td>
<td>IS:3989 - 1984</td>
</tr>
<tr>
<td>GI Pipes</td>
<td>IS:1239 - 1979</td>
</tr>
<tr>
<td>Galvanising for GI Pipes</td>
<td>IS:4736 - 1986</td>
</tr>
<tr>
<td>Pipe Threads</td>
<td>IS: 554 - 1985</td>
</tr>
<tr>
<td>Milleable Iron Fittings</td>
<td>IS:1879 - 1987</td>
</tr>
<tr>
<td>Cast Iron Sluice Valves</td>
<td>IS: 780 - 1984</td>
</tr>
<tr>
<td>Full Way Valves</td>
<td>IS: 778 - 1984</td>
</tr>
</tbody>
</table>
QUALITY ASSURANCE AND QUALITY CONTROL:

The work shall conform to high standard of design and workmanship, shall be structurally sound and aesthetically pleasing. Quality standards prescribed shall form the backbone for the quality assurance and quality control system. In case quality standard prescribed does not appear in the quality standard, it shall be taken & considered as per relevant BIS/International standard/Manufacturer standard.

At the site, the Contractor shall arrange the materials and their stacking/storage in appropriate manner to ensure the quality. Contractor shall provide equipment and manpower to test continuously the quality of material, assemblies etc. as directed by the Client’s Representative. The test shall be conducted continuously and the result of tests maintained. In addition the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of surface.

The Client’s Representative shall be free to carry out such tests as may be decided by him at his sole direction, from time to time, in addition to those specified in this Document or Requires by Statutory authority. The Contractor shall provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.

The test shall be conducted at Standard Laboratory selected by Client’s Representative. Contractor shall keep the necessary testing equipment such as hydraulic testing machine, smoke testing machine, gauges and other necessary equipment required. The Client’s Representative shall transport the samples to the laboratory. Testing charges shall be borne by the Contractor. Testing may be witnessed by the Contractor or his Authorised Representative. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.

Statutory approvals of drawing and installation of equipment shall be taken by the contractor, from statutory authority/TAC, as required.

4.0 SANITARY FIXTURES & C.P. FITTINGS:

4.1 SCOPE:

4.1.1 Work under this section shall consist of transportation, furnishing, installation, testing and commissioning and all labour as necessary as required to completely install all sanitary fixtures, brass and chromium plated fittings and accessories as required by the drawings and specified hereinafter or given in the Bill of Quantities. Or other wise considered essentials to make the installation complete in all respect.

4.2 General Requirements

All fixtures and fittings shall be fixed with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Bill of Quantities, specifications, drawings or not.

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per architectural designe requirements. Wherever necessary the fittings shall be centered to dimensions and pattern desired.

4.2.3 Fixing screws shall be half round head chromium plated brass with C.P. washers wherever required as per directions of Client’s Representative.

All fittings and fixtures shall be fixed in a neat workmanlike manner true to levels and heights shows on the drawings and in accordance with the manufacturers recommendations. Care
shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, wall or ceiling surfaces shall be made good at Contractors cost.

All fixtures of the similar materials shall be by the same manufacturers.

All fittings shall be of the chromium plated materials.

Without restricting to the generally of the foregoing the sanitary fixtures shall include all sanitary fixtures, C.P. fittings and accessories etc. necessary and required for the building.

Whether specifically mentioned or not all fixtures and appliances shall be provided with approved fixing devices, nuts, bolts, screws, hangers as required. These supports shall have the necessary adjustment to allow for irregularities in the building area construction.

For the installation of the CP fittings, teflon tape shall be used.

EUROPEAN W.C:

4.6.1 European W.C. of glazed vitreous china shall be wash down, single or double siphonic type, floor or wall mounted set, flushed by means of flush valve as specified in Bill of Quantities. Flush pipe/bend shall be connected to the W.C. by means of suitable rubber adopter. Wall hung W.C. shall be supported by C.I. floor mounted chair.

Each W.C. seat cover shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C. Seat cover shall be of white solid plastic, elongated open front with heavy duty hinges. Exposed fixture trims shall be Chrome plated, and trims of similar function shall be by the same manufacturer.

Flush valves shall be of the best approved quality procurable with C.P. control valve and C.P. flush pipe.

The flush pipe/bend shall be connected to the WC by means of a suitable rubber adopter.

Dual flushing cisterns to be used and shall conform to the requirements of IS:774-1971. High level cisterns shall be of cast iron unless otherwise specified. Low level cistern shall be of the same material as the water closet or as instructed by the Owner/Architect/ Consultant.

The cisterns shall be mosquito proof & shall fulfill the requirements of the local Authority.

The levels of the WC should be checked by placing spirit level on the W.C. W.C. should be tested on completion of fixing by putting small paper balls and flushing out. If all the paper balls are not flushed out, the fixing will have to be rectified/ re-aligned.

KITCHEN /PANTRY SINKS:

4.7.1 Sinks shall be of stainless steel material as specified in the Bill of Quantities/Drawings.

Each sink shall be provided with R. S. brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable angle iron clips or brackets as recommended by the manufacturer. Each sink shall be provided with 40 mm dia Chromium Plated waste with chain and plug or P.V.C. waste with Escutcheon plates. Fixing shall be done as directed by Client’s Representative.

Supply fittings for sinks shall be mixing fittings or C.P. taps, angle cocks etc. all as specified in the Bill of Quantities/Drawings.

WASH BASINS:

Wash basin shall be of white vitreous china of best quality manufactured by an approved firm and sizes as specified in the Bill of Quantities.

Wash basin shall be of under counter drop in type shall be supported on a pair of rolled steel brackets of approved design and shall be mounted on a countertop. So that rim and basin bowl is exposed from top.

Wash basin shall be provided with single lever mixer with chain and rubber plug, chromium plated brass bottle trap of approved quality, design and make where hot water required. Single tap where hot water is not required.

Wash basin shall be fixed at proper location and height and truly horizontal as shown on drawing or as directed by Client’s Representative.

HOSE BIBB’S:

Hose Bib of Chromium Plate tap is draw off tap with horizontal inlet and free outlet knurling on outer face to fix the hose pipe. Hose bib shall be of specified size and shall be of screw down type and shall conform to IS:781-1984. The closing device shall work by means of a
disc carrying a renewable non-metalic washer which shuts against the water pressure on a 
seating at right angle to the axis of the threaded spindle which operate it. The handle shall be 
either crutch or butterfly type securely

URINALS:
Half stall wall hung urinals of glazed vitreous china shall be provided with 15mm dia, C.P. 
brass spreader, 32mm dia C.P. domical waste and C.P. cast brass bottle trap with pipe and 
wall flange and shall fixed to wall by one C.I. bracket and two C.I. clips as recommended by 
manufacturers complete as directed by the Client’s Representative.

Urinals shall be flushed by means of “NO-TOUCH” infrared operated flush valves. 
Waste pipes for urinals shall be any one of the given material as directed by the Client’s 
Representative:
upVC Pipes
Rigid PVC/High density polyethylene.

Waste pipes may be exposed on wall or concealed in chase as directed by the Client’s 
Representative.

MEASUREMENTS:
Rate for providing and fixing of sanitary fixtures, accessories, urinal partitions shall include all 
items and operations stated in the respective specifications and Bill of Quantities, and 
nothing extra is payable.
Rates for all items under specifications para above shall be inclusive of cutting holes and 
chases and making good the same, C.P. screws, nuts, bolts and any fixing arrangement 
required.

WATER SUPPLY:
SCOPE:
Work under this section consists of furnishing all labour, materials equipment and appliances 
necessary and required to completely install the water supply system as required by the 
drawings, specified hereinafter and given in the bill of quantities.
Without restricting to the generality of the foregoing, the water supply system shall include 
the following:-
- Pipe protection & painting.
- Connections to all plumbing fixtures, tanks, pumps etc.
- Providing hot water pipe lines and supply point with isolation valves, wherever required.
iv. Control valves, masonry chambers and other appurtenances.
v. Connections to all plumbing fixtures, tanks and appliances.
- Excavation and refilling of pipe trenches, wherever necessary.
- Internal galvanized water supply piping inside the toilets shaft/plant room/terrace.
- Testing all line and fixtures as specified.

GENERAL REQUIREMENTS:
All materials shall be new of the best quality and shall be furnished, delivered, erected, 
connected and finished in every detail conforming to specifications and subject to the 
approval of Client’s Representative.
Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat 
workmanlike manner.
Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows 
shall be restricted for short connections.
As far as possible all bends shall be formed by means of hydraulic pipe bending machine for 
pipes upto 65mm dia.
Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance 
and shall not cause obstruction in shafts, passages etc. and shall be selected and arranged 
so as to fit properly into the allocated building space.
Pipes shall be securely fixed to walls by suitable clamps at intervals specified.
Valves and other appurtenances shall be located to provide easy accessibility for operation, 
maintenance and repairs.
Connection between dissimilar materials.
Drawings illustrating block out and penetration of pipes in the wall/floor/slab.
Unions: Contractor shall provide adequate no. of unions on all pipes to enable dismantling 
later and for servicing. Union shall be provided near each gunmetal valves.
INTERNAL & EXTERNAL WORKS:

Materials (CPVC pipes, fittings & valves):
All pipes inside the buildings and where specified, outside the building shall be CPVC pipes tubes conforming to Specific Gravity ASTM D 792 at 23°C should be 1.55 as specified. With Tensile Strength as per ASTM D 638 at 23°C should be 55 N/mm²

All special fittings and accessories like internally or externally threaded brass adaptors, ball valves, globe valves, unions, diaphragm valves, butterfly valves, etc shall be made of CPVC by Licensee.

The CPVC solvent cement used for installing CPVC piping systems shall conform to ASTM F493. Pipes from ½” upto 2” pipes and fittings, single step medium bodied CPVC solvent cement should be used. For CPVC pipes and fittings upwards of 2”, a primer shall be used followed by heavy bodied solvent cement conforming to ASTM F493. PVC solvent cement should not be used.

Concealed Piping
All internal concealed plumbing for water supply shall be done with CPVC. The pipes & fittings shall conform to CTS (copper tube size) SDR-11 as per ASTM D2846 OR SDR-13.5. All pipes and fittings from ½” upto 2” shall come under this category. Medium body CPVC solvent cement conforming to ASTM F493 should be used for joining pipes to fittings.

External Piping:
All external plumbing for water supply and distribution shall be done with CPVC pipes. The CPVC pipes above 2” for external water supply lines shall conform to ASTM F441 CPVC Schedule 40 & 80 pipe and will be the CPVC brand. The fittings above 2” size shall conform to ASTM F438 (Schedule 40 CPVC fittings) or ASTM F 439 (Schedule 80 CPVC fittings). All threaded CPVC fittings shall conform to ASTM F437 (threaded CPVC fittings schedule). Heavy bodied CPVC solvent cement shall be used along with a primer. IPS brand primer and heavy bodied CPVC solvent cement only should be used conforming to ASTM F493. All external CPVC pipes shall be coated with water based acrylic paint emulsion for enhanced UV protection.

Installation procedure:
All parameters pertaining to the installation of CPVC plumbing system such as cutting, joining, support spacing, expansion loops, insulation, type of support, special connections, etc. shall be as per the manufacturer’s specifications.

All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets.

Clamps
CPVC Pipes in shafts and other locations shall be supported by galvanized M.S. clamps of design approved by Project Manager. Pipes in wall chases shall be anchored by G.I. hooks. Pipes at ceiling level shall be supported on structural clamps fabricated from M.S. structurals. Pipes in typical shafts shall be supported on slotted angles/channels as per standard drawings.

Spacing of clamps, hooks etc. shall be as per good engineering practice approved by the Project Manager.

Unions
Contractor shall provide adequate number of unions on pipes 50 mm and below to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock, or check valve and on straight runs as necessary at appropriate locations as required and/or directed by Project Manager.

Testing:
After laying and jointing, the pipes and fittings shall be inspected under working condition of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed
and replaced without extra cost. Use of any compound or stop leak compound will not permit. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 1.5 times the working pressure or 7.5 Kg/Sq.cm which ever is more. The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw of taps and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least two hours. The pipes and fittings shall be tested in sections as the work of laying proceeds, having the joints exposed for inspection during the testing.

**Measurements:**

The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include CPVC pipe and CPVC fittings such as bends, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, unions etc.. Deductions for length of valves shall be made. Rate quoted shall be inclusive of all fittings, clamps, cutting holes chased and making good the same and all items mentioned in the specifications and Bill of Quantities.

**VALVES:**

**Butterfly Valves:**

All the isolation valve 50cm and above on the equipment and water lines, where specified or shown on drawings shall be wafer type butterfly valves. They shall be designed to fit without gaskets, the water tight seal being obtained by EPDM seat projection at the faces compressed between the flanges. The valves shall be supplied inclusive of M.S. pipe flanges and high tensile steel bolts of dimensions recommended by suppliers of valves. The valves shall comply with following specifications:

- **Test Pressure** : Body 24 Bar, Seat 16 Bar
- **Valve Component** : Material of Construction
  - **Body** : Cast Iron, Gr. FG 260, IS:210
  - **Disc** : Nylon or Epoxy powder coated high duty iron, Gr. FG 260
  - **Stem** : Stainless Steel or carbon steel IS:1570, Part-II.
  - **Seat** : EPDM
  - **Hand Lever** : Cast Iron (Mechanical Memory Stop)
  - **Bearings** : PTFE or Nylon covered S.S. bush bearings at stem and pivot.
  - **Primary Seal** : Reinforced PTEE slide bearings
  - **Temperature** : 80 Degree C (max.)

**5.5.2 Installation:**

Valve shall be install in a manner that allows future removal and service of the valve. Packing and gasket shall not contain asbestos. The valve shall be of the same size as the pipe to which they are install. Valve above 150mm diameter shall be self locking warm gear type water proof and protory lubricated. Provide chain operators with chain cleats for all valves more than 2.4 meter above floor.

**5.5.3 Non Return Valves:**

All non-return valves shall be provided as shown in the drawings conforming to relevant Indian Standards and in accordance with the following specifications.

<table>
<thead>
<tr>
<th>Size</th>
<th>Construction</th>
<th>Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 50 mm.</td>
<td>Gun metal</td>
<td>Screwed</td>
</tr>
<tr>
<td>65 mm and above</td>
<td>Gun metal/cast iron</td>
<td>Flanged</td>
</tr>
</tbody>
</table>

Non-return valves shall be of approved make. Flap type non-return valve shall be used and tested to 15 Kg/Sq.cm. pressure.

**5.5.4 Ball Valves (Float Valve):**

The ball valve shall be of high pressure class and shall be confirm to IS:1703 of sizes as specified. The nominal size of a ball valve shall be that corresponding to the size of the pipe to which it is fixed. The ball shall be of brass or gun metal as specified and the float shall be
of polythene sheet. The minimum gauge of copper sheet used for making the float shall be 0.45mm for float up to 115mm dia and 0.55mm for float exceeding 115mm dia and shall be special in shape. The valve shall be constructed to permit replacing without console of the valve body from the valve line and the system shall not blow out under pressure. The jointing of the float shall be made by efficiently burnished, lapped and soldered seam or by bracing. Plastic float may also be used if specified. The body of ball valve when assembled in working conditions with the float immersed to not more than half of it’s volume shall remain closed against a test pressure of 10.5 Kg/Sq.cm. All ball valves shall be capable of withstanding a pressure of 14 Kg/Sq.cm. The ball valve shall generally conform to IS specifications No. 1703-1962.

**Ball Valves:**
The ball valve shall be of Brass or Gunmetal as specified conforming to IS:1703. The ball valve shall be as given below:

**High Pressure:**
Indicated by the abbreviation „HP“ for use on mains having pressure. These shall remain closed at a test pressure of 10.5 Kg/Sq.cm.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Diameter of spherical float (mm)</th>
<th>15mm</th>
<th>20mm</th>
<th>25mm</th>
<th>32mm</th>
<th>40mm</th>
<th>50mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>High Pressure</td>
<td>127</td>
<td>152</td>
<td>203</td>
<td>229</td>
<td>254</td>
<td>305</td>
</tr>
<tr>
<td></td>
<td>Low Pressure</td>
<td>114</td>
<td>127</td>
<td>178</td>
<td>203</td>
<td>203</td>
<td>254</td>
</tr>
<tr>
<td></td>
<td>Minimum weight of ball valve</td>
<td>283</td>
<td>446</td>
<td>823</td>
<td>1149</td>
<td>1589</td>
<td>1852</td>
</tr>
<tr>
<td></td>
<td>including back nut, body and piston (gms)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ball valves shall be of following nominal sizes 15mm, 20mm, 25mm, 32mm, 40mm and 50mm. The nominal size shall correspond with the nominal bore of the inlet shanks.

**Air Valves:**
Air valves shall be provided in all high points in the system to prevent air locks as shown on the drawings or directed by Client’s Representatives.

**Testing:**
All valves shall be tested while installed in pipe by hydrostatic pressure of 1.5 time of the working pressure 7.5 Kg/Sq.cm which ever is more.

**Measurements:**
All valves as mentioned in Bill of Quantities shall be measured by numbers and shall include all items mentioned in the Bill of Quantities.

**CHLORINATION OF DOMESTIC WATER LINES:**
After the completion of all the hot and cold water service piping, disinfect all the fresh water supply work and water reservoirs using a chlorine solution.

**Chlorinated Systems Shall Include:**
Domestic fresh water tanks
Fire water tanks
All pipe work systems receiving suction from the above mentioned tanks apart from the fire systems.

Before handover of the system, submit to the consultant copies of the certification of performance and laboratory report (if required). Under no circumstances the use of any portion of the fresh water system until it is properly disinfected, flushed and certified shall be permitted. During the Chlorination work the Contractor shall take all necessary precautions to prevent site staff from drinking the system water. Such precautions shall include looking doors to „wet“ areas and providing warning signs in English and Hindi.

**INTERNAL DRAINAGE: (SOIL, WASTE, VENT AND RAIN WATER PIPES)**
SCOPE:
Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes as required by the drawings, specified hereinafter and given in the Bill of Quantities. Without restricting to the generality of the foregoing, the soil, waste, vent and rainwater pipes system shall include the followings:-
- UPVC vertical and horizontal soil, waste and vent pipes, rainwater pipes and fittings, joints clamps and connections to fixtures.
- Floor traps, floor drain clean out plugs, inlet fittings and rainwater roof drain, area/local drains, trench drain.
- Waste pipes connections from all fixtures e.g. wash basins, sinks, kitchen equipment.
- Testing of all pipes.
- Connection of main.

GENERAL REQUIREMENTS
All materials shall be new of the best quality conforming to specifications and subject to the approval of Client’s Representative.

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

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

Pipes shall be securely fixed to walls by suitable clamps at intervals specified.

Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

All works shall be executed as directed by Client’s Representative.

Pipes, Hangers, Supports, Clamps, Brackets etc.:
All vertical pipes shall be fixed by M.S. Clamps truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard).

Inclined pipes running along ceiling shall be fixed on M.S. adjustable hangers of special design shown on the drawings or as directed. Pipes shall be laid to uniform slope and the hangers adjusted to the proper levels so that the pipes fully rest on them.

M.S. clamps shall be of standard design and fabricated from M.S. flat 40mm x 3mm x 3mm thick. They shall be painted with two coats of black bitumen paint before fixing.

Structural clamps shall be fabricated from M.S. structural members e.g. rods, angles, channels, flats, as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding and paint the clamps with one coat of red oxide. Wooden saddles shall be provided free of cost.

Slotted angle/channel supports on walls shall be provided wherever shown on drawings or as required. Angles/channels shall be fixed to brick walls and bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. Holes required in RCC walls shall be neatly drilled by electric drills and no manual chiseling will be allowed. The spacing of supports horizontally shall not exceed 1.8 M.

Wherever M.S. clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement and for making good with cement concrete 1:2:4 (mix 1 cement :2 coarse sand :4 stone aggregate 20mm nominal size) as directed by the Client’s Representative.

Testing:
All pipe work shall be tested before connecting any appliances and then again after connection of appliances. Pipe shall be tested after installation by one of the test given below as directed by the Client’s Representative.

Before use at site, all u-PVC soil pipes shall be tested by filling up with water for at least 10 minutes at 3 meter head. After filling, pipes shall be struck with a hammer and inspected for blow holes and cracks. All defective pipes shall be rejected and removed from the site within 48 hours.
Water Test:
Pipes shall be tested after installation by filling up the stack with water. All openings and
connections shall be suitable plugged. The total head in the stack shall however not exceed 3 M. The level of water in the stack shall not drop within 8 hours. If there is a drop in level of water the leak shall be detected and rectified and test shall be re-conducted until satisfactory result is achieved.

Smoke Test:
Contractor may test all soil and waste stacks by a smoke testing machine. Smoke shall be pumped into the stack after plugging all inlet and outlet connections. The stack shall then be observed for leakages and all defective pipes and fittings removed or repaired as directed by the Client’s Representative.

UPVC Pipes and Fittings:
The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, free from groovings and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designated by external diameter and shall conform to IS:4985-1981.

<table>
<thead>
<tr>
<th>Outer Dia (mm)</th>
<th>Pressure (Kg/cm²)</th>
<th>Inner Dia (mm)</th>
<th>Weight/Mt(Kg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>4</td>
<td>104.5</td>
<td>1.315</td>
</tr>
<tr>
<td>125</td>
<td>4</td>
<td>118.7</td>
<td>1.712</td>
</tr>
<tr>
<td>140</td>
<td>4</td>
<td>133.0</td>
<td>2.131</td>
</tr>
<tr>
<td>160</td>
<td>4</td>
<td>152.0</td>
<td>2.783</td>
</tr>
<tr>
<td>180</td>
<td>4</td>
<td>175.9</td>
<td>3.560</td>
</tr>
<tr>
<td>200</td>
<td>2</td>
<td>190.1</td>
<td>4.526</td>
</tr>
<tr>
<td>225</td>
<td>4</td>
<td>213.8</td>
<td>5.480</td>
</tr>
</tbody>
</table>

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

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 CPVC adopter for insertion in the R.C.C. slab for a water proof joint complete as directed by Client’s Representative.

Supports:
UPVC pipes require supports at close intervals. Recommended support spacing for unplasticised PVC pipes is 1400 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.

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 chipout occur 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.

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 metre 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.

Waste Pipe from Appliances:
Waste pipe from appliances e.g. wash basins, sinks, urinals, chrome plate where seen
water coolers shall be of galvanized steel (heavy class) conforming to IS:1239-1979.
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:-

<table>
<thead>
<tr>
<th></th>
<th>Vertical</th>
<th>Horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.V.C. Pipes</td>
<td>180 cms</td>
<td>120 cms</td>
</tr>
</tbody>
</table>

Measurements:
UPVC/ CPVC waste/soil, waste, vent and rain water pipes shall be measured over all along
the centre line correct to a centimeter including all fittings along its length. The rate for these
pipes shall be inclusive of all fittings, holder bat clamps, lead caulked joint for UPVC and
cement joints for UPVC and all other items described in the Bill or Quantities. The portion of
the pipe within the collar for C.I/UPVC pipe at the joint shall not be included in the length of
the pipe work.

TRAPS:
Nahani Trap or Floor Traps:
Nahani traps or floor traps shall be cast iron, 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 water proof 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 ponding occurs at perimeters of the drain.

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 galvanized 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 UPVC „P“ or „S“ trap with at least 50mm seal traps shall be
paid for separately). Floor trap inlet fittings and the trap shall be set in cement concrete
blocks.

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.

Cleanout Plugs:
Contractor shall provide cast brass cleanout plugs in all horizontal run more than 15 mtr
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 CPVC socket and lead caulked joint.

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.

EXTERNAL DRAINAGE SYSTEM : (SEWERAGE & STORM WATER):

SCOPE:
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 or given in the Bill of Quantities.
Without restricting to the generality of the foregoing, the drainage system shall include:
Sewer lines including excavations, pipe lines, man holes, drop connections, underground storm water drains, including pipes, man holes, catch basins and open drains, thrust blocks.

GENERAL REQUIREMENTS:
All materials shall be new of the best quality conforming to specifications and subject to the approval of the Client’s Representatives.
Drainage lines shall be laid to the required gradients and profiles.
All drainage work shall be done in accordance with the local municipal bye-laws.
Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority and also existing invert levels required to enter sanitary system.
Location of all manholes, catch basins, etc. shall be confirmed by the Client’s Representatives before the actual execution of work at site.
All excavation, trenches etc shall be barricaded as per instruction of the Client’s Representatives.
All works shall be executed as directed by the Client’s Representatives.

TRENCHES FOR PIPE & DRAINS:
Alignment and Grade:
The drains are to be laid to alignment and gradients in continuous shown on the drawings but subject to such modifications, as shall be ordered by the Client’s Representative from time to time to meet the requirements of the works. No deviations from the line, depths of cutting or gradients of sewers shown in the plans and sections shall be permitted except by the express direction in writing of the Client’s Representative.

Opening out Trenches:
In excavating the trenches at the road metaling, pavement kerbing etc. are to be placed on one side and preserved for rein statement when the trench or other excavation shall be filled-up.
Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Client’s Representative. The Contractor shall not cut or break down any live fence or trees in the line of the proposed works but shall tunnel under them unless the Client’s Representative shall order to the contrary.
The trench to be excavated to alignment + depth required. Trench to be properly dressed and de-watered. Trench shall be kept free of water at all time. Discharge of water shall be into nearest drainage channel not on the road.

All underground pipe to be laid in trench. Pipes to be laid and maintained at required levels and grade during course of work. All joints to be aligned and complete.
Trench shall be of 450mm wide than pipe. Concrete anchors at change in direction for C.I. pipe shall be provided. Pipe shall be rest on cushion in the trench.
The Contractor shall scrub up and clear the surface over the trenches and other excavations of all stumps, roots and all other encumbrances affecting execution of the work and shall remove them from the site to the approval of the Client’s Representative.

Construction Across the Roads:
All the pipe line or drain crossing existing road, the road crossing shall be excavated at a time, the second half being commenced after the pipes have been laid in the first half and the trench refilled. Necessary safety measure for traffic as directed shall be adopted. All type of pipes, water mains, cables etc. met within the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the electrical and communication cable removal of which is necessary, shall be arranged by the Client’s Representative or the Contractor shall arrange to support and protect them during excavation.

Excavation to be Taken to Proper Depth:
The trenches shall be excavated to such depth and width that the sewers pipe shall rest on cushion so that the inverts may be at the levels given on the section/plan. In bad ground the Client’s Representative may order the Contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of the sewer with such
Refilling:
The filling shall be done in layers not exceeding 15mm in depth. Each layer shall be watered, rammed and consolidated. Ramming shall be done with iron rammers where possible and with blunt end of the crow brass where rammers can not be used. Special care shall be taken to ensure that no damage is caused to the pipes, drains, masonry or concrete in the trenches.
Filling in trenches shall be commenced soon after the joints of pipes, cables, conduits etc. have been tested and approved by Client’s Representative. The space around the pipes shall be cleared of all debris where the trenches are excavated in hard/soft soil. The filling shall be done with earth on the sides and tops of pipes in layers not exceeding 15mm in depth. Each layer shall be watered rammed and consolidated. The clods and lumps of earth exceeding 8cm in any direction shall be broken or removed before the excavated earth is used for filling. Generally no test is done to determine the in situ density of filled earth but on the discretion of Client’s Representative the 95 proctor’s compaction test may be done to ensure the in situ density after filling. Consolidation is removal of water from the pores and compaction is the explosion of air from the pores. In case of refilling consolidation places most important role as the watering of the each layer is being done properly. If required by the Client’s Representative proctors needle may also be used for the proper checking of the refilling items of in situ density.

Contractor Shall Restore Settlement and Damages:
The Contractor shall at his own cost make good promptly during the whole period the works are in hand, any settlements that may occur in the surfaces or roads, beams, footpaths, gardens, open spaces etc. Whether public or private caused by his trenches or by his other excavations due to not using the method of compaction as given in clause 7.3.5 and he shall be liable for any accidents caused thereby.
He shall also at his own expense and charges, repair and make good any damage done to the building and other properties.

Disposal of Surplus Soil:
The Contractor shall at his own cost and charge, dispose off from the site all surplus excavated material not required to be used on the works.
i. The width of excavated trench shall be as per table given below:

<table>
<thead>
<tr>
<th>Excavation upto</th>
<th>Upto 100 mm dia pipe</th>
<th>Upto 150 mm dia pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 cms depth</td>
<td>33 cms</td>
<td>33 cms</td>
</tr>
<tr>
<td>90 - 150 cms depth</td>
<td>60 cms</td>
<td>60 cms</td>
</tr>
<tr>
<td>150 - 300 cms depth</td>
<td>75 cms</td>
<td>75 cms</td>
</tr>
<tr>
<td>300 - 500 cms depth</td>
<td>90 cms</td>
<td>100 cms</td>
</tr>
</tbody>
</table>

Protection of Existing Services:
All pipes, water mains, cables etc encountered in the course of excavation shall be carefully protected and supported. In case of any damage caused the same shall be made good at no extra cost failing which necessary works will be carried out by the Clients Representative and contract charged to the Contractor.

RCC PIPES:
All underground storm water drainage pipes and sewer lines where specified (other than those specified cast iron) shall be centrifugally spun RCC pipes NP2 for general and NP3 where road crossing. Pipes shall be true and straight with uniform bore throughout. Cracked, wrapped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the Contractor shall produce, prior to use on site, a certificate to that effect from the manufacturer.
The pipes shall be with or without reinforcement as required and of the class as specified. These shall conform to IS:458 - 1971. The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process.
All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding.
The pipes shall be R.C.C. light duty, NP2 and NP3 type.

Laying:
R.C.C. spun pipes shall be laid on cement concrete bed or cradles as specified and shown on the detailed drawings. The cradles may be pre-cast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12mm below the invert level of the pipe and properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and boning rods, etc. Cradles or concrete bed may be omitted, if directed by the Client’s Representatives.

Jointing: (Rigid Spigot and Socket Joint):
Hemp rope soaked in neat cement wash shall be passed round the joint and inserted in it by means of caulking tool. More skein of yarn shall be added and rammed home. Cement mortar with one part of cement and one part of sand and with minimum water content but on no account soft or sloppy, shall be carefully inserted, punched and caulked into the joint and more cement mortar added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall then be finished off neatly outside the socket at an angle of 45 degree.

Curing:
The joint shall be cured for at least seven days.

Cement Concrete for Pipe Supports:
Unless otherwise directed by the Client’s Representative cement concrete for bed, all round or in haunches shall be laid as follows:

<table>
<thead>
<tr>
<th></th>
<th>Up to 1.5m depth (5”)</th>
<th>Up to 3m depth (10”)</th>
<th>Beyond 3m depth (10”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes in open ground (no sub soil water)</td>
<td>all round (1:5:10)</td>
<td>in haunches (1:3:6)</td>
<td>all round (1:5:10)</td>
</tr>
<tr>
<td>RCC/C.I pipes in sub soil water</td>
<td>all round (1:3:6)</td>
<td>in haunches (1:3:6)</td>
<td>in haunches (1:3:6)</td>
</tr>
<tr>
<td>RCC/C.I. pipes (in all conditions)</td>
<td>all round (1:3:6)</td>
<td>in haunches (1:3:6)</td>
<td>in haunches (1:3:6)</td>
</tr>
<tr>
<td>RCC/C.I. pipes under road or building</td>
<td>all round (1:3:6)</td>
<td>all round (1:3:6)</td>
<td>all round (1:3:6)</td>
</tr>
</tbody>
</table>

RCC pipes or CI pipes may be supported on brick masonry or pre-cast RCC or in situ cradles. Cradles shall be as shown on the drawings.

Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

Testing:
All lengths of the sewer and drain shall be fully tested for water tightness by means of water head maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 1.5 metres head of water at the highest point of the section under test. The pipes shall be plugged preferably with standard drain plugs (with rubber rings) on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head. Permissible drops in water head should not exceed ……………………..

Measurement:
Excavation: Measurement for excavation of pipes trenches shall be made per linear meter. Trenches shall be measured between outside walls of manholes at top and the depth shall be the average depth between the two ends to the nearest cm. The rate quoted shall be for a depth upto 1.5 metre or as given in the Bill of Quantities. Payment for trenches more than 1.5 m in depth shall be made for extra depth as given in the Bill of Quantities and above the rate for depth upto 1.5 m. RCC pipes shall be measured for the length of the pipe line per linear meter i.e.:

i. Length between manholes shall be recorded from inside of one manhole to inside of
other manhole.

Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside of manhole.

**Sewer Appurtenances:**

**Inspection Chambers and Manholes:**

**Size of Chambers/Manholes:**

The size given in Bill of Quantities and drawings shall be internal finished size of chamber. The work shall be done strictly as per standard drawing and following specifications.

**Bed Concrete:**

Shall be in 1:4:8 cement concrete 200 mm thick).

**Brick Work:**

Brick work shall be with best quality bricks in 1:6 cement mortar.

**Plaster:**

Inside of the walls of chamber/manhole shall be plastered with 12/15 mm thick cement plaster 1:3 (1 cement :3 coarse sand) and finished smooth with a floating coat of neat cement. Manholes shall be plastered from out side as above but with rough plaster. Water proofing compound as approved by the Client’s Representative shall be added in the cement sand mortar ratio as specified by manufacturer.

**Benching:**

Channel and benching shall be done in cement concrete 1:2:4 rendered smooth with neat cement. The following depth of channel and benching shall be adopted:

<table>
<thead>
<tr>
<th>Size of Drain</th>
<th>Top of channel at the centre above bed conc.</th>
<th>Depth of benching at side walls above bed conc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 cm</td>
<td>15 cm</td>
<td>20 cm</td>
</tr>
<tr>
<td>15 cm</td>
<td>20 cm</td>
<td>30 cm</td>
</tr>
<tr>
<td>20 cm</td>
<td>25 cm</td>
<td>35 cm</td>
</tr>
<tr>
<td>25 cm</td>
<td>30 cm</td>
<td>40 cm</td>
</tr>
<tr>
<td>30 cm</td>
<td>35 cm</td>
<td>45 cm</td>
</tr>
</tbody>
</table>

**Manhole Covers and Frames:**

The covers and frames shall conform to IS:1726-1960 and shall be of the following grades and types:

**Heavy Duty:**

These shall be denoted by the letters „HD” circular solid type for use under heavy vehicular traffic conditions.

**Medium Duty:**

These shall be denoted by the letter „MD” circular or rectangular solid type for use under light traffic conditions such as foot paths, carriage drives and cycle tracks.

**Light Duty:**

These shall be denoted by the letters „LD” or rectangular size for use in domestic premises of where they are not subjected to wheeled traffic loads.

The covers and frames shall be leanly cast and they shall be free from air and sand holes and from cold shuts. They shall be nearly dressed and carefully trimmed. All castings shall be free from voids whether due to shrinkage gas inclusion or other causes. Covers shall have a raised chequered design on the top surface to provide an adequate non-slip grip.

The covers shall be capable of easy opening and closing and it shall be fitted in the frame in workmanship like manner. The cover shall be gas tight and water tight.

The size of covers specified shall be taken as the clear internal dimensions of the frame.

The approximate weights of the various type of manhole covers and frames shall be as in table given below:
<table>
<thead>
<tr>
<th>Description of Manhole Cover</th>
<th>C.I. Weight of Cover Kg.</th>
<th>Weight of Frame Kg.</th>
<th>Total Weight of Cover and Frame Kg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD 560 mm dia</td>
<td>108</td>
<td>100</td>
<td>208</td>
</tr>
<tr>
<td>LD, rectangular</td>
<td>23</td>
<td>15</td>
<td>38</td>
</tr>
<tr>
<td>455x610mm (single seal)</td>
<td>58</td>
<td>58</td>
<td>116</td>
</tr>
<tr>
<td>MD 500 mm dia</td>
<td>58</td>
<td>58</td>
<td>116</td>
</tr>
</tbody>
</table>

2 ½% variation in weight shall be permissible on either side. Covers and frames shall be coated with a black bituminous composition. The coating shall be smooth and spacious. It shall not flow when exposed to a temperature of 63 Deg. and shall not be brittle as to chip off temp. of 0 Deg. C.

The frame of manhole cover shall be firmly embedded to correct alignment and levels in RCC slab or plain concrete, as the case may be on the top of the masonry.

After completion of the work, manhole covers shall be sealed by means of thick grease.

Foot Rests:

All manholes deeper more than 0.6 m shall be provided with plastic foot rests (Polypropylene is injection moulded around a 12mm dia steel reinforcing bar). These shall be embedded 20cm, deep with 20 x 20 x 10cm blocks of cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20cm, nominal size). The block with plastic foot rest placed it’s centre shall be cast in situ along the masonry and surface finished with 12mm thick cement plaster 1:3 (1 cement : 3 coarse sand) finished smooth.

All cast iron and Mild Steel items shall be provided with two coats of bitumastic paint.

Measurement:

Manhole shall be measured in numbers as indicated in the Bill of Quantity. The depth of manhole shall be measured from invert of channel to the top of manhole cover. Quoted rate shall cover the range of ± 0.24 metre on the depth specified in schedule and also the cost of items specified in the Bill of Quantities and Specifications viz.

- Bed concrete.
- Brick work.
- Plastering.
- R.C.C. top slab, benching and channeling including drop connections.
- Supply and fix M.S. foot rests.
- Keeping holes and embedding pipes for all the connections.
- Excavation, refilling, necessary de-watering and disposing off surplus soil to a place as directed by Client’s Representative.
- Curing.
- Cost of frame and cast iron cover including reinforcement, angle frame and embedding the frame in concrete bed.
- Testing.
- De-watering of chambers.

Gully Trap:

Gully traps shall be fixed in cement concrete 1:5:10 mix and a brick masonry chamber 30 x 30cms C.I. sealed cover and frame weighting not less than 7.3 Kgs to be constructed as per standard drawings. Where necessary, sealed cover shall be replaced with C.I. grating of the same size (1 cement : 5 coarse sand : 10 stone aggregate : 40mm nominal size).

Measurements:

Gully traps shall be measured by the number and rate which shall include all excavation, foundation, concrete, brick masonry, cement plaster inside and outside, CI grating and sealed cover and frame.

DROP CONNECTIONS:
In case where branch pipe sewer enters the manhole of main sewer, a drop connection should be provided. H.C.I. pipes and specials conforming to IS:1729-1964 as revised from time to time shall be of the size same as of the branch pipe sewer.

For 150 x 250mm main line, if the difference in level between the water line (peak-flow-level) and the invert level of branch line is less than 60cm, a drop connection may be provided within the manhole by giving ramp. If the difference in level is more than 60 cm the drop should be provided externally.

Excavation:
The excavation shall be done for the drop connection at the place where the branch line meets the manhole. The excavation shall be carried up to the bed concrete of the manhole and to the full width of the branch line.

Laying:
At the ends of branch sewer line Cast Iron tee shall be fixed to the line which shall be extended through wall of the manhole by horizontal piece of Cast Iron pipe form an inspection on cleaning eye, the open end shall be provided with chain and lid. The Cast Iron drop pipe shall be connected to the tee at the top and to Cast Iron bend at the bottom. The end shall be extended through the wall of the manhole by a piece of Cast Iron pipe which shall discharge into the channel. Necessary channel shall be made with cement concrete 1:2:4 (1 cement :2 coarse sand :4 graded stone aggregate to 20mm nominal size) and finished smooth to connect the main channel. The joint between Cast Iron pipe to fittings shall be lead caulked. The joint between Cast Iron tee and RCC branch line shall be made with cement mortar 1:1 (1 cement :1 fine sand). The exposed portion of the drop connection shall be encased around with minimum 15 cm thick concrete 1:3:6 (1 cement :3 fine sand :6 graded stone aggregate 40mm nominal size) and cured. For encasing the concrete around the drop connection, necessary centering and shuttering shall be provided.

The holes made in the walls of manholes shall be made good with brick work in cement mortar 1:5 (1 cement :5 fine sand) and plastered with cement mortar 1:3 (1 cement :3 coarse sand) on the inside of the manhole wall. The excavated earth shall be back filled in the trench in level with the original ground level.

Making Connections:
The Contractor shall connect the new sewer line to the existing manhole by cutting the walls, benching and restoring them to the original conditions. A new channel shall be cut in the benching of the existing manhole for a new connections. The Contractor shall remove all sewage and water if encountered in making the connection without additional cost to the Owner.

Measurements:
Item for making connection to municipal sewer shall be paid for by number and shall include all items given in the Bill of Quantities.

TUBE WELL:

Scope:
Work under this section shall consist of providing materials and labour necessary and required for boring of tube well as per drawings and specified hereinafter in the Schedule of Quantities. Whether specifically mentioned or not, all fixtures, fittings and appliances shall be provided with necessary devices as required.

General Requirements:
The work in general shall comprise of the following operations:
- Obtaining any approval from the Municipal or other relevant authorities for sinking of the tube well.
Boring the necessary hole of required dia with sinking of necessary casing pipe and removal of the same after the work is over or completing the bore to required depth without casing pipe.

Shrouding with graded gravel around the slotted, blind and housing pipes as described in the schedule.

Giving yield tests as directed by the Owner and other works as described in the schedule.

Tube well yield shall be minimum capacity 20 m³/hour, or as stated in Schedule of Quantities.

The entire work shall be carried out in a workman like manner and strictly in accordance with IS:2800.

The boring of the tube well shall be done by rotary/percussion or any standard method by means of drilling rig or manually subject to site conditions.

The tube well pipe shall be shrouded with pea gravel of size 1/6” to 3/16” size.

The rates quoted shall be as per running metre depth of boring through the soils. The casing pipe will not be paid for and will be the property of the contractors. No compensation will be paid for the casing pipe if left within the ground or after commissioning of the tube well.

The Contractor shall make his own arrangement for the supply of water and power necessary for the work and workman.

All other necessary materials and equipment shall be arranged by the Contractor without any additional cost to the Owner.

In case it is necessary to abandon (with approval of the Owner) the tube well at any stage of construction, no payment will be made to the Contractor for the transport of his plant and equipment or for boring and sinking of casing pipe. No compensation on any account is admissible in this regard.

The Contractor shall not be entitled for any compensation for delay of completion on account of any break-down or dropping of tools, tackles in the bore hole or the time of lowering housing pipe/blind/slotted pipe or lifting the casing pipe.

The time for completion shall be two months from the date of placing firm order.

**Performance Guarantee:**

The contractor shall guarantee the system to maintain flow requirements as per the specifications and drawings.

**Information to be furnished by the Tenderer:**

The tenderer shall furnish the following information:
- Method of drilling adopted
- Date of starting drilling
- Date of completion
- Pilot hole or test hole
- Bit Type  
  - Bit Size
  - hours from To
- Boring done
  - Bit Type
  - Bit Size
  - hours from To
- Reemining
  - Bit Type
  - Bit Size
  - hours from To
- Lithological log
  - from to formation
  - size
- viii) Assembly of production well
  - Length
  - Perforation per meter
  - Housing pipe
  - Blind pipe
  - Strainer
  - Bail Plug
  - Type of tube well/above/below ground level
9.0 RAIN WATER HARVESTING:

9.1 General:
9.1.1 Surface water is inadequate to meet our daily water demand and we have to depend on ground water. Due to rapid urbanization, infiltration of rain water into the sub-soil has decreased drastically and recharging of ground water has diminished. The result of this in decline in water levels in most of the country.
9.1.2 Two overcome with the problem mentioned above. The right solution is to use the rain water harvesting techniques.

9.2 Definition of Water Harvesting:
In scientific terms, water harvesting refers to collection and storage of main water and also other activities aimed at harvesting surface and ground water, prevention of losses through evaporation and seepage and all other hydrological studies and engineering interventions, aimed at conservation and efficient utilization of the limited water endowment of physiographic unit such as a water shed.

In general, water harvesting is the activity of direct collection of rain water. The rain water from the roof or from the surface can be directly stored for direct use or can be recharged in the ground water.

Most of the people are not aware that the rain water is the first form of water in the hydrological cycle, hence is a primary source of water for us. The other source like rivers, lakes and groundwater are all secondary source of water. In present times, we depend entirely on such secondary sources of water. In the process, it is forgotten that rain is the ultimate source that feed the water to all the secondary sources and remain ignorant of its value. Water harvesting means to understand the value of rain and to make optimum of rain water at the place where it falls.
Necessity of Water Harvesting:
In India there is a lot of rain, yet there is no water. The annual rainfall over India is higher compared to the global average rainfall. However, this rainfall occurs during short spells of high intensity. Due to such high intensities and short duration of heavy rain, most of the rain falling on the surface tends to flow away rapidly to these secondary sources as mentioned above, and very little rain water is left for the recharging of the ground water.

It is necessary to implement measures to ensure that rain falling over a region is tapped as much as possible through water harvesting, either by recharging it into the ground water aquifers or storing it for direct use.

Amount of Water Harvested:
The total amount of water that is received in the form of rainfall over an area is called rain water endowment of the area. Now out of this the amount that can be effectively harvested is called the water harvesting potential. Water harvesting potential is rainfall (mm) x collection efficiency.

The collection efficiency accounts for the fact that all the rain water falling over an area cannot be effectively harvested because of evaporation, spillage etc. Factor like runoff coefficient and the first flush wastage are taken into account when estimating the collection efficiency.

Advantages of Rain Water Harvesting:
The advantages by adopting Rain Water Harvesting is as under:

- Provides self-sufficiency to water supply system.
- Reduce the cost for pumping of ground water.
- Provides high quality water, soft and low in minerals.
- Improves the quality of ground water through dilution when recharged to ground water.
- Reduces soil erosion in urban areas.
- The roof top rain water harvesting is less expensive.
- Rain Water harvesting system is simple which can be adopted by individuals.
- An ideal solution of water problem in areas having inadequate water resources.
- Reduces the runoff which chokes the storm water drains.

Method of Rain Water Harvesting:
The method of rain water harvesting are of two types. One by storage of rain water on surface for future use. Second by recharging to ground water.

The storage of rain water on surface is a traditional technique and structures used were underground tanks, ponds, check dams, weirs etc. and recharge to ground water is a new concept of rain water harvesting and name of few of them are recharge pits, trenches, dug wells, hand pumps, recharge wells, recharge shafts, lateral shaft and borewells shaft with borewells etc.
TECHNICAL SPECIFICATIONS

INTERNAL ELECTRICAL WORKS

Internal & External electrical works will be carried out as per CPWD specifications and will be paid accordingly.

CABLES

MEDIUM VOLTAGE 1.1 kV GRADE XLPE INSULATED / PVC INSULATED CABLES as per IS 1554 Part-I. The Hi potential test 2.5 time of the of designed voltage is to be carried out at works

GENERAL

The MV cables shall be supplied, inspected, laid, tested and commissioned in accordance with drawings, Specifications, relevant Indian Standard and cable manufacturer’s instruction.

MATERIAL

Specifications of PVC insulated, sheathed aluminum / copper conductor cable shall be as follows:

Conductor

Stranded compacted circular conductor shall be of electrical grade high conductivity aluminum/ copper conductor as per IS: 8130 / 84.

Insulation

The insulation shall be compounded PVC, application shall be by extrusion process insulation type C (85deg.C) conforming to IS: 5831-1984. The thickness of insulation will be as per the relevant Indian codes.

Laying-up

Insulated conductors of multi core cables shall be with thermoplastic fillers in the interstices. The phase identification of cores shall be by colored strips.

Inner Sheath

Cores shall be surrounded either by a wrapped or an extruded PVC sheath. The thickness of the inner sheath shall be as per relevant Indian codes.

Armouring

The armouring shall be provided over the inner sheath. Single core cable shall have non-magnetic armouring. Multi core cables shall have either galvanized round steel wires or flat steel strip armouring. Steel wires and strips for armouring confirm to IS: 3975. The direction of lay of armouring shall be opposite to that of cores.

Outer Sheath

Single and multi core cables are provided with an extruded PVC outer-sheath. The thickness of the sheath shall be as per IS: 1554-1988. The PVC compound for the outer-sheath shall confirm to Type ST1 of IS 5831. The colour of the outer sheath shall be black.

Specifications for XLPE insulated HR PVC sheathed aluminum / copper conductor cable shall be as follows:
Conductor

Stranded compacted circular conductor shall be of electrical grade high conductivity aluminum / copper conductor per IS: 8130/84.

Insulation

The insulation shall be of natural unfilled chemically cross linked polyethylene conforming to IS: 7098. The thickness of insulation shall be as per the relevant Indian codes.

Laying-up

Insulated conductors of multi core cables shall be with plastic fiber in the interstices. The phase identification of cores shall be by colored strips.

Inner Sheath

The cores shall be surrounded by either a wrapped or by an extruded PVC sheath. The thickness of the inner sheath shall be as indicated in the relevant codes.

Armoring

The armouring shall be provided over the inner sheath. Single core cable shall have non-magnetic armouring. Multi core cables shall have either galvanized round steel wires or flat steel strip. Steel wires and strips for armouring confirm to IS: 3975. The direction of lay of armouring shall be opposite to that of cores.

Outer Sheath

Single and multi core cables are provided with an extruded PVC outer-sheath. The thickness of the sheath shall be as per IS: 1554-1988. The PVC compound for the outer-sheath shall confirm to Type ST2 of IS: 5831. The colour of the outer sheath shall be black.

CABLE LAYING AND HANDLING

It should be ensured that both ends of the cable are properly sealed to prevent ingress / absorption of moisture.

CABLE HANDLING

When cable drums have to be moved over short distance, they should be rolled in the direction of the arrow marked on the drum.

While removing cables, the drums shall be properly mounted on jacks or on a cable wheels or any other suitable means, making sure the spindle, jack etc. are strong enough to take the weight of the drum.

The cables shall not be given a sharp bend to a small radius. The minimum safe bending radius for all types of PVC/XLPE cables shall be taken as 12 times the overall diameter of the cable. Wherever practicable, larger radius should be adopted. At joints and terminations, the bending radius of individual cores of a multicore cable shall not be less than 15 times its overall diameter.

Cable with kinks and straightened kinks, or with similar apparent defects like defective armorng etc. shall not be installed / laid.

Cables of different voltages as well as power and control cables should be kept in different trenches/racks with adequate separation. Where available space is restricted, LV/MV cable shall be laid above HV cables.

Where cables cross over cannot be avoided, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.
Installation of cables including jointing shall be carried out as per IS: 1255 amended and revised to date.

Power and communication cables shall, as far as possible cross at right angles. Where power cables are laid in proximity to communication cables, the horizontal and vertical clearances shall not normally be less than 60 cm.

Cables shall be laid direct in ground, in pipes / closed ducts, in open ducts or on surface depending on environmental conditions, and as required in schedule of quantities.

During the preliminary stages of laying the cable, consideration should be given to proper location of the joint position so that when the cable is actually laid, the joints are made in the most suitable places and as approved by Consultant. As far as possible, water logged locations, carriage ways, pavements, proximity to telephone cables, gas or water mains, inaccessible places, ducts, pipes, racks, etc. shall be avoided.

The cable shall not in any circumstances be bent so as to form an abrupt right angle but must be rounded off at the corners to a radius not less than 12 times the overall diameter of the cable.

In case, where there are chances of any damage to the wiring/cables, such wiring/cables shall be covered with a sheet metal protective covering (not less than 16 SWG), the base of the covering being flush with the plaster or brickwork as the case may be, or the wiring /cables shall be drawn through a heavy gauge metal conduit pipe by complying with all the requirements of conduit wiring system.

Such protective covering shall, in all cases, be fitted on all down drops within 1.5 m from the floor or from floor level upto the switch board, whichever is less.

While cutting and stripping of the outer sheathing of the cable, care shall be taken that the sharp edge of the cutting instrument does not touch the inner insulation of the conductors. The protective outer covering of the cable shall be stripped off near connecting terminal and this protective covering shall be maintained upto close proximity of connecting terminals. The cables laid near junction boxes shall be made moisture proof with a plastic compound.

**CABLE JOINTING & TERMINATION**

Jointing shall be as per the manufacturer’s recommendations using standard kits. Cable joints shall be made in suitable, approved cable joint boxes, jointing of cables in the joint boxes and filling of compound shall be done as per manufacturer’s recommendations. Heat shrinkable joints shall be made.

Cables shall be terminated onto the terminals of switchgear through crimping lugs of proper size and of heavy duty. Cable lugs shall be fitted onto the cable by crimping or compression jointing.

Continuity of cable armouring is to be maintained. Double compression glands to be used. Proper crimping tools to be used.

**TRENCHING & CABLE LAYING**

The minimum width of trench shall be 45 cm and depth shall be 75cm for laying of cable. Where more than one cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the minimum gap between the cables is one diameter of the cable unless specified otherwise.

The clearance between axis of the end cables and the sides of the trench shall be minimum 1.5 D (diameter) of the end cable.

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature shall be provided.
Where gradients and changes in depth are unavoidable, these shall be gradual.

The bottom of the trenches shall be level and free from stone, brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 9 cm in depth.

Cable laid in trenches in a single tier formation shall have a covering of clean, dry sand of not less than 20 cms. above the base cushion of sand before the protective cover is laid.

In the case of vertical multi-tier formation, after the first cable has been laid, a sand cushion of 30 cms shall be provided over the initial bed before second tier is laid. If additional tiers are formed, each of the subsequent tiers shall have a sand cushion of 30 cms as stated above. The top-most cable shall have final sand covering not less than 17 cms before the protective cover is laid.

Unless otherwise specified, the cables shall be protected by second class bricks of not less than 20 cm x 10 cm x 10 cm (nominal size) as per CPWD building specification, or protection covers placed on top of the sand, (brick to be laid breadth wise) for the full length of the cable to satisfaction of the owner. Where more than one cable is to be laid in the same trench, this protective covering shall cover all the cables and project at least 5 cm over the sides of and cables.

The trenches shall be then back filled with excavated earth free from stone or other sharp-edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 30 cm. Unless otherwise specified, a crown of earth not less than 50 mm in the center and tapering towards the sides of the trench shall be left to allow for subsidence. The crown of earth, however, should not exceed 10 cms.

Where road bends or lawns have been cut or kerb stones displaced, the same shall be repaired to the satisfaction of the architect and all surplus earth or rock removed to places as specified.

In locations such as road crossing, entry to building in paved areas etc. cables shall be laid in pipes or closed ducts.

All cable entry/exit points into the building through pipe sleeves shall be properly sealed with water and fire safe sealants in an approved manner to avoid any seepage of water into the building.

Manholes of adequate size, as decided by the Architect, shall be provided to facilitate of adequate strength feeding/drawing in of cables and to provide working space for persons. Suitable manhole covers with frame of proper design shall cover Manholes.

CABLE LOOPS: Sufficient cable loop length shall be left.

CABLES ON HANGERS OR RACKS / TRAYS

The contractor shall provide and install all iron hangers racks, or racks with die-cast cleat, with fixing rag bolts or girder clamps or other specialist fixing as required.

Where hangers or racks are to be fixed to wall sides ceiling and other concrete structures, the contractor shall be responsible for cutting away, fixing and grouting in rag bolts and making good the damages as required.

The hangers or racks shall be designed to leave at least 25 mm clearance between the cables and the face to which it fixed. Multiple hangers shall have two or more fixing holes. All cables shall be saddled at not more than 500 mm intervals. These shall be designed to keep provision of some spare capacity for future development. Minimum spacing between the cables shall be one diameter of the cable or as specified.

CABLE TRAY

The MS cable trays should have undergone rigorous rust proofing process, which should comprise of alkaline, degreasing, descaling in diluted sulpharic acid and a recognized
phosphating process. The sheet work shall then be given two coats of oxide primer before
two coats of final painting. Cable trays shall be either painted (Stove enameled) or hot dip
galvanized as called for in the schedule of quantities.

Cable trays shall be complete with bends, joints, coupler plates and accessories as may be
required for joining the cable trays.

Cable trays shall be either perforated or ladder type as called for in the schedule of quantities.

10. **PERFORATED CABLE TRAYS**

Standard technical details of perforated cable tray shall be as follows:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>150mm to 450mm width</td>
<td>2mm thick &amp; 40mm collar</td>
</tr>
<tr>
<td>2.</td>
<td>600mm to 750mm width</td>
<td>2mm thick &amp; 50mm collar</td>
</tr>
<tr>
<td>3.</td>
<td>900mm to 1200mm width</td>
<td>3mm thick &amp; 75mm collar</td>
</tr>
</tbody>
</table>

Minimum 10mm dia GI rod suspender shall be used @ 1500mm intervals.

11. **LADDER TYPE CABLE TRAYS**

Standard technical details of ladder type cable trays shall be as follows:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>SIZE OF TRAY (Width)</th>
<th>SIZE OF MAIN CHANNEL</th>
<th>SIZE OF RUNG &amp; SPACING BETWEEN RUNGS</th>
<th>SIZE OF ANGLE FOR SUPPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>900mm to 1500mm</td>
<td>25 x100 x 25 x 3mm</td>
<td>20 x 50 x 20 x 3mm @ 250C/C</td>
<td>50x50x5mm @150mm C/C</td>
</tr>
<tr>
<td>2.</td>
<td>600mm to 750mm</td>
<td>25 x 75 x 25 x 2.5mm</td>
<td>20 x 40 x 20 x 2.5mm @ 250C/C</td>
<td>40X40x5mm @180mm C/C</td>
</tr>
<tr>
<td>3.</td>
<td>150mm to 450mm</td>
<td>5 x 75 x 25 x 2mm</td>
<td>20 x 30 x 20 x 2.5mm @ 250C/C</td>
<td>32X32x4mm @180mm C/C</td>
</tr>
</tbody>
</table>

Fixing arrangement shall be as approved by the Consultant / Owner / PMC

Hardware to be used in cable tray system shall be galvanized or zinc passivated.

**Quality of Zinc**

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS: 209-1992.

**Coating Requirement**

Minimum weight of zinc coating for mild steel flats with thickness upto 6 mm in accordance
with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square meter shall be calculated by dividing
the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross
inclusions, bare patches black spots, pimples, lumpiness, runs; rust stains bulky white
deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing, pickling in acid, cold rinsing
and then galvanizing.

**TESTING OF CABLES**
The Meggar value in normal dry weather shall be 50 mega ohm for 1.1 kV grade cable. Cables shall be tested at works for the following tests before being dispatched to site by the project team:

- Insulation Resistance Test.
- Continuity resistance test.
- Sheathing continuity test.
- Earth test (in armoured cables)
- Hi Pot Test.

Test shall also be conducted at site for insulation between phases and between phase and earth for each length of cable, before and after jointing. On completion of cable laying work, the following tests shall be conducted in the presence of the Owner’s site representative:

- Insulation Resistance Test (Sectional and overall)
- Continuity resistance test.
- Sheathing continuity test.
- Earth test.

All tests shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the PMC / Owner representative.

CABLE TAGS

Cable tags shall be made out of 2mm thick aluminum sheets. Each tag shall be 2” in dia or 3” x 3” square with one hole of 2.5mm dia, 6 mm below the periphery, or as approved by Consultant. Cable designations are to be punched with letters / number punches and the tags are to be tied to cables with piano wires of approve quality & size. Tags shall be tied inside the panels beyond the glancing as well as above the glands at cable entries. Along trays tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 meters.

Cables shall be secured to cable trays with 3mm thick x 25mm wide aluminum strips/suitable GI clamp, or as approved by Consultant, at 1000 mm intervals and screwed by means of rust proof screws, washers and bolts, of adequate but not excessive lengths. Cable trays for horizontal runs suspended from the ceiling will be supported with mild steel straps or brackets, at 1000 mm intervals and the overall tray arrangement shall be of a rigid construction. External cabling route marker with GI plate marked with “DANGER 1.1 kV CABLE” with 1 meter long GI angle iron grouting bracket including 1:3:6 ratio cement concrete base block of minimum size 200 x 200 x 350 mm to be provided or as approved by Elect. Supply Company.

EARTHING

SYSTEM OF EARTHING

The system shall be TNS with 4 wires supply system (R, Y, B, N and 2 Nos. E) brought from the main LT Panel.

All non-current carrying metal parts of the electrical installation shall be earthed as per IS: 3043 – 1987 with latest amendment. All metal conduits, cable sheath, switchgear, DBs, light fixture, equipment and all other parts made of metal shall be bonded together and connected to earth electrodes. Earthing shall be in conformity with provisions of rules 32, 61, 62, 67 and 68 of Indian Electricity Rules, 1956.

All earthing conductors shall be of high conductivity copper or GI, as specified in the schedule of quantities & shall have protection against mechanical damage. The cross-sectional area of earth conductors shall not be smaller than half that of the largest current carrying conductor.

Main earthing conductors shall be taken from the earth connections at the main LT panel to an earth electrode with which the connection is to be made. All joints in tapes shall be with four rivets and shall be brazed in case of copper and by welding bolting in case of GI. Wires
shall be connected with crimping lugs, all bolts shall have spring washers. Sub-mains earthing conductors shall run from the main distribution panel to the sub distribution panel. Final distribution panel earthing conductors shall run from sub-distribution panel.

Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor, or its distribution panel. Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to distribution panel at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, lighting fitting etc. which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of the earthing conductor for earthing purposes, even though the run of metallic conduit is earthed.

All Lighting fixtures, sockets outlets, fans, switch boxes and junction boxes etc. shall be earthed with copper wire as specified in schedule of quantities. The earth wire ends shall be connected with solderless/bottle type copper lugs.

All the earth wires in switch boxes, sockets outlets, DB’s and light fixtures shall be of green Colour (PVC insulated).

Main earth bus shall be taken from the L.T. switch board to earth electrodes. The electrical resistance of earthing conductors shall be low enough to permit passage of fault current necessary to operate fuse or circuit breaker, and it shall not exceed 1 ohm.

**SIZING OF EARTHING CONDUCTORS**

The cross sectional area of earthing conductor shall not be smaller than half of the largest current carrying conductor subject to an upper limit of 80 Sq.mm. If the area of the largest current carrying conductor or bus bar exceeds 160 sq.mm then two or more earthing conductors shall be used in parallel, to provide at least half the cross sectional area of the current carrying conductor or bus bars. All fixtures, outlet boxes, junction boxes and power circuits upto 15 amps shall be earthed with PVC insulated copper wire.

All 3 phase switches and distribution panels upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper / GI wires. All 3 phase switches and distribution panels upto 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia copper / GI wires. All switches, bus bar, ducts and distribution panels of rating 200 amps and above shall be earthed with minimum of 2 nos separate and independent 25 mm x 3 mm copper / GI tape.

Earthing details given in Table – A & B shall be referred to as a general guidance. Exact sizes to be worked out by the contractor as per relevant IS Codes.

**Table - A**

**Size of earth leads**

For Transformer/Generator Neutral Point Earthing:

<table>
<thead>
<tr>
<th>Transformer/</th>
<th>Electrolytic</th>
<th>Galvanized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare copper</td>
<td>Iron</td>
<td></td>
</tr>
<tr>
<td>DG Set Rating</td>
<td>Conductor Wire or strip</td>
<td>Conductor wire or strip</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>50kVA &amp; below/4mm dia</td>
<td>4mm dia</td>
<td>25mm x 6.0mm</td>
</tr>
<tr>
<td>75 kVA</td>
<td>25mm x 3.0mm</td>
<td>25mm x 6.0mm</td>
</tr>
<tr>
<td>100 kVA</td>
<td>25mm x 6.0mm</td>
<td>32mm x 6.0mm</td>
</tr>
<tr>
<td>150 kVA</td>
<td>25mm x 6.0mm</td>
<td>40mm x 6.0mm</td>
</tr>
<tr>
<td>200 kVA</td>
<td>25mm x 6.0mm</td>
<td>40mm x 6.0mm</td>
</tr>
<tr>
<td>250 kVA</td>
<td>25mm x 6.0mm</td>
<td>40mm x 6.0mm</td>
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<tr>
<td>300 kVA</td>
<td>25mm x 6.0mm</td>
<td>40mm x 6.0mm</td>
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<tr>
<td>500 kVA</td>
<td>40mm x 6.0mm</td>
<td>40mm x 6.0mm</td>
</tr>
<tr>
<td>750 kVA</td>
<td>40mm x 6.0mm</td>
<td>50mm x 6.0mm</td>
</tr>
<tr>
<td>1000 kVA</td>
<td>40mm x 6.0mm</td>
<td>50mm x 6.0mm</td>
</tr>
<tr>
<td>1250 kVA</td>
<td>50mm x 6.0mm</td>
<td>50mm x 6.0mm</td>
</tr>
<tr>
<td>1500 kVA</td>
<td>50mm x 6.0mm</td>
<td>75mm x 6.0mm</td>
</tr>
<tr>
<td>2000 kVA</td>
<td>50mm x 6.0mm</td>
<td>75mm x 6.0mm</td>
</tr>
</tbody>
</table>

NOTE: - EXACT SIZE OF EARTH LEAD TO BE DETERMINED AS PER LATEST IS CODES.

TABLE – B

(b) For Equipment Earthing (Applicable to Transformer, Generators, Switchgears, Panels, DB’s, Motors etc.)

| Rating of Bare Electrolytic Copper conductor Galvanised Iron Wire / Strip |
|----------------|----------------------|----------------------|
| 400-V, 3ph Equipment Wire / Strip |
| 50 cy. In kVA  |
| upto 5        | 2mm dia              | 2mm dia              |
| 6 to 15       | 3mm dia              | 3mm dia              |
| 16 to 30      | 4mm dia              | 4mm dia              |
| 31 to 50      | 6mm dia              | 6mm dia              |
| 51 to 100     | 25mm x 3.0mm         | 25mm x 6.0mm         |
| 101 to 125    | 25mm x 3.0mm         | 32mm x 6.0mm         |
| 126 to 150    | 25mm x 3.0mm         | 32mm x 6.0mm         |
| 151 to 200    | 25mm x 6.0mm         | 40mm x 6.0mm         |
| 201 to 300    | 25mm x 6.0mm         | 50mm x 6.0mm         |
| 301 to 500    | 32mm x 6.0mm         | 50mm x 6.0mm         |
| 501 to 800    | 40mm x 6.0mm         | 50mm x 6.0mm         |
| Above 800     | 50mm x 6.0mm         | 50mm x 6.0mm         |

NOTE: EXACT SIZE OF EARTH LEAD TO BE DETERMINED AS PER LATEST IS CODES.

NOTE: ALL THREE PHASE EQUIPMENT SHALL BE DOUBLE EARTHED

PROHIBITED CONNECTIONS

Neutral conductor, sprinkler pipes, or pipes conveying gas, water, or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a earthing conductor.

CONNECTION/JOINTS

The earthing connections/joints should be bolted, riveted, welded, brazed type.
In case of bolted joints, GI/Passivated hardware’s of adequate size/nos. should be used for firm connections. The minimum contact area should be equal to the width of the strip or cross-sectional area of earthing lead. Welded/brazed joints should be smooth and continues. All welded/brazed joints should be treated with anti-corrosive paints to protect it from corrosion/rusting.

All bolted connections/joints of Cu strip should be tinned.

Wherever, flexible earthing connection is must, it should be hydraulically crimped lugs of Copper/Aluminum. The effective earthing connection surface should be smooth & free from paints and oxide coatings.

**EARTHING**

The following must always be ensured in earthing system:

All earths must be interconnected. This includes transformer neutrals, Transformer body, HT Panels, LT Panels, lightning protection system earths, UPS earths etc and provision for interconnection with other services earthing grid etc. shall be made. All earth pits should be at equi-potential.

Extraneous conductive parts such as gas pipes, other service pipes and ducting risers and pipes of fire protection equipment and exposed metallic parts of the building structure.

The Contractor shall get the soil resistivity test done at his own cost of the area where earthing pits are to be located before starting the installation.

**RESISTANCE TO EARTH**

The resistance of earthing system shall not exceed 1 ohm.

**SPECIFICATION FOR HOT DIP GALVANIZING PROCESS FOR MILD STEEL USED FOR EARTHING FOR ELECTRICAL INSTALLATION**

**GENERAL REQUIREMENTS**

**Quality of Zinc**

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS: 209-1992.

**Coating Requirement**

Minimum weight of zinc coating for mild steel flats with thickness upto 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square meter shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs; rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing. Jointing of earthing tape shall be by welding. All joints and cut ends shall be properly painted with aluminum paint.

**MAINTENANCE FREE CHEMICAL EARTHING:**

Maintenance Free Chemical Earthing shall be done strictly as per manufacturer’s recommendations. It shall be completely maintenance free, long life close to 25 years, environmentally safe, non corrosive & electrically conductive. The earth resistance results shall be less than one ohm.
MV PANELS:
GENERAL

Medium voltage power control centres (generally termed as switchboard panels) shall be in sheet steel clad cubicle pattern, free floor standing, totally enclosed, compartmentalized design having multitier arrangement of the incomers and feeders as per details given in the schedule of quantities. All panels shall conform to the requirements of the latest addition of IS and shall be suitable for 415 V, 3 phase AC supply or 230 V single phase AC supply as required. The drawing of panel may get approved from Engineer En-charge before placing order.

CONSTRUCTIONAL FEATURES

The Switch Boards shall be totally enclosed, sheet steel cubicle pattern, extensible on either side, dead front, floor mounting type (wall mounting if specifically asked for in BOQ) and shall have a bus bar chamber at the top and the cable entry from the bottom. (For panel requiring top cable entries if any, refer to BOQ). The cable terminations should be inside the feeder compartment only.

The Switch Boards shall be completely dust and vermin proof. Synthetic rubber gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust and vermin proof to provide a degree of ingress protection of IP 43. All doors and covers shall also be fully gasketed with synthetic rubber. All the live parts shall be properly shrouded with FRP sheets.

The Switch Board shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be constructed from CRCA sheet steel of thickness not less than 1.6 mm. Joints of any kind in sheet metal shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal. Base channel shall be fabricated from ISMC 75 and door shall be provided at the bottom with arrangement for fixing bolts in the foundation.

All panels and door covers shall be properly fitted and square with the frame. The cutouts in the panel shall be correctly positioned.

Lifting lugs of adequate strength shall be provided on each transport section of the panels. Fixing screws shall enter holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in the construction of the Switch Boards.

SWITCHBOARD DIMENSIONAL LIMITATIONS

A base channel 75 mm x 5 mm thick shall be provided at the bottom.

The overall height of the Switch Board shall be limited to 2200 mm

The height of the operating handle, push buttons etc shall be restricted between 300 mm and 1900 mm from finished floor level.

BUS BARS

The bus bars shall be suitable for 4 wire, 415 volts, 50 Hz. system. The main bus bar shall be made of high conductivity electrolytic grade AL 91E Aluminium. The bus bars shall have uniform cross section throughout the panel. The bus bars shall be capable of carrying the rated current at 415 volts continuously. The bus bar will run in a separate busbar chamber using bus insulators made of non-deteriorating, vermin proof, non hygroscopic materials such as epoxy fiber, reinforced polyester or moulding compound (min. 25mm clearance between phase to phase & phase to neutral busbars shall be provided). The interval between the two insulators will be designed after considering the following:

 Strength and safe load rating of the insulator,
 The vibrating force generated during a fault,
 A Factor of safety of 1.25
 A set of insulators at both ends of the bus.
Bus bars shall be sized considering maximum current density of 1 Amps/ cross section Sq.mm area. The size of the bus bar calculations must be approved by the consultants. The bus bars shall be designed to withstand a temperature rise of 45°C above the ambient. To limit the temperature rise in the bus bar chamber a set of louvers can be provided at strategical places considering the air circulation. All the bus bars shall be insulated with PVC heat shrinking sleeves throughout (except at joints) the length of the panel. The electro-galvanised high tensile steel nuts, bolts, plain or spring washers of suitable size will be used in connecting the various section of the bus bars.

SWITCH BOARD INTERCONNECTIONS

All connections between the bus bars/Breakers terminations shall be through solid Aluminium strips of adequate size to carry full rated current which shall be PVC/fibre glass insulated. For switch unit ratings upto 63A PVC insulated copper conductor wires of adequate size to carry full load current can be used. The terminations of all such interconnections shall be properly crimped.

CABLE TERMINATIONS

Knockout holes of appropriate size and number shall be provided in the Switch Board in conformity with the location of incoming and outgoing conduits/cables. All cable entries shall be from bottom until & unless specifically asked for in the BOQ.

The cable terminations of the circuit breakers shall be brought out to terminal cable sockets suitably located in the panel.

All outgoing links for FSU/MCB feeders shall be in the feeder compartment only. The Switch Boards shall be complete with tinned brass cable sockets, tinned brass compression glands, gland plates, supporting clamps and brackets etc for termination of 1100 volt grade aluminium conductor PVC cables.

EARTHING

The panels shall be provided with an aluminium earth bus of suitable size running through out the length of the switchboard. Suitable earthing eyes/bolts (at min. two points) shall be provided on the main earthing bus to connect the same to the earth grid at the site. Sufficient number of star washers shall be provided at the joints to achieve earth continuity between the panels and the sheet metal parts.

INTERLOCKING

The panels shall be provided with the following interlocking arrangement.

The door of the switch-fuse compartments is so interlocked with the switch drive or handle that the door can be opened only if the switch is in ‘OFF’ position. De-interlocking arrangement shall also be provided for occasional inspection.

It shall not be possible for the breaker to be withdrawn when in `ON' position.

It shall not be possible for the breakers to be switched on unless it is either in fully inserted positions or for testing purposes in fully isolated position.

The breaker shall be capable of being raked in to `testing 'isolated' and `maintenance' positions and kept locked in any of these position.

A safety latch to ensure that the movement of the breaker as it is withdrawn, is checked before it is completely out of the cubicle shall be provided.

WIRING

All wiring for relays and meters shall be with PVC insulated copper conductor wires. The wiring shall be coded and labeled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 1.5 sq.mm except for the circuits related to current transformers or circuits with current carrying capacity more than 5 Amps (for which min. 2.5 Sq.mm copper conductor wires shall be used).
SHEET STEEL TREATMENT AND PAINTING

Sheet Steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulfuric acid and a recognised phosphating process. The steel work shall then receive two coats of oxide primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.

All sheet steel shall after metal treatment shall be powder coated with shade RAL 7032 (Siemens Gray) on the outside of the panel and mounting plates shall be of orange shade. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns (shade of paint may be changed if the Engineer In charge so desires).

NAME PLATES AND LABELS

Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

INSTALLATION

Installation shall be done by erection Contractor.

TESTING AND COMMISSIONING

Copies of type tests and routine test as per relevant specification, carried out at manufacturer’s work shall be submitted to the ENGINEER IN CHARGE as required.

Wiring and connections including earthing shall be checked for continuity and tightness.

Insulation shall be measured with a 500 V megger and insulation resistance shall not be less than 100 Mega ohms

Interlocking operation to be checked as per requirement.

Tests shall be performed in presence of authorized representative of the ENGINEER IN CHARGE for which the contractor shall give due prior notice.

HIGH VOLTAGE TEST

A high voltage test with 2.5 KV for one minute shall be applied between the poles and earth. Test shall be carried out on each pole in turn with the remaining poles earthed, all units raked in position and the breakers closed. Original test certificate shall be submitted along with panel.

PRE-COMMISSION TESTS:

Panels shall be commissioned only after the successful completion of the following tests. The tests shall be carried in the presence of Architect's/Consultant's or their representatives.

All main and auxiliary bus bar connections shall be checked and tightened.

All wiring termination and bus bar joints shall be checked and tightened.

Wiring shall be checked to ensure that it is according to the drawing.

All wiring shall be tested for insulation resistance by a 1000 volts meggar.

Phase rotation tests shall be conducted

All relays and protective devices shall be tested for correctness of settings and operation by introducing a current generator and an ammeter in the circuit.

CLIMATIC CONDITIONS:

The panels & switch gear components shall be suitable for following climatic conditions:
<table>
<thead>
<tr>
<th></th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBT</td>
<td>45°C</td>
<td>3°C</td>
</tr>
<tr>
<td>RH</td>
<td>90%</td>
<td>20%</td>
</tr>
</tbody>
</table>

HEATING ARRANGEMENT:

The panel shall be provided with a thermostatically controlled heating arrangement for monsoon (200 Watt) to take care of high humidity conditions. A 6/16A service socket outlet (single phase) shall be provided in one of the compartments in all the panels.

METERING, INSTRUMENTATION AND PROTECTION

The specifications hereinafter laid down shall cover all the meters, instrumentation and protective devises required for the electrical work. The ratings, type and quantity of meters, instruments and protective devices shall be as per the schedule of quantities and drawings.

Measuring Instruments

General

Direct reading electrical instruments shall be in conformity with IEC-51, BS: 89 or IS: 1248. The accuracy of direct reading shall be 1.0 for voltmeters and 1.5 for ammeters. Other type of instruments shall have accuracy of 1.5. The error due to variations in temperature shall be limited to a minimum. The meter shall be enclosed in a dust tight housing. The housing shall be of steel or phenolic mould. The design and manufacture of the meters shall ensure the prevention of fogging of instrument glass. Instrument meters shall be sealed in such a way that access to the measuring element and to the accessories within the case shall not be possible without removal of the seal. The meters shall be provided with white dials and black scale marking. The pointer shall be black in colour and shall have zero position adjustment device which could be operated from outside. The direction of deflection shall be from left to right. Suitable selector switches shall be provided for all ammeters and voltmeters intended to be used on three phase supply.

Ammeters

Ammeters shall be moving iron type. The moving part assembly shall be with jewel bearings. The jewel bearing shall be mounted on a spring to prevent damage to pivot due to vibrations and shocks. The ammeters shall be manufactured and calibrated as per the latest edition of IS 1248 or BS 89. Ammeters shall be instrument transformer operated, and shall be suitable for 5 A. Secondary of instrument transformer. The scales shall be calibrated to indicate primary current, unless otherwise specified. The ammeters shall be capable of carrying sustained overloads during fault conditions without damage or loss of accuracy.

Voltmeters

Voltmeter shall be of moving iron type. The range for 400 volts, 3 phase voltmeters shall be to 0 to 500 volts. Suitable selector switch shall be provided for each voltmeter to read voltage between any two lines of the system. The voltmeter shall be provided with protection fuse of suitable capacity.

INSTRUMENT TRANSFORMERS

Current Transformers

Current transformers shall be in conformity with IS:2705 (Part-I, II, & III) in all respects. All current transformers to be used in the L.T. Electrical panels shall be low tension, ring type resin cast current transformer with the requisite currents ratio having secondary of the current transformers selected will be based on the following;

For energy measuring : 1.0 class of accuracy.
For other metering : 1.5 class of accuracy.
For protects on: 3.0 class of accuracy. Where a common CT is used for different functions the CT accuracy class will be equal to the best class required by any of those function.

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 35 MVA on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identification of poles. Current transformers shall be provided with earthing terminals for earthing chassis frame work and fixed part of the metal casing (if any). Each CT shall be provided with rating plate indicating the following:

- Name and make
- Serial Number
- Transformation ratio
- Rated burden
- Rated voltage
- Accuracy class

The current transformers to be selected for this panel will have at least 20% extra VA capacity available over the normal capacity based on the following details;

For ammeters: 3 VA
For current coils of KW & KWHR, PF, KVAR meters or for all recorders: 5 VA.
For normal wiring: 2 VA.
For current coil of protection relays: 10 VA under; no circumstances the VA rating of the CT's will be less than 15 VA.

Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CTs shall be copper conductor, PVC insulated wires with proper termination lugs and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner.

**CONTROL DEVICES**

**Push Buttons**

The push buttons used in the panels will be rated for more than 415 volts and 2 amps. All the push buttons will be mounted on the front door and the assembly will be in two parts. All the push buttons will be mounted on the front door of the cubicle in regular symmetrical fashion as per the general norms being practiced. Only one make of push buttons will be used in the assembly of all the panels. The selection of the colour of the push buttons will be as follows:

<table>
<thead>
<tr>
<th>Function</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting/Switching ON</td>
<td>Green</td>
</tr>
<tr>
<td>Stopping/Switching OFF</td>
<td>Red</td>
</tr>
<tr>
<td>Resetting</td>
<td>Black</td>
</tr>
<tr>
<td>Forward ON</td>
<td>Yellow</td>
</tr>
<tr>
<td>Reverse ON</td>
<td>Blue</td>
</tr>
<tr>
<td>Emergency OFF</td>
<td>Red/Mushroom</td>
</tr>
</tbody>
</table>

**Indicating Lights**

The indicating lights used in the panel will be pleasant looking and round shape having the following features:

- A separate front lens for it's easy replacement.
- Facility to replace the bulb from the front.
- Baynet pin cap bulbs of standard size to be used.
- The shape of the lens to allow viewing from sides.
- Series resistance with use of low voltage bulb for longer life.
- Clear and distinct indication for light ON and OFF with differences of brightness of the lens.
The selection of the colours of the indicating lamps will be as follows:
- Red for system in operation
- Amber for system ready for operation.
- Green for system being put off.
- Red, yellow and blue for incoming supply.

**TESTING**

Instrument transformers shall be tested at factory as per IS:2705 & IS:3156. The test shall incorporate the following:

- Type tests
- Routine tests

Original test certificates in triplicate shall be provided.

Meters shall be tested as per IS: 1248. The tests shall include both type tests and routine tests. Original test certificate in triplicate shall be furnished.

a) Suitable injection tests shall be applied to the secondary circuit of every instrument to establish the correctness of calibration and working order.
   All relays and protective devices shall be tested to establish correctness of setting and operation by introducing a current generator and an ammeter in the circuit.

**MINIATURE CIRCUIT BREAKERS**

The MCB’s shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system. MCB’s shall be quick make and break type conforming to relevant IS. Housing shall be heat resistant and have a high impact strength. MCB’s shall be flush mounting type and shall be provided with trip free manual operating liver with ON/OFF indications

MCB’s shall be provided with magnetic thermal releases for overcurrent and short circuit protection. The overload or short circuit device shall have a common trip bar in case of DP and TPN MCB’s. The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with H.R.C. fuse/PVC cable characteristic.

The MCB’s shall have a minimum breaking capacity of 10 kA at 230/415 volts in accordance with IEC : 898 - 1995 and IS : 8828 – 1996

**MOULDED CASE CIRCUIT BREAKERS**

**GENERAL**

Moulded case circuit breakers shall be incorporated in the switch board wherever specified. MCCB shall conform to IEC:947-II or IS:13947-II in all respects. MCCB shall be suitable for three phase 415 volts AC. Suitable discrimination shall be provided between upstream and down stream breakers in the range of 10-20 milli seconds. All MCCBs will have earth fault module (if specifically asked) and front operated. All four pole MCCB shall be suitable for three phase four wire system, with the neutral clearly identified and capable of first make last break feature.

**CONSTRUCTION**

The MCCB cover and case shall be made of high strength heat-resistant and flame retardant thermosetting insulating material, operating handle shall be quick make/quick break. The operating handle shall have suitable ‘ON’ ‘OFF’ and ‘TRIPPED’ mechanical indicators notable from outside. All MCCBs shall have a common operating handle for simultaneous operation and tripping of all the three phases. The MCCB should be suitable for disconnection and isolation with marking on front name plate.

Suitable arc extinguishing device shall be provided for each contact. Tripping unit shall be thermal-magnetic type provided on each pole and connected by a common trip bar such that
tripping of any one pole operates all three poles to open simultaneously. Thermal magnetic tripping device shall have IDMT characteristics for sustained over load and short circuits. All MCCBs above 250 Amps will also have short circuit magnetic pickup level adjustment.

**MCCBs**

All MCCBs shall have variable thermal overload releases which can be adjusted at site.

Contact tips shall be made of suitable arc resistant, sintered alloy for long electrical life. Terminals shall be of liberal design with adequate clearances. All MCCBs of higher ratings above 250 Amps, shall be provided with separate extended arcing contacts.

**INTERLOCKING**

Moulded case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

- Handle interlock to prevent unnecessary manipulations of the breaker.
- Door interlock to prevent the door being opened when the breaker is in ON or OFF position.
- Defeat-interlocking device to open the door even if the breaker is in ON position.

**BREAKING CAPACITY**

The moulded case circuit breaker shall have a rated service. Short circuit breaking capacity of not less than 25 KA rms at 415 volts AC. Wherever required, higher breaking capacity breakers to meet the system short circuit fault shall be used.

**ACCESSORIES**

All the accessories like shunt, undervoltage contact blocks shall be of snap fitting possible at site.

**TESTING**

Original test certificate of the MCCB shall be furnished.

Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

### 21.0 MEDIUM VOLTAGE AIR CIRCUIT BREAKER

#### 1.0 GENERAL

Air circuit breakers shall be incorporated in the panels wherever specified. ACB shall conform to IEC 947-II or IS: 13947-II in all respects. ACBs shall be suitable for operation on 415 volts, 3 phase, 50 Hz, AC supply. All air circuit breakers using in the panel will be mounted in separate cubicles and will be of the same make to maintain the uniformity.

**TYPE AND CONSTRUCTION**

Air circuit breakers shall be of enclosed pattern, dead front air break type with trip free operating mechanism. All ACBs will be thermal magnetic type. Air Circuit breakers shall be of with drawable type and will be mounted on a rigid steel frame. The ACBs shall be strong and robust in construction with suitable arrangement for anchoring when in fully engaged or fully drawn out positions. There shall be no dependence upon the panel board frame for any critical alignment. The withdrawal arrangement shall be such as to allow smooth and easy movement. The ACB shall have minimum four positions service, test , isolated and maintenance.
All the current carrying parts of the circuit breakers shall be silver plated. Suitable arcing contacts shall be provided to protect the main contacts. The contacts shall be of spring loaded design. The sequence of operation of the contacts shall be such that arcing contacts ‘make before’ and break after the main contacts. Arcing contacts shall be provided with efficient arc chutes on each pole. The contact tips and arc chutes shall be suitable for ready replacement. Self aligning isolating contacts with automatic shutters to screen the live parts shall be provided. The design of the breaker shall be such that all the components are easily accessible for inspection, maintenance and replacement.

**Operating Mechanism**

Air circuit breaker shall be provided with a quick-make, trip free operating mechanism. The operating mechanism shall be strain-free spring operated. The system will have horizontal, self aligning, isolating pairs of moving and stationary power and control contacts. The unit will have three horizontal positions corresponding to:

- **Plugged in Position**

  Here both the power and control contacts are in made position and the breakers gets mechanically locked in this position. The breaker can go in ON position only after being locked in this position.

- **Test Position**

  Here the power contacts gets isolated where as the control contacts can be kept in made status. The breakers can be mechanically locked in this position and made ON and off for testing purposes.

- **With drawn Position**

  In this position the power and control connections are in isolated status and the moving portion of the breaker can be dismantled from the panel.

  An isolating shutter or set of shutters are to be provided for the automatic coverage of live power and control fixed isolating contacts in the withdrawn position.

  All the breakers with remote closing arrangement will have a spring charging motor of single phase 230 V and a closing coil. In case of power failure the spring charging can be done manually with the help of button or lever. The circuit breaker should switch on only when the spring is charged fully which should be able to store energy for one closing and one tripping operation. The spring will also get fully charged when the breaker is in closed position. In this case the spring should store enough energy to make first tripping, one re-closing and the second tripping. The ACB should have an anti pumping feature.

  The breaker will have quick making trip free closing mechanism. The operation of the mechanism will be independent of the speed of the closing lever or the duration of the closing signal.

  The breaker will have following indications distinctly not able from out side :-

  - Mechanical indicator for spring fully charged.
  - Mechanical indicator for spring discharged.
  - Electrical indication of breaker ON status.
  - Electrical indication of breaker OFF status.
  - Electrical indication of trip circuit healthy.
  - Separate trip indication for overload and short circuit.

  All breakers will have switching ON and OFF time of less than 4 cycles and will have the following interlocks for the safe operation of the equipment. Breakers to ON only when mechanically locked many of the three horizontal isolation position.
When the breaker is in plugged in position it will ON only with the front door closed. The breakers will be provided with 6 Nos. each of type NO and NC auxiliary contacts rated for 10 Amps AC at 415 V and 6 Amps DC at 48 V. These contacts are in addition to the ones already in use for the operation of the breaker and will be required for subsequent interlocks incorporated in near future.

When ever requested mechanical positive inter locks will be provided between the operation of different breakers with the help of individually unique and matched castle key locks.

**Rating**

The rating of the circuit breaker shall be as per the drawings and schedule of quantities. The rated breaking capacity of the breakers shall be minimum 50 KA or as specified at 415 volts AC. The rated making capacity shall be as per relevant standard.

**Accessories**

Circuit breakers shall be provided with the following Accessories.
- Under-voltage relay for the incoming ACB.
- Overload release with IDMT characteristics.
- Instantaneous over current relays.
- Alarm switches (if specifically asked for)
- Auxiliary switches
- Circuit breaker position indicators ON/OFF/TEST/ ISOLATED.

**Testing**

Testing of each circuit breaker shall be carried out at the works as per IS:13947-II and the original test certificate shall be furnished in triplicate. The tests shall incorporate at least the following:
- Impulse withstand test
- Power frequency withstand test
- Short circuit test
- Temperature-rise test under rated conditions.

**ADDITIONAL REQUIREMENTS**

The contractor shall submit the original manufacturer’s test certificates in respect of, ACB, Pumping Sets, Motors, Starters, Main switches etc.

The aluminium copper conductor cable (heavy) should be ISI marked PVC insulated, armored and should be confirming to relevant IS-Specifications, codes with latest amendments.

**Test Certificate:**
A test certificate from the manufacturers shall be handed over to the department before installation of the equipment specifying that the equipment conforms to relevant I.S. S/P.W.D. specifications.

**Wiring Diagram:**
After completion of the work a complete drawing showing connections to the various equipments is to be prepared by the tenderer and to be submitted to the department alongwith final bill of the work.

**Connections:**
Inter connections from the bus-bar chamber to the different main switches/Air circuit breakers should be through solid copper bars of the required capacity duly insulated for which no extra payment will be made.

The rates quoted should be F.O.R. at site of work including cost of installation, freight, octroi taxes and other charges. Nothing extra over and above rates will be admissible.

Superfluous conditions and conditional tender will be rejected.

Telegraphic tenders and tenders without earnest money in shape of deposit at call will not be accepted.

The machinery will be installed as per standard P.W.D. specifications and to the entire satisfaction of the Engineer-in-charge.

The quantity of electrical equipments and pumping sets can be increased/ decreased by the department.

The tender submitted by the firms shall be valid for 90 days (3 months) from the date of opening of Price Bid.

In case any mistake is found in the N.I.T. the same shall be rectifiable even after the opening of the tender and execution of contract agreement as per requirement and site conditions.

Pump, Motor, Generator, Starters, ACB shall be inspected by Department officers at the factory premises before being transported to the store or agency/work place.

**OPERATION & MAINTENANCE**

The contractor shall maintain all Independent Feeders erected under this contract for a period of 12 months during the Defect Liability Period. Details of staff to be deputed during the maintenance period shall be submitted to the Engineer-in-Charge and prior approval shall be taken.
<table>
<thead>
<tr>
<th>S. no.</th>
<th>Item</th>
<th>Manufacturer's Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Civil and Interior Works</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Grey Cement (OPC 43 Grade)</td>
<td>ACC, Ultratech, Ramco, JSW, Birla, Jay-Pee</td>
</tr>
<tr>
<td>2</td>
<td>White Cement</td>
<td>JK, Birla or equivalent</td>
</tr>
<tr>
<td>3</td>
<td>Reinforcement Steel (TMT bars)</td>
<td>Tata, sail, Jindal, JSW Steel, Rashtriya Ispat Nigam</td>
</tr>
<tr>
<td>4</td>
<td>Structural Steel sections</td>
<td>Sail, Vizag, Tata</td>
</tr>
<tr>
<td>5</td>
<td>Concrete Additives</td>
<td>Fosroc, Choksey, Sikka</td>
</tr>
<tr>
<td>6</td>
<td>Anti termite Chemical</td>
<td>Pest Control India Ltd., Pest Con India, or Equivalent</td>
</tr>
<tr>
<td>7</td>
<td>Tile grouts, Joint Filler</td>
<td>Laticrete, Bal Endura, GE Bayer Silicon</td>
</tr>
<tr>
<td>8</td>
<td>Polysulphide Sealant</td>
<td>Fosroc, Choksey, Pidilite</td>
</tr>
<tr>
<td>9</td>
<td>Silicone Sealant</td>
<td>GE Bayer Silicon, Dow Corning, Wacker.</td>
</tr>
<tr>
<td>10</td>
<td>Epoxy</td>
<td>Fosroc, Sika, Choksey, BASF</td>
</tr>
<tr>
<td>11</td>
<td>Water Prooﬁng Membrane – Bitumen Based</td>
<td>Sikka, Fosroc, BASF</td>
</tr>
<tr>
<td>12</td>
<td>Admixture</td>
<td>Choksey, BASF, Fosroc</td>
</tr>
<tr>
<td>13</td>
<td>Formwork Release Agent</td>
<td>Choksey, MBT, BASF</td>
</tr>
<tr>
<td>14</td>
<td>Non Shrink grouts</td>
<td>Fosroc, Sikka</td>
</tr>
<tr>
<td>15</td>
<td>Non Metallic Floor Hardeners</td>
<td>Fosroc, Choksey, BASF</td>
</tr>
<tr>
<td>16</td>
<td>Bitumen</td>
<td>Shalimar tar products, Mathura oil refinery</td>
</tr>
<tr>
<td>17</td>
<td>Synthetic Enamel Paints</td>
<td>Berger, Nerolac, Asian, ICI Dulux</td>
</tr>
<tr>
<td>18</td>
<td>Oil Bound Distemper</td>
<td>Berger, Nerolac, Asian, ICI Dulux</td>
</tr>
<tr>
<td>19</td>
<td>Cement Paint</td>
<td>Snowcem Plus, Berger, Nerolac</td>
</tr>
<tr>
<td>20</td>
<td>Plastic Emulsion Paint</td>
<td>Berger, ICI, Nerolac, Asian</td>
</tr>
<tr>
<td>21</td>
<td>Other Paints &amp; Primer</td>
<td>ICI Dulux, Asian, Berger, Nerolac</td>
</tr>
<tr>
<td>22</td>
<td>Textured Coating/Paint</td>
<td>Heritage, Unite, Spectrum</td>
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<tr>
<td>23</td>
<td>Melamine</td>
<td>ICI Dulux, Timberstone Melamine Coating,</td>
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<tr>
<td>24</td>
<td>Polyurethane Paint</td>
<td>MRF, Nerolac, Textin</td>
</tr>
<tr>
<td>25</td>
<td>Silicon Water Repellent Solution</td>
<td>GE Bayer Silicon, Choksy chemicals, Bal Endura, BASF</td>
</tr>
<tr>
<td>26</td>
<td>Ceramic Tiles (Glazed, Matt, Others)</td>
<td>Kajaria, RAK, NITCO, SOMANY, JOHNSON</td>
</tr>
<tr>
<td>27</td>
<td>Vitrified Tiles</td>
<td>Kajaria, Rak, NITCO, SOMANY, JOHNSON</td>
</tr>
<tr>
<td>28</td>
<td>Laminated Wooden flooring</td>
<td>Pergo, Berry, Floor Master</td>
</tr>
<tr>
<td>29</td>
<td>PVC/ Vinyl Flooring</td>
<td>Polyﬂor, Ger Floor, Tarkett</td>
</tr>
<tr>
<td>30</td>
<td>Terrazzo Tile</td>
<td>NITCO, Unistone, Hindustan</td>
</tr>
<tr>
<td>31</td>
<td>Interlock Tiles, Grass Paver Block</td>
<td>Nimco Prefab, K K Manhole, Hindustan</td>
</tr>
<tr>
<td>32</td>
<td>Cement Concrete Tiles, Designer Tiles</td>
<td>Unistone, Dazzle, Eurocorn,</td>
</tr>
<tr>
<td>33</td>
<td>Laminates &amp; veneers</td>
<td>Century, Greenply, Merino, Archidply</td>
</tr>
<tr>
<td>34</td>
<td>MDF Grade-I as per IS-12406&amp; Ecomark</td>
<td>Century, Greenply, Merino, Archidply</td>
</tr>
<tr>
<td>35</td>
<td>Adhesive for wood work</td>
<td>Dunlop, Fevicol</td>
</tr>
<tr>
<td>36</td>
<td>Pre Laminated Particle Board</td>
<td>Century, Greenply, Merino, Archidply</td>
</tr>
<tr>
<td>37</td>
<td>Plywood, Block Board, Soft Board</td>
<td>Century, Greenply, Merino, Archidply</td>
</tr>
<tr>
<td>38</td>
<td>Paving Stones</td>
<td>Unistone, Nimco Prefab, K K Manhole, Hindustan</td>
</tr>
<tr>
<td>39</td>
<td>Wax Polish</td>
<td>Mansion, Reckitt &amp; Colman</td>
</tr>
<tr>
<td>40</td>
<td>Polyethylene Sealant</td>
<td>MBT, Choksey, Fosroc, Pidilite</td>
</tr>
<tr>
<td>41</td>
<td>Polyeylethane Board, Back Up Rod</td>
<td>Supreme Industries or Equivalent</td>
</tr>
<tr>
<td>42</td>
<td>Stainless Steel Hinges</td>
<td>Hettich, Doorset, Godrej, Dorma</td>
</tr>
<tr>
<td>43</td>
<td>Mirror &amp; Float Glass</td>
<td>Modi Float Glass, Asahi Glass, Saint Gobain</td>
</tr>
<tr>
<td>44</td>
<td>Door Hardware</td>
<td>Godrej, Dorset, Dorma, Hettich</td>
</tr>
<tr>
<td>45</td>
<td>Furniture hardware</td>
<td>Hettich, Blum</td>
</tr>
<tr>
<td>47</td>
<td>Water Stopper</td>
<td>Fixopan, Caliplast or equivalent</td>
</tr>
<tr>
<td>48</td>
<td>Aluminum Composite Panel</td>
<td>Alucobond, Alstrong, Aludecor</td>
</tr>
<tr>
<td>49</td>
<td>Asphalt Emulsion</td>
<td>STP, Karnak Chemical Corporation.</td>
</tr>
<tr>
<td>50</td>
<td>Expansion Fastener</td>
<td>Hilti, Fischer, Canon</td>
</tr>
<tr>
<td>51</td>
<td>Stainless Steel</td>
<td>Salem, Jindal, Cavelier</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Supplier(s)</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>52</td>
<td>Anchor Fastener, Anchor Bolts</td>
<td>Hilti, Fischer, Canon</td>
</tr>
<tr>
<td>53</td>
<td>Gypsum Partition &amp; Gypsum Ceiling with frame</td>
<td>Saint Gobin, Boral, Lafarge, Vans</td>
</tr>
<tr>
<td>54</td>
<td>Impregnated Fibre Board</td>
<td>STP or equivalent</td>
</tr>
<tr>
<td>55</td>
<td>Joint Filler and Bitumen Products</td>
<td>STP or equivalent</td>
</tr>
<tr>
<td>56</td>
<td>Electrodes</td>
<td>Advani-Overlikon, ESAB, Dwekam</td>
</tr>
<tr>
<td>57</td>
<td>Mineral Fibre Ceiling System</td>
<td>Aura, AMF, USG, Decosonic</td>
</tr>
<tr>
<td>58</td>
<td>H.T. Bolts</td>
<td>Unbrako or equivalent</td>
</tr>
<tr>
<td>59</td>
<td>Steel Doors (General purpose)</td>
<td>Shakti Met-Dor or equivalent</td>
</tr>
<tr>
<td>60</td>
<td>Steel Doors (Fire rated)</td>
<td>Global Fire Protection Company, Radiant safe Fire Doors, Godrej, Navair, Shakti Met-Dor</td>
</tr>
<tr>
<td>61</td>
<td>Fire Door (Wooden)</td>
<td>Navair, Aadhunic, Radiant</td>
</tr>
<tr>
<td>62</td>
<td>Aluminum Sections</td>
<td>Jindal, Hindalco, Indo Alusys</td>
</tr>
<tr>
<td>63</td>
<td>Rolling Shutter</td>
<td>Shivam, Milestones, Rama, Prakash</td>
</tr>
<tr>
<td>64</td>
<td>Pre-coated Roof Sheeting</td>
<td>Multicolor, BHP, Bluescope, Japan Metal Systems, Lloyds, CRIL</td>
</tr>
<tr>
<td>65</td>
<td>Glass wool and related products, Mineral wool</td>
<td>UP-Twiga, Owens Corning, Lloyds</td>
</tr>
<tr>
<td>66</td>
<td>Polycarbonate sheets</td>
<td>GE Plastics, Danpalon, Polygal</td>
</tr>
<tr>
<td>67</td>
<td>Self drilling Screws</td>
<td>Hilti, Builtex or equivalent</td>
</tr>
<tr>
<td>68</td>
<td>Logo, Signs, Name plates</td>
<td>D-Line, Sign Sutra, Sameer</td>
</tr>
<tr>
<td>69</td>
<td>Pre-Engineered Building</td>
<td>Kirby Building, Tiger Steel or equivalent</td>
</tr>
<tr>
<td>70</td>
<td>Flush Doors</td>
<td>Merino, Greenlam, Century, Archidply,</td>
</tr>
<tr>
<td>71</td>
<td>MS Sliding Motorized Door</td>
<td>Shivam Associates - Beninca R1524 K System or equivalent</td>
</tr>
<tr>
<td>72</td>
<td>Water proofing compound</td>
<td>Pidilite, Cico, Fosroc, Choksey, Mapei</td>
</tr>
<tr>
<td>73</td>
<td>Fasteners</td>
<td>Gun, Atul, Hilti, Canon</td>
</tr>
<tr>
<td>74</td>
<td>Aluminum fittings</td>
<td>Crown, Nutile, Mecoy</td>
</tr>
<tr>
<td>75</td>
<td>Extruded vitrified clay tile</td>
<td>Duvtex, Unistone, Pioneer</td>
</tr>
<tr>
<td>76</td>
<td>POP</td>
<td>Sriram or equivalent</td>
</tr>
<tr>
<td>77</td>
<td>outdoor furniture (sitting bench, dustbin)</td>
<td>Arhant or equivalent</td>
</tr>
<tr>
<td>78</td>
<td>Modular furniture</td>
<td>Godrej, HNI, Featherlite</td>
</tr>
<tr>
<td>79</td>
<td>Chairs and Sofas</td>
<td>Godrej, HNI, Featherlite</td>
</tr>
<tr>
<td>80</td>
<td>Acoustical paneling</td>
<td>Absound overseas, Anutone, Armstrong</td>
</tr>
<tr>
<td>81</td>
<td>Modular Toilets</td>
<td>Merino, Dorma, Trespa</td>
</tr>
<tr>
<td>82</td>
<td>Mosaic tiles</td>
<td>Nitco, surya, Laxmi</td>
</tr>
<tr>
<td>83</td>
<td>Acoustical False Ceiling</td>
<td>Absound overseas, Anutone, Armstrong</td>
</tr>
<tr>
<td>84</td>
<td>Exterior tiles</td>
<td>Duvtex, Unistone, Pioneer</td>
</tr>
<tr>
<td>85</td>
<td>Patch Fitting/Spider Fitting</td>
<td>D-Line, Hettich, Dorma</td>
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<tr>
<td>86</td>
<td>UPVC Door &amp; Window</td>
<td>Fenesta or Equivalent</td>
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<tr>
<td>87</td>
<td>Acid and alkali resistant tiles</td>
<td>Kajaria, NITCO, Durato</td>
</tr>
<tr>
<td>88</td>
<td>Ceramic Rainscreen ventilated faced tile/Teracotta</td>
<td>Terrial, Soladrih</td>
</tr>
<tr>
<td>89</td>
<td>Roller Blinds</td>
<td>Hunter Douglas / Mac/Vista</td>
</tr>
<tr>
<td>90</td>
<td>GRC Jali</td>
<td>Unistone, Birla GRC, Grasim</td>
</tr>
<tr>
<td>91</td>
<td>Metal Ceiling</td>
<td>Aura, Unimet, Hunter Douglas</td>
</tr>
<tr>
<td>92</td>
<td>Decking Sheet</td>
<td>Tata Bluescope Corus or equivalent</td>
</tr>
<tr>
<td>93</td>
<td>Glass bricks/Blocks</td>
<td>Solaris, Seves or Equivalent</td>
</tr>
<tr>
<td>94</td>
<td>Aluminium standing Seam roofing</td>
<td>Kalzip/Bemo/Sanko/Kingspan</td>
</tr>
<tr>
<td>95</td>
<td>Foam Concrete</td>
<td>Valifoam/Salifoam/AE Foam</td>
</tr>
<tr>
<td>96</td>
<td>Expansion Joints</td>
<td>3R Joints &amp; seals, sandfield, vexcoll</td>
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<tr>
<td>97</td>
<td>Raised/False Access Flooring</td>
<td>Unifloor, Tate, Kingspan</td>
</tr>
<tr>
<td>98</td>
<td>Lifts</td>
<td>Kone, Otis, Mitsubishi, Schinder</td>
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<tr>
<td>99</td>
<td>Calcium Silicate False Ceiling</td>
<td>Aerolite, Armstrong (Mylar/Newton)</td>
</tr>
<tr>
<td>100</td>
<td>“T” Grid For calcium Silicate False Ceiling</td>
<td>RK, Grid System, Gridline</td>
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<tr>
<td>101</td>
<td>Sewage Treatment Plant(STP)</td>
<td>Organic Solutions or Equivalent</td>
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<tr>
<td>ELECTRICAL</td>
<td></td>
<td></td>
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<tr>
<td>-----------------------------------------------</td>
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<tr>
<td><strong>A. ELECTRICAL HIGH SIDE EQUIPMENT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. UPS SYSTEM</td>
<td>EMERSON/3 M POWER / SOCOMAC</td>
<td></td>
</tr>
<tr>
<td>2. INVERTOR</td>
<td>LUMINOUS / MICROTEK / SU-KAM</td>
<td></td>
</tr>
<tr>
<td><strong>B. ELECTRICAL SYSTEM/ PANELS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. FUSES &amp; SWITCH FUSE UNIT</td>
<td>L&amp;T/ ABB/ SCHNEIDER/ GE</td>
<td></td>
</tr>
<tr>
<td>2. ACB / MCCB / CONTACTOR</td>
<td>L&amp;T/ ABB/ SCHNEIDER/ GE</td>
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<tr>
<td>3. METAL CLAD SOCKET</td>
<td>SIEMENS/ MDS/ BHARTIA CUTLUR HAMMER</td>
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</tr>
<tr>
<td>4. RISING MAINS / BUS DUCT</td>
<td>ABB/ SPC ELECTROTECH / SCHNEIDER</td>
<td></td>
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<tr>
<td>5. LED'S LIGHT</td>
<td>PHILIPS/ WIPRO/ BAJAJ</td>
<td></td>
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<tr>
<td>6. ISOLATORS FOR MOTORS</td>
<td>MDS/ SIEMENS/ SCHNEIDER/ ABB/ GE</td>
<td></td>
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<tr>
<td>7. CHANGE OVER SWITCH</td>
<td>HIH-ELCON/ HPL SOCOMAC / GE</td>
<td></td>
</tr>
<tr>
<td>8. CONTACTOR, TIMER, SINGLE PHASE PREVENTOR &amp; OVER LOAD RELAY</td>
<td>L&amp;T/ ABB/ SCHNEIDER/ GE</td>
<td></td>
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<tr>
<td>9. METERS - DIGITAL TYPE</td>
<td>AE/ L&amp;T/ RISHAB/ GE</td>
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<tr>
<td>10. PROTECTIVE &amp; APFC RELAYS</td>
<td>ASLTOM/ ASHIDA/ L&amp;T</td>
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<tr>
<td>11. CT's / PT's - DRY TYPE-EPOXY</td>
<td>AE/ KAPPA</td>
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<tr>
<td>12. INDICATING LAMP / PUSH BUTTON ACTUATORS - LED CLUSTER TYPE</td>
<td>L&amp;T/ SIEMENS/ BCH</td>
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<tr>
<td>13. ROTARY SWITCHES</td>
<td>L&amp;T/ KAYCEE/ BCH</td>
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<tr>
<td>14. TERMINAL BLOCK</td>
<td>ELEMEX/ WAGO</td>
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<tr>
<td>15. LT PANELS</td>
<td>TRICOLITE INDUSTRIES / SPC ELECTROTECH / ADLEC / SCHNEIDER ELECTRIC / C&amp;S/ ABB</td>
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<tr>
<td>16. LIGHTNING ARRESTER</td>
<td>ERICO/ ESE</td>
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<tr>
<td>17. GAS FIRE SUSPERSSION SYSTEM</td>
<td>FIRE LINE/ TYCO FIRE</td>
<td></td>
</tr>
<tr>
<td><strong>C. CABLES/ TERMINATIONS/ ACCESSORIES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. LUGS</td>
<td>DOWELLS/ COMET</td>
<td></td>
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<tr>
<td>2. BRASS CABLE GLANDS</td>
<td>COMMET/ BELIGA</td>
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</tr>
<tr>
<td>3. LT POWER CABLE (ALUMINIUM/ COPPER)</td>
<td>UNIVERSAL/ NICCO/ POLYCAB / SKYTONE/ HAVELLS</td>
<td></td>
</tr>
<tr>
<td>4. CONTROL CABLE (COPPER)</td>
<td>UNIVERSAL/ NICCO/ POLYCAB / SKYTONE/ HAVELLS</td>
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<tr>
<td>5. HT XLPE CABLE</td>
<td>UNIVERSAL / RPG CABLES / NICCO/SKYTEONE</td>
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<tr>
<td>6. H.T. CABLE END TERMINATION</td>
<td>BIRLA 3 M/ REYCHEM/ FRONTEC</td>
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<tr>
<td>7. Fire Survival Cable</td>
<td>AFW FRTEK PRYSMIAN BELDEN</td>
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<tr>
<td><strong>D. CONDUITING &amp; WIRING ACCESSORIES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. MS CONDUIT / GI CONDUIT (ISI MARKED)</td>
<td>BEC/ POLYPACK/ AKG/ATUL</td>
<td></td>
</tr>
<tr>
<td>2. PVC CONDUIT (ISI MARKED)</td>
<td>BEC/ POLYPACK/ AKG/ATUL</td>
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<tr>
<td>3. PVC INSULATED COPPER CONDUCTOR FRLS WIRE</td>
<td>FINOLEX / HAVELLS/ SKYTONE</td>
<td></td>
</tr>
<tr>
<td>4. PLATE TYPE - SWITCHES / SOCKETS / TV &amp; TELEPHONE SOCKETS AND ALL OTHER WIRING ACCESSORIES</td>
<td>M.K/ LEGRAND/ ANCHOR-ROMA</td>
<td></td>
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<tr>
<td>5. ACCESSORIES FOR METALIC / GI CONDUIT ( ISI MARKED )</td>
<td>SHRMA STEEL CORPORATION / PRAKASH ENGINEERING WORKS / SUPER SALES CORPORATION</td>
<td></td>
</tr>
<tr>
<td>6. PVC INSULATION TAPE</td>
<td>STEEL GRIP/ ANCHOR</td>
<td></td>
</tr>
<tr>
<td>7. PHENOL LAMINATED SHEET</td>
<td>HYLUM/ FORMICA</td>
<td></td>
</tr>
<tr>
<td>8. RACEWAYS &amp; CABLE TRAY</td>
<td>CTM ENGG/SWIFT/ OBO BEHERMAN</td>
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</tr>
<tr>
<td><strong>E. LIGHTING DBs &amp; MCBs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. MCB, 10KA</td>
<td>ABB/ GE/ HAGER/ MERLIN GERIN</td>
<td></td>
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<tr>
<td>2. DISTRIBUTION BOARD</td>
<td>MDS/ SPC ELECTROTECH/ L&amp;T/ EATON</td>
<td></td>
</tr>
<tr>
<td>3. ELCB / ELMCB / RCCB</td>
<td>MDS/ GE/ HAGER/ MERLIN GERIN</td>
<td></td>
</tr>
<tr>
<td><strong>LIGHTING FIXTURES &amp; FANS</strong></td>
<td></td>
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<tr>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>BULK HEAD FITTINGS</td>
<td>BAJAJ/ CROMPTON/ PHILIPS</td>
</tr>
<tr>
<td>2</td>
<td>EXHAUST FANS / CEILING FAN / WALL MOUNTED FAN</td>
<td>CROMPTON/ POLAR/ ALMONARD/KHAITAN</td>
</tr>
<tr>
<td>3</td>
<td>LIGHTING FIXTURES</td>
<td>PHILIPS/ BAJAJ/ WIPRO.</td>
</tr>
<tr>
<td>4</td>
<td>LIGHTING CONTROL SYSTEM</td>
<td>SCHNIDER/ PHILIPS/ LUTRON</td>
</tr>
</tbody>
</table>

**G. ELV- TELEPHONE/ CCTV/ DOOR ACCESS/ FIRE ALARM/ PUBLIC ADDRESS & MISC. SYSTEMS**

| 1 | SMOKE DETECTORS | NOTIFIER/ HONEYWELL(Eclipse series)/ Ansel (Tyco)/COOPER |
| 2 | HEAT DETECTORS | NOTIFIER/ HONEYWELL(Eclipse series)/ Ansel (Tyco)/COOPER |
| 3 | MANUAL CALL BOX | NOTIFIER/ HONEYWELL(Eclipse series)/ Ansel (Tyco)/COOPER |
| 4 | HOOTER/ SOUNDER | NOTIFIER/ HONEYWELL(Eclipse series)/ Ansel (Tyco)/COOPER |
| 5 | RESPONSE INDICATOR | Sterling wilson /Tyco/Agni/Sudhir |
| 6 | FIRE PANEL | NOTIFIER/ HONEYWELL(Eclipse series)/ Ansel (Tyco)/COOPER |
| 7 | PA AMPLIFIER | Bosch EV / Paso / Digiton |
| 8 | PA SPEAKERS | Bosch EV / Paso / Digiton |
| 9 | LINE MATCHING TRANSFORMER | Bosch EV / Paso / Digiton |
| 10 | GOOSE NECK MIKE | Bosch EV / Paso / Digiton |
| 11 | INVERTER | TOPAZ INTERNATIONAL/ LUMINOUS/ HYTES |
| 12 | CAMERA WITH ALL ACCESSORIES | HONEYWELL/ PELCO/ BOSCH |
| 13 | ROAD BARRIER | NICE/ MAGNETICS/ GODREJ/ GE |
| 14 | CARD READER | SENSORMATIC-USA/ MOTOROLA/ HONEYWELL(XLS-3000) |
| 15 | MONITOR | LG/ SAMSUNG/ SONY |
| 16 | MULTIPLEXER | SENSORMATIC OR EQUIVALENT |
| 17 | SEQUENCER | ALBA/ VANTAGE |
| 18 | PROXIMITY CARD | MOTOROLA/ HUGHES/ HONEYWELL/GE/SIEMENS |
| 19 | TELEPHONE TAG BLOCK | CTM ENGG/SYSTIMAX/SCHNIEDER/PANDUIT |
| 20 | TELEPHONE CABLES | DELTON/ SKYTEC/ CLIPSAL |
| 21 | CO-AXIAL CABLES | FINOLEX/ DELTON/ SKYTEC |
| 22 | EPABX | ALKATEL/ SIEMENS/ NORTEL |
| 23 | CCTV SYSTEM | HONEYWELL/ SIEMENS/ PELCO |
| 24 | IT & TELECOM SYSTEM | SCHNIEDER/ SYSTIMAX/ PANDUIT |
| 25 | FIRE ALARM SYSTEM | NOTIFIER/ HONEYWELL(Eclipse series)/ Ansel (Tyco)/COOPER |
| 26 | ACCESS CONTROL SYSTEM | HONEYWELL/ SIEMENS/GE |
| 27 | Fire Survival Cable | AFW FRTEK PRYSMIAN BLEN |
| 28 | Feedback Supressor | Bosch EV / Paso / Digiton |
| 29 | Mixer Band Equilizer | Bosch Dynacord / Paso / Digiton |
| 30 | Projector | Barco/ Vivitek / Christie |
| 31 | Ceiling mounting kit for projector | Drapper / Red Leaf / Suvira |
| 32 | Fixed screen | Drapper / Red Leaf / Suvira |

**H. MISCELLANEOUS SYSTEMS**

| 1 | BATTERIES | EXIDE/ STANDARD |
| 2 | BATTERY CHARGER | KELTRON/ NELCO/ EXIDE/ HBL NIFE |
| 3 | EARTHING (ALL TYPE) | Nutech Products, Mahavir Industrial Corporation, Pranav Energy. |

**I. DG/PANEL/TRANSFORMER**

<p>| 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 |</p>
<table>
<thead>
<tr>
<th></th>
<th>PLUMBING SYSTEM</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VITREOUS CHINA SANITARYWARE PARRYWARE, ROCA, HINDWARE, JAQUAR</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PLASTIC W.C. SEATS &amp; COVERS PARRYWARE, ROCA, HINDWARE, JAQUAR</td>
<td>JAQUAR /ESS ESS /GROHE</td>
</tr>
<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>
<td></td>
</tr>
<tr>
<td></td>
<td>SHOWER WITH WALL FLANGE, C.P. WASTE 32-40 mm DIA, BOTTLE TRAP, HEALTH FAUCET</td>
<td></td>
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<tr>
<td></td>
<td>WITH STEEL BEDED CONNECTING PIPE.</td>
<td></td>
</tr>
<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 JAINA /NEELKANT/ANUPAM</td>
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<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>
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<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>
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<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 UNIQUE / ZOLOTO / KENT</td>
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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>
</tr>
<tr>
<td>13</td>
<td>ePVC PIPES SDR.12.5 SCHEDULE-40</td>
<td>ASTRAL POLYTECHNIC PRIVATE LIMITED / ASHIRVAD ENTERPRISES PRIVATE LIMITED / JAIN PLASTICS &amp; CHEMICALS LIMITED / FINOLEX INDUSTRIES</td>
</tr>
<tr>
<td>14</td>
<td>HDPE PIPE</td>
<td>JAIN PLASTICS &amp; CHEMICALS LIMITED / CHEM PLAST INDUSTRIES STUROY POLYMERS LIMITED / KISAN GROUP OF COMPANIES / FINOLEX INDUSTRIES</td>
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<td>15</td>
<td>C.I. CLASS LA PIPES</td>
<td>SFMC TRADING CO, HYDERABAD / 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>HINDUSTAN CEMENT PIPE COMPANY, HYDERABAD / PRAGATI CONCRETE UDYOUG / K.K. SPUN PIPES / J. K. SPUN PIPES / SOOD &amp; SOOD</td>
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<tr>
<td>17</td>
<td>STONEWARE PIPES &amp; GULLY TRAP</td>
<td>MITRA PIPES PVT LTD</td>
</tr>
<tr>
<td>18</td>
<td>GUNMETAL VALVES (FULLWAY, CHECK, GLOBE AND NON RETURN VALVES)</td>
<td>LEADER VALVES LIMITED / ARKAY SALSE CORPORATION DELHI</td>
</tr>
<tr>
<td>19</td>
<td>BALL VALVE</td>
<td>TBS ENGINEERS PVT. LTD. / VIRGO ENGINEERING LTD. / GOOJARMAI GANPATRAI / AUDCO INDIA LIMITED</td>
</tr>
<tr>
<td>20</td>
<td>BUTTERFLY VALVE (LEVER TYPE)</td>
<td>LEADER VALVES LIMITED / CASTLE VALVES LIMITED / AUDCO INDIA LIMITED</td>
</tr>
<tr>
<td>21</td>
<td>BUTTERFLY VALVE (GEAR TYPE)</td>
<td>LEADER VALVES LIMITED / CASTLE VALVES LIMITED / AUDCO INDIA LIMITED / GOOJARMAI GANPATRAI</td>
</tr>
<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</td>
</tr>
<tr>
<td></td>
<td>DESCRIPTION</td>
<td>MANUFACTURER/MAKE</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>
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<tr>
<td>25</td>
<td>FOOT VALVE / CHECK VALVES (BRASS)</td>
<td>LEADER VALVES LIMITED/ INDIAN VALVE CO. LTD.</td>
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<tr>
<td></td>
<td></td>
<td>CALCUTTA/ ADVANCE VALVES (P) LIMITED/ GOOJARMAL</td>
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<td></td>
<td>GANPATRAI/AAROKO 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/</td>
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<tr>
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<td></td>
<td>AAROKO 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/ WEST</td>
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<td></td>
<td></td>
<td>BANGAL IRON COMPANY WEST BANGAL/ SHINING</td>
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<td>ENGINEERING WORKS (FOUNDRY) AGRA.</td>
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<tr>
<td>28</td>
<td>HAND DRIER (304 Grade S.S.)</td>
<td>THE VEERA TRADING COMPANY/ KOPAL ENGG. CORPN. NEW</td>
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<td></td>
<td></td>
<td>DELHI/ ASKON ENGINEERS BOMBAY</td>
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<tr>
<td>29</td>
<td>LIQUID SOAP DISPENSER (304 Grade S.S.)</td>
<td>THE VEERA TRADING COMPANY/ ASKON ENGINEERS BOMBAY</td>
</tr>
<tr>
<td>30</td>
<td>STORAGE TYPE WATER HEATER</td>
<td>VENUS / RACOLD/ BAJAJ OR EQUIVALENT</td>
</tr>
<tr>
<td>31</td>
<td>INSULATION</td>
<td>THERMAFLEX OR EQUIVALENT</td>
</tr>
<tr>
<td>32</td>
<td>SOLAR HOT WATER EQUIPMENT</td>
<td>TATA-BP/ SOLAHART</td>
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<tr>
<td>33</td>
<td>ELECTRICAL HOT WATER HEATER</td>
<td>VENUS/ KINGSTON</td>
</tr>
<tr>
<td>34</td>
<td>PVC FOOT REST &amp;SFRC COVERS</td>
<td>KK MANHOLES OR EQUIVALENT</td>
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**PUMPS AND EQUIPMENTS**

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<th>DESCRIPTION</th>
<th>MANUFACTURER/MAKE</th>
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<tbody>
<tr>
<td>1</td>
<td>WATER TRANSFER PUMPS</td>
<td>ABB/ GROUNDfos/ KIRLOSKAR/ SIEMENS/ CROMPTON</td>
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<td>2</td>
<td>IRRIGATION PUMP</td>
<td>GROUNDfos/ KIRLOSKAR</td>
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<td>3</td>
<td>SUMP PUMP</td>
<td>SALMSON/ ZENIT/ KSB/ GROUNDfos</td>
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<td>WATER LEVEL INDICATOR</td>
<td>ADVANCE OR EQUIVALENT</td>
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<td>5</td>
<td>WATER LEVEL CONTROLLER</td>
<td>ADVANCE OR EQUIVALENT</td>
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<tr>
<td>6</td>
<td>ELECTRONIC SENSING PROBE</td>
<td>ADVANCE OR EQUIVALENT</td>
</tr>
<tr>
<td>7</td>
<td>CHLORINATOR</td>
<td>ASIA LMI Pvt. Ltd/ TOSHNIWAL</td>
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<tr>
<td>8</td>
<td>WATER METER</td>
<td>CRESENT/ KAYEE/ KAPSTAN/ ANAND AASHI</td>
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<tr>
<td>9</td>
<td>SOUNDER PATTERN VALVE FOR FILTER AND SOFTENER</td>
<td>LABLINE/ AIP (AGRICULTURE AND INDUSTRIAL PUMPS.)</td>
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<tr>
<td>10</td>
<td>PRESSURE GAUGE</td>
<td>FIEBIG/ H. GURU</td>
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<td>11</td>
<td>ELECTRICAL PANEL</td>
<td>ABB/ SPC ELECTROTECH /SCHNEIDER/ EATON</td>
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<td>12</td>
<td>NON RETURN VALVE (65mm DIA &amp; ABOVE)</td>
<td>KIRLOSKAR/ LEADER</td>
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<tr>
<td>13</td>
<td>BUTTERFLY VALVE (LEVER TYPE)</td>
<td>LEADER VALVE LIMITED/ CASTLE VALVE LIMITED/ AUDCO</td>
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<tr>
<td></td>
<td></td>
<td>INDIA LIMITED</td>
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<td>14</td>
<td>BUTTERFLY VALVE (GEAR TYPE)</td>
<td>LEADER VALVE LIMITED/ CASTLE VALVE LIMITED/ AUDCO</td>
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<td>INDIA LIMITED</td>
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<td>15</td>
<td>FILTER AND SOFTENER</td>
<td>THERMAX/ WATCON/ BHARTIYA TECHNO CRAFT/ MIGRANI</td>
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<tr>
<td>16</td>
<td>MOTORIZED VALVE</td>
<td>DANFOSS/ HONEYWELL</td>
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<td>17</td>
<td>VIBRATION PAD</td>
<td>RESISTOFLEX/ KANWAL INDUSTRIES</td>
</tr>
<tr>
<td>18</td>
<td>VIBRATION ELIMINATOR</td>
<td>RESISTOFLEX/ KANWAL INDUSTRIES</td>
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**Note:**

Wherever equivalent makes are referred, the same shall be as per BIS and as per approval of Engineer-in-charge/Consultant.

Contractor shall be required to get the items/products approved in respect of their make, finish, texture, colour & such parameters, which are essential.