
**CONSTRUCTION/EXTENSION OF GURU RAMDAS LANGAR HALL
AT
SRI HARMANDER SAHIB, AMRITSAR**

**TENDER DOCUMENT
FOR
PLUMBING/SANITARY WORKS**

Owner : **SHIROMANI GURDWARA PARBANDHAK
COMMITTEE
SRI AMRITSAR.**

Services Consultant: **Narinder Singh,
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**PROJECT: CONSTRUCTION OF GURU RAMDAS LANGAR HALL,
AT SRI HARMINDER SHAB, AMRITSAR**

PLUMBING/SANITARY & FIRE PROTECTION WORKS

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I) SPECIAL CONDITIONS OF CONTRACT

1.0 GENERAL

These special conditions are meant to amplify the specifications and General Conditions of Contract. If any discrepancy is noticed between these conditions, General Conditions of Contract, Specifications, Bills of Quantities and Drawings, the most stringent of the above shall apply for execution of the work as per decision of Project Manager (Client's representative) at site.

The materials, design and workmanship shall satisfy the specifications contained herein and Codes referred to. Where the technical specifications stipulate the requirement in addition to those contained in the Standard Codes and specifications those additional requirements shall also be satisfied. In the absence of any Standard/ Specifications covering any part of the work covered in this tender document, the instruction/ directions of Project Manager will be binding on the contractor.

The scope of this section is to describe materials and systems for complete Plumbing/Sanitary and Fire protection installations of building which form together with the project documents, a complete volume of work and quality description.

All electrical installation shall be of high quality, safe, complete and fully operational including all necessary items and accessories whether or not specified in detail. All electrical work shall be completed in accordance with the regulations and standards to the satisfaction of the Project Manager/Consultants. The general provisions, special provisions and general requirements apply to the entire installation.

The work shall be carried out simultaneously with building work and shall be continued till it is completed satisfactorily along with the completion of essential portions of the building works.

2.0 **OWNER, ARCHITECT, SERVICES CONSULTANTS:**

The Owner, Architects & Services Consultants for the subject work are:

OWNER
SHIROMANI GURDWARA PARBANDHAK COMMITTEE,
AMRITSAR,PUNJAB

SITE
GURU RAMDAS LANGAR HALL.
SRI HARMINDER SAB,
AMRITSAR
PUNJAB.

SERVICES CONSULTANTS
M/s. Narinder Singh Consulting Engineers
G-128, Nariana Vihar,
New Delhi – 110028
E-mail: hvacconsult@hotmail.com

3.0 SCOPE OF WORK

Contractor shall furnish all labour, materials, factory supplied new equipment, transportation and incidentals necessary for supply, installation, testing & commissioning of complete Sprinkler & Drainage Works as described in these documents & drawings.

The works to be executed under the contract comprise as detailed here under for:

3.1 PLUMBING/SANITARY WORKS

Supply, Installing, Testing and Commissioning of following:

- a) Sanitary Fixtures and C.P Fitting (Installation only)
- b) Basement Drainage.
- c) Soil, Waste, Vent Pipe and Fitting/Associate Accessoreis.

3.2 FIRE PROTECTION & SPRINKLER SYSTEM

Supply, Installing, Testing and Commissioning of following:

- a) Fire Hydrant System (Internal)
- b) Automatic Sprinkler System
- c) Fire Extinguisher

4.0 Before commencing the works the Contractor shall supply to the Owner for their approval

- a) Drawings showing the general arrangement of temporary facilities.
- b) Provisions for dealing with any water encountered on the works.
- c) Arrangements and methods of execution including all devices whatsoever for the whole of the works.
- d) Order in which the Contractor proposes to execute the work. This will be indicated by diagrams and description. This will be subject to adjustment and approval by the Owner.
- e) Any other item of specific relevance to the Contract if requested by the Project Manager.

Unless specifically mentioned otherwise all the relevant codes & standards published by the Bureau of India Standards before the acceptance of the contract shall apply and govern in respect of design, workmanship, quality and properties of materials, testing and measurements.

5.0 The contractor shall organise his operations in a workman like manner and take all necessary precautions to provide safety and prevent accidents on the site to both person and property, more so if they will be working in proximity to working machinery of existing plants in operation. The Owner shall have the power in requiring the contractor to adopt from time to time such measures as they may consider necessary to ensure the above requirements. The Owner shall not be responsible for any consequence resulting from violation of safety requirements. In particular the Contractor shall ensure compliance with the following safety codes:-

IS : 3696 (Pt. I) - Safety code for scaffolds and ladders - pt. I, scaffolds.

IS : 3696 (Pt. II) - DO - pt. II - Ladders.

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- IS : 4130 (Pt. III) - Safety code for demolition work.
- IS : 4014 (Pt. II) - Code of practices for steel Tubular Scaffolding - pt. II - Safety Regulations for Scaffolding.
- 6.0** No escalation of any account shall be allowed, till the final completion of work. All duties taxes octroi, turnover tax etc. shall be borne by the contractor.
- 7.0** Latest relevant BIS specifications shall govern this contract and work shall be carried out strictly in accordance of these.
- 8.0** Time is the essence of this contract. The contractor is expected to work in more than one shift. Nothing extra shall be paid for the same.
- 9.0** The Contractor must submit a Time Schedule with the Tender. The same shall be reviewed during the time of execution. Suitable amendments shall be made in the work programme if in the opinion of the Project Manager the progress of the work is not satisfactory. Nothing extra shall be paid for the same.
- 10.0** In case the contractor fails to match the progress of the work to the programme approved by the Project Manager/Owner, the Owner reserves the right to get the complete or a portion of the work executed by any other agency at the risk of the contractor.
- 11.0** The Contractor shall remove all unserviceable material and such other materials as directed by the Owner from time to time from the site, at his own cost and maintain the site clean to the satisfaction of the Owner. Nothing extra shall be paid for the same.
- 12.0** Rates for extra items shall be derived in order, as under :
- i) From the nearest item of the Tender,
 - ii) Actual cost plus 15% towards overheads and profit.
- 13.0** In case of delay a penalty shall be imposed on the contractors as Liquidated Damages. The decision of Project Manager/Owner in this matter shall be final, conclusive and binding on the contractor. Refer Annexure-IV.
- 14.0** The Owner shall not provide any equipment/machine required for any of the operation as described in the drawings, schedule of quantity, specifications etc.
- 15.0** The contractor must get acquainted with the proposed site of the work and the specifications and conditions carefully before tendering. The work shall be executed as per programme approved by the Project Manager/Owner. If part of site is not available for any reason or there is some unavoidable delay in supply of materials stipulated by the Owner, the programme of execution shall be modified accordingly and the contractor shall have no claim for any extras or compensation on this account of delays or work in odd hours since it is the running property. At no point of time the existing services will be disconnected without prior approval of SGPC or Consultants.
- 16.0** Immediately after the award of work, the contractor shall produce samples of all materials to be used and incorporated in the works for approval of the Project Manager. Only materials conforming to the approved samples shall be used in the works.
- 17.0** The architectural and other drawings shall, at all times, be properly correlated for executing any work. Samples shall be prepared for approval before starting any items of work specified by the Project Manager including verifying & getting the layout-approved etc.
- 18.0** Rates quoted for the items in all individual sections shall be valid for carrying out the items of work at any place, any level and at any height.

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- 19.0** Collection and stacking of materials shall include all leads. The rates quoted by the contractor shall hold good irrespective of the source from which the materials are brought so long as they conform to the specifications and as approved by the Project Manager.
- 20.0** The contractor shall be responsible for watch and ward and handling, storing of all materials handed over to him by the Owner or brought by him to the site. Nothing shall be paid to him for this.
- 21.0** The drawings referred to in the tender documents are available for inspection to the intending tenderers in the office of the Project Manager. Tenderers shall inspect the same and acquaint themselves with the work to be executed. The contractor shall have no claim or reference to these drawings in respect of any of the rates after acceptance of the tender.
- 22.0** When required by the Project Manager, the contractor shall supply for the purpose of testing, samples of any materials to be used in the works as per specifications. The contractor shall provide all such samples at his own cost including suitable packages to contain them, to the Owner. All the expenditure required suitable packages to contain them, to the samples, packing them, conveyance, handling & delivery upto the testing charges and fees to be paid in this respect shall be borne by the contractor including cost of all materials and samples.
- 23.0** The period and time limit for virtual completion of the works shall be 12 Calendar Months from the date of issue of work order to commence works or landing over of site in respect of the award of contract. This time period shall be inclusive of the mobilisation period and monsoon period.
- 24.0** Time Schedule shall be submitted by the contractor and it shall be reviewed periodically in consultation with the Consultants and Client. The time schedule of the activities shall be so done by the contractor so as to finish the work within the stipulated, stagewise and total completion time.

The work have to be executed in shifts and all necessary arrangements are to be made by the contractor & nothing extra shall be claimed for the by the Contractor.

- 25.0** Contractor shall obtain comprehensive all risk (CAR) insurance policy to cover damages to and loss of property and person as under :
- a) Civil Work under construction including all adjacent boundary walls, power,lines, water supply lines, sewer lines, road telephone cable etc.
 - b) Material at site including plants, machinery and other perishable items.
 - c) Injury to persons belonging to the Employer & their Employees, Project Managers, Consultants, Suppliers & Visitors to site or adjacent premises.
 - d) Compensation payable under N C A on account of injury to all workers belonging to the contractors or to the sub contractors.
- 26.0** Contractors shall submit once every fortnight, a detailed report of the following :
- a) Materials procured, consumed & balance at site for previous week as well as expected deliveries during next fortnight.
 - b) List of equipment and machinery at site, stand by as well as those under repair & equipment scheduled to arrive during next fortnight.
 - c) Skilled unskilled, labour & supervisors working at site during past week & expected increased in next fortnight.
 - d) Steps proposed for speeding up the progress of work in the next week.

Contractor must appoint full time responsible site Engineer conversant with the nature of works and attend all site meetings etc.

- 27.0** It should be carefully noted that numerous agencies will be working in the project simultaneously and the contractor shall have to work at every stage in close coordination with each of these agencies. He shall have to programme his work accordingly in consultation with other agencies as per sequential requirements as may be decided by the Consultants and Client or simultaneous execution of other components of the work by other agencies may necessitate reorganizing, which shall not be accepted as grounds for any delay or excuse of any nature what so ever.
- 28.0** The contractor should make his own arrangements for water for drinking purpose at his own cost. However he shall be allowed to use the existing supply lines, free of cost, but he shall have to make all necessary distribution system as his own cost.
- 29.0** The contractor shall make his own arrangements for electricity and its distribution. However Electricity Connection, if any available, shall be given at one point at the site, but the Employers do not guarantee uninterrupted supply. For smooth running of work Contractor shall make his own arrangement of DG Set of adequate capacity. Energy thus provided shall be metered and the contractor shall reimburse the cost of energy to the Employer as per prevailing rates.
- 30.0** In arriving at the quantity of materials consumed for reconciliation purpose only the following maximum ceiling limits of wastage (%) shall be allowed over theoretical consumption computed from the quantities certified in the final bill :

Wastage shall not be removed without Client permission.

- 31.0** The Contractor shall submit shop Drawings in 4 set all the works within 7 days of receipt of relevant drawings from the Consultants, for the approval.
- 32.0** Water shall be supplied at one point at site and contractor shall be responsible for providing flow meter and draw water from this point. The cost of flow meter, water line shall be borne by contractor. Also the cost of water consumed will be charged from the contractor at the same rate as actual.

33.0 SAFETY BARRIERS AND CONSTRUCTION SAFETY

The Contractor shall at his own cost provide for the protection and safety of the persons working in the area, safety barriers around all openings in every location and at the periphery and edges of all slabs, staircases and stairwells, lift shafts, ducts etc., all to the approval and satisfaction of the Project Manager. However contractor shall take appropriate safety precautions suitable for specific locations/ situations and as instructed by the Project Managers.

The Contractor shall, in general, be fully responsible for all matters with regard to every form of safety during construction and in connection with the execution of the Works, and the Contractor shall take all necessary precautions and provide at his cost everything necessary to ensure such safety at all times. Should any accidents occur due to the Contractor's failure to comply with such safety requirements and to take all other safety measures necessary, the Contractor shall be fully responsible for all such accidents and he shall bear and pay for all costs and damages in connection therewith and as a consequence thereof. The Contractor shall indemnify the Owner from and against all claims in this regard.

34.0 DISPOSAL OF RUBBISH FROM THE WORKS AND THE SITE AND PROVISION OF SAFETY NETTING/SCREENS BY CONTRACTOR

The Contractor shall at all times keep the Works and the site in clean, neat and tidy condition. All rubbish from the Works and the site shall be collected and deposited in large bins provided on the site for such purpose by the Contractor at his own cost. The rubbish from such bins shall be regularly carted away by the Contractor to rubbish tips and dump yards beyond the site.

35.0 MALPRACTICES

The Contractor shall not try to influence in any manner the employees, staff or anyone else of the Owner and his Consultants and Project Manager by offering undue favours, monetary gains, or any such illegal gratifications for any reason whatsoever. If it is established that the Contractor has indulged in such activity, the Owner reserves the right to terminate the Contract forthwith.

36.0 LIST OF APPROVED MAKES:

The Contractor shall quote for the first make of materials from the list of approved makes. In case of deviations from the same alternate makes with subsequent price reduction to the client shall be quoted by the contractor. The contractor shall clearly indicate the list of materials proposed to be used by him & enclose the same with the tender.

37.0 MATERIALS SUPPLIED BY THE OWNER

The Contractor shall conduct all checks and carry out all tests and obtain test certificates necessary to ascertain and ensure that the Owner supplied materials are in conformity with the requirements stipulated in the Contract Documents. Should any of the Owner supplied materials obtained from any supplier not be in conformity with the requirements stipulated in the Contract Documents then the Contractor shall not take acceptance of such materials and he shall not incorporate them in the Works unless so specifically authorised by the Project Manager/ Consultants and it shall be the Contractor's responsibility to bring this matter to the immediate attention of the Project Manager/Consultants and seek his instructions in respect of the disposal of such materials. Should the Contractor fail to comply with this procedure then all costs and/or delays which are a result and consequence thereof shall be to the account of the Contractor.

With respect to reconciliation of Owner supplied materials, the quantities of such materials allowed towards consumption for the Works by the Contractor shall be the theoretical requirement plus permissible wastage. The theoretical requirement shall be determined by measurements made in accordance with the dimensions shown on the Drawings to which the Works shall be executed. Owner supplied materials used due to any reason whatsoever for replacement and/or rectification work shall not be deemed to be theoretical requirement, and the costs in respect of these materials used for such work shall be borne by the Contractor.

38.0 TOOLS, TACKLES, EQUIPMENTS & SCAFFOLDING

All tools, tackles & equipments necessary for the installation and testing shall be provided by the contractor. The quoted rates shall take into account for providing any such equipment, which may not form part of the installation, but are necessary for the execution of the job. Contractor shall be responsible to make his own arrangement to provide scaffolding/supports etc., necessary for his work. However the contractor may use the civil contractors scaffoldings if available with prior understanding with the civil contractors.

39.0 COMPLETION CERTIFICATE

On completion of the installation a certificate shall be furnished by the contractor countersigned by the Qualified Engineer/Supervisor, under whose direct supervision the installation was carried out.

40.0 GUARANTEE

At the close of the work and before issuance of final certificate of virtual completion by the Project Manager/ Consultants, the contractor shall furnish written guarantee indemnifying the owner against defective materials and workmanship for a period of one year after completion. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to owner, the following :

41.0 STAFF

The contractor shall employ competent qualified, full time Mechanical/Plumbing engineers to direct the work of all installation in accordance with the drawings and specifications. The engineers shall be available at all times at site to receive instructions from the Project Manager., in the day to day activities throughout the duration of contract. The engineer shall correlate the progress of the work in conjunction with all the relevant requirement of Local authority.

42.0 SANITARY ARRANGEMENTS AT SITE

Contractor shall provide and install adequate latrines and urinals for use by the workmen away from the site. He shall ensure that the workmen shall avail of this facility and not commit any nuisance within the area under construction. This provision shall be strictly enforced by the contractor.

ANNEXURE - I

**TO SPECIAL CONDITIONSSUBMITTALS TO BE MADE BY THE CONTRACTOR
DURING THE EXECUTION OF THE WORK**

1. Weekly progress report including number of men employed under each trade, Equipments at site etc.
2. Fortnightly progress report-showing progress against programme.
3. Programme of work for the forth-coming week.
4. Labour and Equipment Deployed at site - programmed requirement VS actual deployed -- weekly.
5. Updated approved monthly PERT Chart along with monthly progress chart -- weekly.
6. Construction Materials by Contractor: status and mobilisation programme - Fortnightly.
7. Owner supplied Materials for the coming (next) month - monthly.
8. Reconciliation of owner supplied materials -- Monthly.
9. Value of work anticipated to be done in the forth coming month including value of any materials / equipment of large value -- Monthly.

ANNEXURE - II

MATERIALS SUPPLIED BY OWNER

The wastage and other conditions in respect of owner supplied materials shall be as given below, with respect to clause 37 of special conditions of contract.

<i>S.No</i>	<i>Material</i>	<i>Unit Price</i>	<i>Issue</i>	<i>Wastage Allowance</i>
1.	Sanitary Fixtures	No.	Free of Cost	No Wastage allowed
2.	Bath Tubs	No.	Free of Cost	No Wastage allowed
3.	C.P. Fittings Fixtures	No.	Free of Cost	No Wastage allowed

The above materials will be delivered to the Contractor in a condition in original packing as supplied by the manufacturers / suppliers.

It shall be the responsibility of the Contractor to inspect/verify all items supplied by the Owner and satisfy himself as to the acceptability of the materials and certify that the materials have been received in good condition. It will be presumed that the contractor has received the materials in good working condition and correct quantities (as stated in the delivery challans) unless he conveys in writing to the contrary with specific details to the Project Manager.

Further handling of materials, transportation of materials from infrastructure site to construction points, etc. where applicable shall be the responsibility of the contractor and nothing extra shall be payable towards the same.

The contractor shall in consultation with Project Manager, accurately workout the requirements of materials for timely delivery. Especially the long delivery items (to be identified after award of the contract) shall be indented well in time so that there is no delay in the supply of these items.

ANNEXURE III

SAFETY REQUIREMENT/GENERAL PRECAUTIONS

1. All workmen to be dressed in approved uniform.
2. All workers to be in good neat appearance.
3. No smoking and tobacco chewing permitted within the premises.
4. All workers to have photo ID card with the following prominently displayed:
 - i) Name of client
 - ii) Name, address and contact number of contractor
 - iii) Name of worker
 - iv) Designation
 - v) Address of worker
 - vi) Worker code number

All the ID cards to be submitted to security department. Subsequently on approval, all cards to be laminated and chained by the contractor.
5. All workers to keep I-Card in visible portion. Card to hung prominently on all working time inside the hotel premises.
6. All workers are subject to security check
7. All contractors to make schedule of entry and exit of all workman. Proper record book to be maintained at site. The record book to be accessible to the Consultant and SGPC Authorities.
8. All tools and plants and refundable material to be noted and verified by the hotel security.
9. All tools and plants to be labeled by the contractor for identification.
10. Insurances/Safeties:
 - i) The contractor shall at this own cost provide for the protection and safety of the persons working in the area. The contractor shall be fully responsible for all matters with regard to every form of safety during construction. Should any accidents occur due to the contractors failure to comply with safety requirements, the contractor shall be fully responsible for all such accidents and he shall bear and pay for all the costs and damages. Rs. 1,00,000/- in each accident at each job site & & to a limit of Rs. 5,00,000/- for all accidents at all job site.
 - ii) Workman compensation.
 - iii) Contractor all risks policy.

Annexure – IV

SCHEDULE OF FISCAL ASPECTS

S. No.	Description	Fiscal Aspect
1.	Period of Completion	Completion Period/Construction Period will be for 12 Months from the date of issue of Notice of Award/Letter of Intent.
2.	Schedule of Rates to Cover Taxes and Duties	The Schedule of Rates (and therefore the Contract Sum) shall be deemed to include and cover for all Excise Duties, Sales Tax on works contract, Sales Tax on material, Transport Charges, Entry Tax, Service Tax, VAT, Octrol, labour cess, Education cess, E.S.I & PF for labours, Toll Tax, Stamp Duties, Central and State Government or local body or Municipal Taxes or Duties and / or taxes or duties from any other body whatsoever which shall be applicable from time to time. The final short listed contractors will be asked to submit detailed schedule of rates showing tax component separately before issue of LOI.
3.	Space & Labour hutment	Will not be allowed at site, contractor shall be responsible for the making its own arrangements.
4.	Contractor Store, site offices and other facilities	Owner will give the space for temporary offices and temporary storage for the tools & tackles. Contractor will be responsible for safety and security of its materials.
5.	Nominate Sub-Contractor	The Contractor can consider to nominate sub- contractors with the prior to approval of Project Manager.
6.	Over time Work.	Nothing extra shall be paid on this account.
7.	No financial or other compensation for delays	Nothing extra shall be paid on this account. No escalation is payable on any account.
8.	Liquidated Damages	The Contractor should submit the bar chart based on period of completion mentioned in the tender before issue of the Notice of Award/L.O.I. The approval of submitted bar chart is necessary from the Project Manager. If Project Manager is not satisfied with the submitted bar chart from the contractor, then in this case contractor has to follow the Project Manager bar chart based on the period of completion mentioned in the tender. The Milestones will be derived from the approved bar chart from the Project Manager at the time of issue of Notice of Award/LOI. If any Milestone is not achieved by the contractor, the contractor shall pay the Owner 1.00% (one percent) of the Contract Sum per week of delay, limited to ten percent (10%) maximum of the Contract Sum (inclusive of amounts, increases or decreases, in respect of change orders). The LIQUIDATED DAMAGES shall be applicable on the entire contract amount.
9.	Variation in tender quantity	Overall Variation Limit to be \pm 25% of the Contract Sum.
10.	Interface with other vendor/ Coordination with the others vendor	Contractor shall be responsible for the coordination with other contractors working at the site for smooth work progress of the project.
11.	Termination by Owner	The Owner, may without, prejudice to any other right or remedy and after giving the contractor seven days notice in writing, terminate the employment of the contractor and take charge of all materials,

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S. No.	Description	Fiscal Aspect
		equipment, tools, and plant and machinery thereon and use these as the Owner's property for the completion of the Project, subject to conditions listed in the tender document.
12.	Termination by Contractor	In case the Work remains suspended (Totally Stopped) for a continuous period of more than Six (6) Months by or at the instance of the Owner or on account of any court orders not arising out of any misconduct of the Contract, or because of any Force- majeure causes, the contractor shall be entitled to Terminate this contract by serving one month's notice in writing and thereupon to have the accounts settled with the Owner, subject to conditions mentioned in the detailed tender document.
13.	Water & Electricity	Water & Electricity required for the installation/ construction purposes shall be provided at one location or chargeable basis. The Contractor shall provide at its own cost distribution as per its requirements and therefore the costs of cable, switches, fuses etc shall be borne by the Contractor. However the Owner shall not be responsible to pay any compensation for any interruption in the supply of electricity & contractor has to arrange his own backup at his own cost. No compensation shall be entertained on this account & there will no relaxation on liquidated damage clause.
14.	Site Cleaning	The Contractor shall maintain the site and all work thereon in clean condition at all times. The contractor shall remove all scrap, debris and other unwanted material from the site and as directed by the Project Manager. In case of default the owner shall have the right to clean the site from the other agency and the cost for it shall be debited to the contractor account.
15.	With Holding Payment	The Project – Manager may withhold payment on account of subsequently discovered evidence and nullify the whole or a part of any payment certificate to such extent as may be necessary to protect the Owner from loss on account of including but not limited to the following. (i). Defective work not remedied by the Contractor. (ii) Failure of the Contractor to make payments properly and regularly to his own workers, to his sub- contractors, to his suppliers. (iii) Damage by the contractor to the work of other contractors, sub-Contractors or vendors etc.
16.	Insurance	Before commencing the execution of the work, the contractor, without hunting his obligations and responsibilities under this contract shall insure in the joint names of the contractor and owner, latter being the beneficiary, against his liability for nay maerial or physical damages, loss or injury which may occur to any property, including that of the owner/Project Manager/Architect, Sub-Contractors, Vendors or a member of the general public by or arising out of the execution of the work or in carrying out the contract. It shall be obligatory for the Contractor to obtain and retain for all relevant times the insurance cover (in the joint nemes of the contractor and owner/Project Manager, latter being the beneficiary) under the policies mentioned in the tender document. The sum to be insured shall also cover the value of entire contract sum including the cost of owner supplied material. The validity of the insurance policy will be valid upto 120 days after the contract period or extended as mutually agreed from time to time.

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S. No.	Description	Fiscal Aspect
17.	Running/Interim Bills	One bill in a month. There shall be no minimum value of bill, however Contractor shall submit the cash flow statement within the 15 days of issue of notice of Award/LOI.
18.	Running Bills cerification and payment	Within 30 days of submission of R. A. Bill/Invoice.
19.	Final bill Payment	Within 120 days working days after receipt of contractors final bill complete in all respects.
20.	Retention Money	Deduction towards retentation money shall be 10% of the value of work done of each RA bill, subject to a maximum of 5% of the contract sum. 50% Retention money will be released after issue of virtual completion/Certificate from the Project Manager. Balance 50% will be released after satisfactory completion of defect liability period.
21.	Secured advance against materials	Not applicable. All payment made as per the payment terms.
22.	Defects Liability Period	12 Months from the date of final commissioning as certified by the Project Manager. Where extended Guarantee periods are stipulated in the Contract Documents for particular parts of the Works, the Contractor shall furnish appropriate guarantees in approved formats for same before issuance of the Final Completion Certificate from the Owner or its representative.
23.	Performance Bank Guarantee	To be submitted with in 10 days from the date of issue of Notice of Award/LOI for the 10% of the Contract sum in the form of bank gurantee as per the approved format valid up to 3 (Three) months after the end of the Defect Liability Period .
24.	Mobilisation Advance	Refer Para-1 above
25.	Others	The Contractor shall also submit within fifteen days of the award of

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S. No.	Description	Fiscal Aspect
		works, a detailed schedule along with dates for material delivery for the project, a list of machinery and equipment to be used on the site along with site utilization plan showing the placement of equipment, machinery, material stacking areas, temporary stores/ sheds, workshops and site offices etc., a list of tests to be conducted at and off site, a cash flow statement for the project. Any deviations from the list of approved makes and vendors must be brought to the notice of the Project Manager and a substitute got approved well in advance of the actual execution. All subcontractors and specialized agencies must be got approved from the Project Manager.
27.	Extra Item	Basic Cost of Material +labour Cost + 15% of basic cost of material and labour cost towards CP, overhead, tools and plant machinery, transportation, loading/unloading etc. of the works contract tax and service tax shall be paid extra on actuals.

II) TECHNICAL SPECIFICATIONS:

A) SANITARY FIXTURES:

1.0 SCOPE OF WORK:

- 1.1 Work under this section shall consist of furnishing all material and labour necessary and required to completely install all sanitary fixtures, chromium plated fittings and accessories as required by the drawings specified hereinafter and given in the Schedule of Quantities.
- 1.2 Without restricting to the generality of the foregoing the sanitary fixtures & C.P. fittings shall include the following:
- a) Sanitary fixtures
 - b) Chromium plated fittings
 - c) Stainless steel sinks
 - d) Accessories e.g toilet paper holders, coat hook, dispenser etc.
 - e) Mirror
- 1.3 Whether specifically mentioned or not all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required.
- 1.4 All exposed pipes within toilets and near fixtures shall be chromium plated brass or copper unless otherwise specified.

2.0 GENERAL REQUIREMENTS:

- 2.1 All materials shall be new and of best quality confirming to specification and subject to the approval of the Architect/Consultants. Wherever particular makes are mentioned, the choice of selection shall remain with the Owner/Architect.
- 2.2 Sanitary fixtures shall be of the best quality approved by the Owner/Architect. Wherever particular makes are mentioned, the choice of selection shall remain with the Owner/Architect.
- 2.3 All Appliances, fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, specifications, drawings. Accessories shall include proper fixing arrangement, brackets, nuts, bolts, screws and required connection pieces.
- 2.4 Fixing screws shall be half round head chromium plated brass screws with C.P. washers where necessary.
- 2.5 Porcelain sanitary ware shall be glazed vitreous china of first quality free from warps, cracks and glazing defects confirming to I.S. 2556.
- 2.6 Sinks for pantry or kitchen shall be stainless steel or as specified in the schedule of quantities.
- 2.7 Chromium plated fittings shall be cast brass chromium plated of the best quality approved by the Owner/Architects.
- 2.8 All Appliances, fittings and fixtures shall be fixed in a neat workmanlike manner true to level and heights shown 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, Filing Plaster, Paint, insulation or terrace shall be made good by the Contractor at his own cost.
- 2.9 Sanitary appliances, subject to the type of appliance and specific requirements, shall be fixed in accordance with the relevant standards and the following :

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- a) Contractor shall, during the entire period of installation and afterwards protect the appliances by providing suitable cover or any other protection so as to absolutely prevent any damage to the appliances until handing over. (The original protective wrapping shall be left in position for as long as possible).
 - b) The appliance shall be fixed in a manner such that it will facilitate subsequent removal if necessary.
 - c) All appliances shall be securely fixed. Manufacturers' brackets and fixing methods shall be used wherever possible. Compatible rust- proofed fixings shall be used. Fixing shall be done in a manner that minimizes noise transmission.
 - d) Pipe connections shall be made with demountable unions. Pipe work shall not be fixed in a manner that it supports or partially supports an appliance.
 - e) Appliances shall be fixed so that water falls to the outlet.
 - f) Appliances shall be fixed true to level firmly fixed to anchor or supports provided by the manufacturer and additional anchors or supports where necessary.
- 2.10 Sizes of Sanitary fixtures given in the Specifications or in the Schedule of Quantities are for identification with reference to the catalogues of makes considered. Dimensions of similar models of other makes may vary within $\pm 10\%$ and the same shall be provided and no claim for extra payment shall be entertained nor shall any payment be deducted on this account.

3.0 EUROPEAN WATER CLOSET:

- a) WC shall be single or double siphonic wash down type floor wall mounted set, as shown in the drawings, flushed by means of a flushing cistern.
- b) Each W.C. set shall be provided with a solid plastic seat of colour given in the schedule of quantities, rubber buffers and chromium plated hinges. Plastic seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C.
- c) Flush pipe/bend shall be connected to the Water Closet by means of suitable rubber adapter.
- d) Wall hung Water Closet shall be supported by C.I. chair.

4.0 URINALS:

- 4.1 Urinals shall be lipped type half stall white glazed vitreous china of best quality and size as mentioned in the Schedule of Quantities.
- 4.2 Half stall urinals shall be provided with 15 mm dia C.P. spreader, 32 mm dia C.P. domical waste and C.P. cast brass bottle trap with pipe and wall flange and shall be fixed to wall by C.I. brackets, C.I. wall clips and CP brass screws as recommended by manufacturer complete as directed by Architect/Consultants.
- 4.3 Flushing for urinals shall be by means of no hand operation, infra-red electric flush valve with complete kit of plumbing, infra-red photo cells, solenoid valve. The automatic flush sensor plate shall be flush and press fitted and be of high quality mirror polish finish. Each urinal shall be provided with one flush valve unit.
- 4.4 Flush pipes shall be GI pipes concealed in wall chase but with chromium plated bends at inlet and outlet or as given in Schedule of Quantities. These shall be measured and paid for separately.
- 4.5 GI waste pipes shall be provided for urinals wash basin, sink.

5.0 URINAL PARTITIONS:

- 5.1 Urinal partitions shall be white glazed vitreous china of size specified in the Schedule of Quantities.
- 5.2 Porcelain partitions shall be fixed at proper heights with CP brass bolts, anchor fasteners and MS clips as recommended by the manufacturer and directed by the Architect/Consultants.

6.0 WASH HAND BASIN :

- 6.1 Wash basins shall be coloured or white glazed vitreous china of best quality, size, shape and type specified in the Schedule of Quantities.
- 6.2 Each basin shall be provided with painted MS angle or CI brackets and clips and the basin securely fixed to wall. Placing of basins over the brackets without secure fixing shall not be accepted. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Architect/Consultants.
- 6.3 Each basin shall be provided with 32 mm dia C.P. waste of standard pattern with pop-up waste or rubber plug and chain as specified in the Schedule of Quantities, 32 mm dia C.P. brass bottle trap and angle valve with C.P. pipe to wall and flange as given in the schedule of quantities.
- 6.4 Each basin shall be provided with single hole mixing fitting or as specified in the Schedule of Quantities.
- 6.5 Basins shall be fixed at proper heights as shown on drawings. If height is not specified, the rim level shall be 79 cms or as directed by Architect/Consultants.

7.0 SINKS :

- 7.1 Sinks shall be white glazed fireclay or vitreous china or stainless steel or any other material as specified in the Schedule of Quantities.
- 7.2 Each sink shall be provided with M.S. or C.I. brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable painted angle iron brackets or clips as recommended by the manufacturer. Each sink shall be provided with 40 mm dia C.P. waste with china and rubber plug with CP Brass chain as given in the Schedule of Quantities. The MS Angle shall be provided with Two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Architect/Consultants.
- 7.3 Each sink shall be provided with hot and cold mixing fittings or CP taps as specified in the schedule of quantities.

8.0 SHOWER SET:

- 8.1 Shower set shall comprise of single lever shower mixer, C.P. Shower arm with wall flange and shower head of approved quality or as specified in the Bill of Quantities or supplied by the project Manager.

Shower Mixer and shower arm shall be so fixed as to keep the wall flange clear off the finished wall. Wall flanges embedded in the finishing shall not be accepted.

9.0 BATH TUB

- 9.1 Bath Tub shall comprise of Bath tub mixer, Telephonic shower arrangement of approved quality or as specified in the bill of quantities or supported by the project manager.
- 9.1 40mm dia 'P' Trap.
- 9.2 40mm dia drain & overflow assembly
- 9.3 Spout

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10.0 MIRRORS :

- 10.1 Mirrors shall be electro coated copper 5.5mm thick of approved make. The size shall be as specified in the Schedule of Quantities or as shown on the drawings. The image shall be clear and without waviness at all angles of vision.
- 10.2 Mirrors shall be provided with backing of 12mm thick marine plywood or 6mm thick cement asbestos sheet fixed with CP brass semi round headed screws and cup washers or CP brass clamps as specified or instructed by Architect/Consultants.

11.0 TOILET PAPER HOLDER :

- 11.1 Toilet paper holder shall be of CP brass, powder coated/S.S. heavy duty of approved make and colour or as specified in Bill of Quantities.

12.0 TOWEL RAIL :

- 12.1 Towel rail shall be of C.P. brass with reinforced bends and circular flanges. The size of the rail shall be as specified. The brackets shall be fixed by means of CP brass screws to wooden cleats firmly embedded in the wall.

13.0 HAND DRIER :

- 13.1 The hand drier shall be no touch operating type with solid state time delay to allow user to keep hand in any position.
- 13.2 The hand drier shall be fully hygienic, rated for continuous repeat use (CRU).
- 13.3 The rating of hand drier shall be such that time required to dry a pair of hands up to wrists is approximately 30 seconds.
- 13.4 The hand drier shall be of wall mounting type suitable for 230V, single phase, 50 Hz, AC power supply.

14.0 TOILETS FOR DISABLED:

- 14.1 Where specified in washroom facilities designed to accommodate physically handicapped, accessories should be provided as directed by the Project Manager.
- 14.2 Stainless steel grab bars of required size suitable for concealed or exposed mounting and non-slip gripping surface shall be provided in all washrooms to be used by physically handicapped as directed by the Project Manager.

15.0 ACCESSORIES:

- 15.1 All C.P. bib taps and Angle valves shall be quarter turn-type washerless fittings. The angle valve shall be provided with stainless steel mesh filter.
- 15.2 Contractor shall install all chromium plated stainless steel and powder coated accessories as shown on the drawings or directed by Architect/Consultants and given in the Schedule of Quantities.
- 15.3 All C.P. accessories shall be fixed with C.P. brass half round head screws and cut washers in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by Architect/Consultants.
- 15.4 Joints/ gaps between all sanitary appliances/fixtures and the floor/ walls shall be caulked with an approved mildew resistant sealant, having anti-fungal properties, of colour and shade to match that of the appliance/ fixture and the floor/ wall to the extent possible.

16.0 TESTING:

All appliances, fixtures and fittings shall be tested before and after installation. Water seals of all appliances shall be tested. The Contractor shall block the ends of waste and ventilation pipes and shall conduct an air test with a pressure of 38mm water gauge for minimum of 3 minutes in accordance with BS:5572.

17.0 MEASUREMENT

- 17.1 Sanitary fixtures shall be measured by numbers.
- 17.2 Rate for providing and fixing of sanitary fixtures, accessories shall include all items, and operations stated in the respective specifications and Schedule of Quantities and nothing extra is payable.
- 17.3 Rates for all items under specifications paras above shall be inclusive of cutting holes and chases and making good the same, C.P. brass screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning etc. complete.
- 17.4 Mirrors shall be measured on surface area basis in sqm/Nos.

B) SOIL, WASTE, VENT & RAIN WATER PIPES/BASEMENT DRAINAGE/PLANTER DRAINAGE:

1.0 SCOPE OF WORK :

- 1.1 Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent, AHU drain, Rain water pipes, drainage sump riser and fittings as required by the drawings and given in the Schedule of Quantities.
- 1.2 Without restricting to the generality of the foregoing, the soil, waste, vent pipe rain water system shall include the following :-
- a) Horizontal and Vertical C.I. soil, waste and vent pipes, and fittings, Drip seal joint, clamps and connection to fixtures.
 - b) Floor and Urinal traps, Floor Drain, Cleanout plugs, G.I. inlet fittings and CP brass/stainless steel grating.
 - c) Waste pipe connection from all fixtures e.g wash basins, sinks, urinals, kitchen equipments and plant room equipment.
 - d) UPVC/CI Rain water pipes/CI LA Drainage Sump Pump Riser.
 - e) UPVC sump vent pipe and fittings.

2.0 GENERAL :

- 2.1 All materials shall be new of the best quality conforming to IS codes and specifications and subject to the approval of Consultants.
- 2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.
- 2.3 Pipes shall be fixed in a manner as to provided easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.
- 2.4 Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified.
- 2.5 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.
- 2.6 All work shall be executed as directed by the Engineer-in-charge.

3.0 CENTRIFUGAL CAST IRON (SPUN) PIPE :

- 3.1 Soil, waste, vent and anti-siphonage pipes, fittings and accessories shall be centrifugal cast iron (spun). All pipes shall be straight and smooth and their inside free from irregular bore, blow holes, cracks and other manufacturing defects. Pipes shall be centrifugally cast (spun) iron soil pipes conforming to IS: 3989-1984.

- 3.2 Standard weight, dimensions and pig lead required for joints shall be as follows:

For pipes conforming to IS:3989-1984 (centrifugally spun C.I pipes)

S.No.	Nominal	Diameter	Thickness	Overall weight 6' length 1.83 mm	Internal diameter of socket	Depth of lead
	In	Mm	mm	Kg	mm	Mm
1	3	75	3.5	12.7	99	25
2	4	100	4.0	19.2	126	25
3	6	150	5.5	35.5	178	38

3.3 Tolerance:

Acceptable tolerance for pipes to IS:3989 shall be as follows:

a)	Wall thickness	- 15%
b)	Length	+20 mm
c)	Weight	-10%

4.0 FITTINGS :

- 4.1 Fittings shall conform to the same Indian Standard (IS : 3989-1984) for pipes. Contractor shall use pipes and fittings of matching specifications.
- 4.2 Fittings shall be of the required degree of curvature with or without access door as detailed in the drawings or as directed.
- 4.3 Access door shall be made up with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal later. The fixing shall be air and water tight.

5.0 FIXING :

- 5.1 All vertical pipes shall be fixed by MS 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).
- 5.2 Horizontal pipes running along ceiling shall be fixed on structural adjustable clamps of special design shown on the drawings or as directed. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.
- 5.3 Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the building Contractor for making such provisions in the structure as necessary. All damages shall be made good by the Contractor at his own cost to restore the surfaces.

6.0 CLAMPS :

- 6.1 Holder bat clamps shall be of standard design fabricated from MS flats 40x3mm thick and 12mm dia MS rod and 6mm nuts and bolts; painted with two coats of black bitumen paint before fixing. The clamps shall be fixed in cement concrete 1:2:4 mix (1 cement : 2 sand : 4 stone aggregate 20mm nominal size) blocks 100x100x100mm deep.
- 6.2 Where holder bat clamps are to be fixed in RCC column or slotted angles, walls or beam they shall be fixed with 40x3mm flat iron "U" type clamps with anchor fasteners of approved design.
- 6.3 Structural clamps shall be fabricated from MS structural members e.g. rods, angles, channels, flats as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding material and paint the clamps with one coat of red oxide and two or more coats of black enamel paint to give an even shade.
- 6.4 Wherever MS clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement, RCC block and making good with cement concrete 1:2:4 mix (1 cement : 2 sand : 4 stone aggregate 20mm nominal size) as directed by the Architect/Consultants.

7.0 TRAPS :

7.1 Floor Trap:

Floor trap 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 of size 300mm x 300mm and of required depth, firmly supported on the structural floor. The blocks shall be in 1 :2 :4 mix (1 cement : 2 coarse : 4 stone aggregate 20mm nominal size) and extended to 40mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks at no extra cost.

7.2 Urinal Trap:

Urinal traps shall be cast iron P or S traps with or without vent and set in cement concrete block specified under Clause 7.1 Floor Trap without extra charge.

7.3 Floor Trap Inlet/GI Inlet Fitting:

Traps and connections shall ensure free and silent flow of discharging water. Where specified, Contractor shall provide a special type cast iron or G.I. inlet hopper without or with one or two or three inlet sockets to receive the waste pipe. Joint between G.I. waste pipe and hopper inlet socket shall be Drip seal joint. Hopper shall be connected to a CI 'P' or 'S' trap with at least 50mm seal (hopper and traps shall be paid for separately). Floor trap inlet hoppers and the traps shall be set in cement concrete blocks as specified under clause 7.1 Floor trap above without extra charge.

8.0 CP/S.S. GRATING :

Floor and Urinal Traps, Floor drain shall be provided with 80-125 mm square or round C.P./stainless steel grating with rim of approved design and shape. Minimum thickness shall be 4 mm or as specified in the Schedule of Quantities.

9.0 JOINTING :

Soil, waste, vent and anti-siphonage pipes shall be jointed with Drip seal joint.

The following minimum procedures shall be complied with while making the pipe joints :-

- a) Ensure that the pipes are clean internally and undamaged.
- b) The pipes shall be cut square with sharp tools.
- c) The cut ends of the pipes shall be filed/ reamed and finished smooth.
- d) Any deformed ends shall be re-rounded.
- e) It shall be ensured that the pipe ends shall enter the fittings and sockets to full depth of the jointing area.
- f) The pipe work shall be assembled in a manner such that it does not entail making of joints in restricted locations.
- g) Each metal pipe spigot shall be centered with three lightly wedged pieces of hardwood or folded lead.
- h) The jointing surfaces shall be cleaned to remove any coatings or cutting oils, etc.

10.0 CI LA PIPE AND FITTING:

10.1 Sump Pump discharge Pipe/Rain Water horizontal header running at Basement ceiling/Rain Water Pipe running underground shall be centrifugally cast [spum] iron pressure pipe {class LA} conforming to IS 1536:2001

10.2 Dimension, Standard weight shall be as follows

Nominal Diameter DN mm	Barial			Socket Mass kg	Total for one working Length L in kg (Approved is Length)				
	DE mm	E mm	Mass for 1 Meter kg		3.66 m	4 m	4.5 m	5 m	5.5 m
80	98	7.2	14.7	5.5	59	64	72	79	87
100	118	7.5	18.6	7.1	75	82	91	100	109
125	144	7.9	24.2	9.2	97.8	106	118	130	142
150	170	8.3	30.1	11.5	122	132	147	162	177
200	222	9.2	44.0	16.8	178	193	215	237	259
250	274	10	59.0	22.9	240	260	290	319	349
300	326	10.8	76.5	29.8	310	336	374	412	450
350	378	11.7	96.3	37.5	390	423	471	519	567

10.3 Fitting for CI LA Pipe shall confirm to IS : 1538 – 1967 where possible junction from branch pipe shall be made by a 'Y' Tee.

11.0 CLEAN OUT PLUGS :

11.1 Contractor shall provide cast brass clean out plugs as required. Clean out plugs shall be threaded and provided with key holes for opening. Clean out plugs shall be fixed to the pipe by a GI socket and lead caulked joint.

12.0 WASTE PIPE FROM APPLIANCES :

12.1 Waste pipe from appliances e.g. washbasins, sinks and urinals etc. shall be of Galvanised-iron (GI) heavy duty (class 'c') conforming to IS : 1239 Part I as given in the Schedule of Quantities.

12.2 All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps as directed by the Architect/Consultants. Spacing for the clamps shall be 3000mm for vertical runs and 2400mm for horizontal runs.

12.3 Pipes shall be galvanized steel tubes conforming to IS : 1239 (Heavy Class) and quality certificates shall be furnished. Pipes shall be provided with all required malleable fittings conforming to IS : 1879 e.g. tees, couplings, bends, elbows, unions, reducers, nipples, plugs etc. All GI waste pipes shall be terminated at the point of connection with the appliance with an outlet of suitable diameter. Pipes in chase shall be painted with two coats of black bitumestic paint and exposed pipes with one coat of red oxide primer and two or more coats of synthetic enamel paint or as given in the Schedule of Quantities.

13.0 WC PAN CONNECTORS:

TECHANICAL SPECIFICATION OF WC PAN CONNECTOR:

13.1 The WC pan connector shall be flexible/soft and shall be made of single body construction with integral fins, made from EVA (Ethgl vinyl Acetate). The pan connector must confirm to BS 5627:

1984. The pan connector must be supplied with one seal made of TPE (Thermo plastic Elastomeric). The pan connector must be supplied with factory fitted spring loaded seal guard.

13.2 The connector shall not be allowed to come in contact with mineral oil, grease, putty or any compound containing mineral oil or grease.

13.3 The pan connector must be stored away from direct sun light and flames.

13.4 **FIXING:**

The soil pipe must be reasonably clean and smooth on the inner surface, in case the soil piping is in C.I material then supplier supplied bush/adaptor shall be used.

The connector socket is pushed fully home on to the pan spigot, the reafter the WC is placed in position gently pushing the fitment to ensure that the connector end fits into the spigot of the pipe. The pan connector must be pushed in such an way as to ensure that the seats and fins turn inward to ensure proper sealing.

14.0 CEMENT CONCRETE:

Cast iron soil and waste pipes under floor in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate 12 mm size) 75 mm in bed and around. When pipes are running well above the structural slab, the encased pipe shall be supported with suitable cement concrete pillars of required height at intervals of 1.8 m.

15.0 PAINTING :

15.1 Soil, waste, vent and anti-siphonage pipes in any exposed location in shafts, pipe spaces etc. shall be painted with two coats of primer and two or more coats of synthetic enamel paint of colour as specified to given an even shade.

15.2 Pipes shall be painted with paint of approved quality and shade in accordance with approved pipe colour code.

15.3 GI waste pipes in chase shall be painted with two coats of bitumen paint. Exposed pipes shall be painted with two or more coats of synthetic enamel paint over two coats of etch primer.

15.4 CI soil and waste pipes below ground and those covered in cement concrete shall not be painted.

16.0 CUTTING AND MAKING GOOD HOLES/ CHASES :

16.1 Pipes shall be fixed and tested as the building work proceeds. Contractor shall provide all necessary holes, cut outs and chases in structural members as the building work proceeds. Wherever holes are cut or left originally, they shall be made good with cement concrete 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregated 20mm nominal size) or cement mortar 1 : 2 (1 cement : 2 coarse sand) as directed by the Architect/Consultants and the surface restored as in original condition to the entire satisfaction of the Architect/Consultants at no extra cost.

17.0 TESTING :

17.1 Testing shall be done in accordance with IS : 1172 and IS:5329 except as may be modified hereinunder.

17.2 Before use at site all CI pipes shall be tested by filling up with water for at least 30 minutes. 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.

17.3 Soil and waste pipes shall be tested in sections after installation, by filling up the stack with water. All openings and connections shall be suitably plugged as approved by the Architect/Consultants. The total head in the stack shall be 4.5m at the highest point of the section under test. The period

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of test shall be two (2) hours minimum as directed by the Architect/Consultants. If any leakage is visible, the defective part of the work shall be cut out and made good.

- 17.4 The Contractor shall test all vent pipes by a smoke testing machine. Smoke shall be pumped into the stack after plugging all inlets and connections. The stack shall then be observed for leakages and all defective pipes and fittings removed or repaired as directed by the Architect/Consultants.
- 17.5 A test register shall be maintained and all entries signed and dated by Contractor and Architect/Consultants. A proforma of the proposed test register shall be submitted to the Architect/Consultants for approval.
- 17.6 All pipes in wall chase or meant to be chased or buried shall be hydro tested before the chase is plastered or the pipe encased or buried.

18.0 UPVC PIPES & FITTINGS:

18.1 UPVC PIPE AND FITTINGS FOR RAIN WATER DISPOSAL SYSTEM :

- 18.1.1 Rain water pipe shall be UPVC SWR Type A conforming to IS : 13592-1992.
- 18.1.2 Dimension of SWR Pipe Fittings shall be as per DIN 19531 and DIN 19534 and conforms to IS : 14735-1999.

Rubber ring shall be conforming to IS : 5382.

18.1.3 DIMENSION OF SWR PIPES CONFORMING TO IS : 13592-1992

S.No.	Nominal Outside diameter(D) mm	Toleran Of Outside diameter	Wall Thickness – Type A (t) mm		Wall Thickness – Type B (t) mm	
			Min in	Max	Min	Max
1.	75	+0.3	1.8	2.2	3.2	3.8
2.	90	+0.4	1.9	2.3	3.2	3.8
3.	110	+0.4	2.2	2.7	3.2	3.8
4.	160	+0.5	3.2	3.8	4.0	4.6

18.1.4 Maximum Support Distance in Meter :

S.No.	Size (mm)	Horizontal Support Distance (m)	Vertical SupportDistance (m)
1.	40	0.4	1.2
2.	50	0.5	1.5
3.	75	0.75	2.0
4.	110	1.1	2.0
5.	160	1.6	2.0

- 18.1.5 Rubber ring shall be of make and type approved by Pipe and fitting manufacturer. Rubber ring joint shall be made in an approved manner as recommended by the manufacturer.
- 18.1.6 For testing, seal hermetically at all opening below the top of the section to be tested. The water level shall then be raised to a height of not less than 3m above the highest point of the section being tested or as the inspection offer may direct. Every joint shall be carefully examined for leaks.

19.2 UPVC PIPE AND FITTING FOR AHU DRAINAGE:

- 19.2.1 Garden Hydrant mains & sump riser shall be rigid. UPVC pipes conforming to IS : 4985-200 of class specified. If class is not mentioned in the Bill of Quantities the same shall be class V (10.0 Kg/Sq.cm).

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Fittings for UPVC pipe shall be injection moulded fittings with spigot & sockets suitable for solvent weld joints/sealing ring joint conforming to IS : 7834-1987. Fitting must have suitable provision for expansion.

Fittings shall be of the same make that's of pipe.

- 19.2.2 Solvent/sealing ring shall be of make and type approved by pipe and fittings manufacturer. Joint shall be made in an approved manner as recommended by the manufacturer.
- 19.2.3 Pipe 63 mm OD to 400 mm OD shall be ring tight/ring fit rigid PVC pipes with sealing ring conforming to IS : 4985-2000.
- 19.2.4 Elastomeric sealing ring shall be of high quality EPDM rubber to meet the practical requirement of site.
- 19.2.5 Provide UPVC flanges at internal of 20-25 m for all pipes 65 mm dia and above.
- 19.2.6 Provide suitable UPVC thread adapter for connection between pipes and valves.
- 19.2.7 Provide cement concrete supports and anchor block at all bends, tees, and other location. Connections at garden hydrant outlet, near valves must also be anchored.
- 19.2.8 Fitting pressure rating shall be next higher size of UPVC pipe pressure rating.

20.0 UPVC PERFORATED DRAINAGE PIPE AND FITTING:

20.1 Perforated drainage pipe shall be rigid UPVC conforming to IS:4985 of class specified. If class is not mentioned in the bill of quantities the same shall be class-III (6 kg/sq.cm).

20.2 SLOT WIDTH:

S.No.	Pipe Diameter	Slot Width
1.	110 OD UPVC Pipe	1.5 mm
2.	160 OD UPVC pipe	2.0 mm
3.	200 OD UPVC pipe	2.0 mm

20.3 SLOT LENGTH:

S.No.	Pipe Diameter	Slot Width
1.	110 OD UPVC Pipe	55 mm
2.	160 OD UPVC pipe	70 mm
3.	200 OD UPVC pipe	1000 mm

20.4 SLOT ANGLE AND ROWES:

- 180° and two rows

20.5 Fitting for UPVC pipes shall be injection moulded fittings with spigot and socket suitable for solvent weld joint. Fittings must have suitable provision for expansion.

20.6 Fittings shall be conforming to IS:7834-1987 (part 1 to Part 8).

20.7 Solvent shall be of make and type approved by pipe and fitting manufactures. Joints shall be made in an approved manner as recommended by the manufacturer.

21.0 TECHNICAL DETAIL :

[1] Dimension of Unplasticized PVC Pressure Pipes [Ring Fit/Ring Tight Rigid PVC Pipes [As per IS : 4985-2000].

Nominal Outside Diameter	Mean Outside Diameter		WALL THICKNESS							
			Class 2		Class 3		Class 4		Class 5	
			0.4 MPa		0.6 MPa		0.8 MPa		1.0 Mpa	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
63	63.0	63.3	1.5	1.9	2.2	2.7	2.8	3.5	3.5	4.1
90	90.0	90.3	2.1	2.6	3.1	3.7	4.0	4.6	5.0	5.7
110	110.0	110.4	2.5	3.0	3.7	4.3	4.9	5.6	6.1	7.1
125	125.0	125.4	2.9	3.4	4.3	5.0	5.6	6.4	6.9	8.0
140	140.0	140.5	3.2	3.8	4.8	5.5	6.3	7.3	7.7	8.9
160	160.0	160.5	3.7	4.3	5.4	6.2	7.2	8.3	8.8	10.2
180	180.0	180.6	4.2	4.9	6.1	7.1	8.0	9.2	9.9	11.4
200	200.0	200.6	4.6	5.3	6.8	7.9	8.9	10.3	11.0	12.7
225	225.0	225.7	5.2	6.0	7.6	8.8	10.0	11.5	12.4	14.3
250	250.0	250.8	5.7	6.5	8.5	9.8	11.2	12.9	13.8	15.9
280	280.0	280.9	6.4	7.4	9.5	11.0	12.5	14.4	15.4	17.8
315	315.0	316.0	7.2	8.3	10.7	12.4	14.0	16.1	17.3	19.9
355	355.0	356.1	8.1	9.4	12.0	13.8	15.8	18.2	19.6	22.6
400	400.0	401.2	9.1	10.5	13.5	15.6	17.8	20.5	22.0	25.3

Notes :

1. The table is based on metric series of pipe dimension given in ISO 161/1 in respect of pipe dimensions and ISO DIS 4422.
2. The wall thickness of pipe is based on a safe working stress of 8.6 MPa at 27°C. The working pressure gets reduced at sustained higher temperatures. Occasional rise in temperature, as in summer, with concurrent corresponding reduction in temperature during nights has no deleterious effect on the working pressure of the pipes considering the total life of pipe.

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[2] Dimension of UPVC Pressure Pipe [IS : 4985-2000].

Nominal outside Diameter (Nominal Size)	Mean Outside Diameter		WALL THICKNESS											
			Class 1 0.25 Mpa		Class 2 0.4 Mpa		Class 3 0.6 Mpa		Class 4 0.8 Mpa		Class 5 1.0 Mpa		Class 6 1.25 Mpa	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
20	20.0	20.3	-	-	-	-	-	-	-	-	1.1	1.5	1.4	1.8
25	25.0	25.3	-	-	-	-	-	-	1.2	1.6	1.4	1.8	1.7	2.1
32	32.0	32.3	-	-	-	-	-	-	1.5	1.9	1.8	2.2	2.2	2.7
40	40.0	40.3	-	-	-	-	1.4	1.8	1.8	2.2	2.2	2.7	2.8	3.3
50	50.0	50.3	-	-	-	-	1.7	2.1	2.3	2.8	2.8	3.3	3.4	4.0
63	63.0	63.3	-	-	1.5	1.9	2.2	2.7	2.8	3.3	3.5	4.1	4.3	5.0
75	75.0	75.3	-	-	1.8	2.2	2.6	3.1	3.4	4.0	4.2	4.9	5.1	5.9
90	90.0	90.3	1.3	1.7	2.1	2.6	3.1	3.7	4.0	4.6	5.0	5.7	6.1	7.1
110	110.0	110.4	1.6	2.0	2.5	3.0	3.7	4.3	4.9	5.6	6.1	7.1	7.5	8.7
125	125.0	125.4	1.8	2.2	2.9	3.4	4.3	5.0	5.6	6.4	6.9	8.0	8.5	9.8
140	140.0	140.5	2.0	2.4	3.2	3.8	4.8	5.5	6.3	7.3	7.7	8.9	9.5	11.0
160	160.0	160.5	2.3	2.8	3.7	4.3	5.4	6.2	7.2	8.3	8.8	10.2	10.9	12.6
180	180.0	180.6	2.6	3.1	4.2	4.9	6.1	7.1	8.0	9.2	9.9	11.4	12.2	14.1
200	200.0	200.6	2.9	3.4	4.6	5.3	6.8	7.9	8.9	10.3	11.0	12.7	13.6	15.7
225	225.0	225.7	3.3	3.9	5.2	6.0	7.6	8.8	10.0	11.5	12.4	14.3	15.3	17.6
250	250.0	250.8	3.6	4.2	5.7	6.5	8.5	9.8	11.2	12.9	13.8	15.9	17.0	19.6
280	280.0	280.9	4.1	4.8	6.4	7.4	9.5	11.0	12.5	14.4	15.4	17.8	19.0	21.9
315	315.0	316.0	4.6	5.3	7.2	8.3	10.7	12.4	14.0	16.1	17.3	19.9	21.4	24.7
355	355.0	356.1	5.1	5.9	8.1	9.4	12.0	13.8	15.8	18.2	19.6	22.6	24.1	27.8
400	400.0	401.2	5.8	6.7	9.1	10.5	13.5	15.6	17.8	20.5	22.0	25.3	27.2	31.3

Notes :

1. The table is based on metric series of pipe dimension given in ISO 161/1 in respect of pipe dimensions and ISO DIS 4422.
2. The wall thickness of pipe is based on a safe working stress of 8.6 MPa at 27°C. The working pressure gets reduced at sustained higher temperatures. Occasional rise in temperature, as in summer, with concurrent corresponding reduction in temperature during nights has no deleterious effect on the working pressure of the pipes considering the total life of pipe.

22.0 MEASUREMENT AND RATES:

22.1 General :

- a) Rates for all items shall be inclusive of all work and items called for in the specifications given above and the Schedule of Quantities as applicable for the work under floors, in shafts or at ceiling level at all heights and depths.
- b) All rates are inclusive of cutting holes and chases in RCC and masonry work and making good the same.
- c) All rates are inclusive of pre testing at site and final testing of the installations, materials and commissioning.

22.2 Pipes :

- a) The unit of measurement shall be linear metre to the nearest centimeter.
- b) All UPVC & CI soil, waste, vent, anti-siphonage and rain water pipes, AHU Drainage & sump riser shall be measured net, when fixed correct to a centimeter, including all fittings along their length after fixing. The length shall be taken along center line of the pipes and fittings. No allowance shall be made for the portions of pipe lengths entering the sockets of the adjacent pipes or fittings. The above shall apply to all cases i.e. whether pipes are fixed on wall face or pillars or embedded in masonry or pipes running at ceiling level. The quoted rate shall include lead jointing.
- c) GI pipes shall be measured in running metre correct to a centimeter for the finished work which shall include fittings e.g. bends, tees, elbows, reducers, crosses, sockets, nipples, nuts, unions etc. The length shall be taken along center line of the pipes and fittings. All pipes and fittings shall be classified according to their diameter, method of jointing and fixing substance, quality and finish. The diameters shall be nominal diameter of internal bore. In case of fittings of unequal bore, the largest bore shall be considered.

22.3 Pipe Encasing/ Supports :

Cement concrete around pipes shall be measured along the center of the pipe line measured per linear metre and include any masonry supports, shuttering and centering, curing, cutting etc. complete as described in the relevant specifications.

22.4 Angles/ Channels

Slotted angles/ channels shall be measured per linear metre of finished length and shall include support bolts and nuts, length embedded in the cement concrete blocks of 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregate 20mm nominal size) formed in the masonry walls; nothing extra shall be paid for the cement concrete block and making good the masonry wall, anchor fastners etc. complete.

22.5 Traps

Unit of measurement shall be the number of pieces. All urinal traps, trap gratings, hoppers, clean out plugs shall be measured by number and shall include all items described in the relevant specifications and Schedule of Quantities. Cockroach traps shall not be measured separately and are deemed to be included in the rate for traps.

22.6 Painting

Painting of pipes shall be measured per running metre for each diameter of pipe and shall be inclusive of all fittings and clamp. No deduction shall be made for fittings.

C) EXTERNAL SEWERAGE & STORM WATER DRAINAGE:

1.0 Scope of Work:

1.1 Without restricting to the generality of the foregoing, the drainage system shall interalia include:

- a) Storm water drainage system including, earth works for excavation, disposal, backfilling and compaction, pipe lines, manholes, catch basins and connections to Rain water Harvesting or connected as indicated by the Architect/Consultants.
- b) Overflow from Rain Water Harvesting Pit shall be discharge to existing Storm Water drain through submersible drainage pump.

2.0 General Requirements:

- 2.1 All material shall be of the best quality conforming to specification and subject to the approval of the Engineer-in-charge.
- 2.2 Storm Water Drainage lines and open drains shall be laid to the required gradients and profiles.
- 2.3 All drainage work shall be done in accordance with the local municipal bye-laws.
- 2.4 Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority if required.
- 2.5 Location of all manholes, catch basin etc shall be got confirmed by the Architect/Consultants before the actual execution of work at site. As far as possible, no drains or sewers shall be laid in the middle of road unless otherwise specifically shown on the drawings or directed by the Architect/Consultants in writing.

3.0 Excavation :

3.1 Alignment and Grade:

The drains are to be laid to alignment and gradients shown on the drawings but subject to such modifications, as shall be ordered by the Construction Manager/Consultants 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 Construction Manager/Consultants.

3.2 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 Construction Manager/Consultants. 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 Construction Manager/Consultants shall order to the contrary.

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 Construction Manager/Consultants.

3.3 Construction Across the Roads:

All works across the roads shall be carried out as per the directions of the Construction Manager/Consultants.

3.4 Excavation to be taken to proper depth:

The trenches shall be excavated to such a depth that the sewers shall rest as described earlier so that the inverts may be at the levels given on the section/plan. If the strata found as slushy/with block cotton soil etc, the Construction Manager/Consultants 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 materials as decided by Construction Manager/Consultants in writing.

3.5 Refilling:

After the sewer or other works have been laid and proved to be water tight, the trench or other excavation shall be refilled. Utmost care shall be taken in doing this, so that no damage is caused to the sewer and other permanent works. Filling in the trenches upto 50 cms above the crown of the sewer shall consist of the finest selected materials placed carefully in 15 cms layers watered to optimum moisture level and consolidated. After this has been laid, the trench and the other excavation shall be refilled carefully in 15 cms layers with materials taken from the excavation, each layer being watered and consolidated.

3.6 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 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.

3.7 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.

3.8 Timbering of Sewer and Trenches:

The contractor shall at all times support efficiently and effectively the sides of the sewer trenches and other excavations by suitable timbering, piling, sheeting, etc in loose or sandy strata and below the surface of the sub soil water table without extra cost.

All timbering, sheeting and piling with their walls and supports shall be of adequate dimensions and strengths and fully broad and strutted so that there is no risk of collapse or carrying in the walls of the trench.

The Contractor shall be held accountable and responsible for the sufficiency of all timbering, bracing, sheeting and piling used, and for all damage to persons and property resulting from the improper quality, strength, planning, maintaining or removing of the same.

3.9 **WIDTH OF TRENCH:**

The width of excavated trench shall be as per table given below:

S.No.	Excavation upto	Upto 100 mm dia pipe	Upto 150 mm dia pipe
1	90 cms depth	33 cms	33 cms
2	91 - 150 cms depth	60 cms	60 cms
3	151 - 300 cms depth	75 cms	75 cms
4	301 - 500 cms depth	90 cms	100 cms

3.10 Protection of Existing Services:

All pipes, water mains, cables etc encountered in the course of excavation shall be carefully protected and supported.

4.0 SALT GLAZED STONEWARE PIPES:

4.1 Stoneware pipes shall be of first class quality salt glazed and free from rough texture, inside and outside and straight. All pipes shall have the manufacturers name marked on it and shall comply to IS : 651-1971.

4.2 Laying:

The pipes shall be carefully laid to the levels and gradients shown on the plans and sections.

4.3 Jointing:

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.

4.4 Curing:

The joint shall be cured for atleast seven days.

4.5 Testing:

All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure 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 atleast 3.0 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.

The contractor shall give a smoke test to the drains and sewers at his own expense and charges, if directed by the Construction Manager/Consultants.

4.6 Gully traps :

4.6.1 Gully traps shall be of the same quality as described for stoneware pipes under para Salt Glazed Stoneware Pipes.

4.6.2 Gully traps shall be fixed in cement concrete 1:4:8 mix and a masonry chamber 300 x 300 mm. The CI sealed cover and frame shall weigh not less than 7.3 kg. Where necessary, sealed cover shall be replaced with CI grating of the same size.

5.0 Reinforced Cement Concrete Pipes :

5.1 All underground storm water drainage pipe shall be centrifugally spun S & S RCC Pipe of specified class. Pipes shall be true and straight with uniform bore, through out cracked, wrapped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the Contractor shall produce, when directed a certificate to that effect from the manufacturer.

5.2 Laying of R.C.C. Pipes:

Loading, transporting and unloading of concrete pipes shall be done with care. Handling shall be such as to avoid impact. Gradual unloading by inclined planes or by chain block is recommended. All pipe sections and connections shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used. Pipes shall be lowered into the trenches carefully. Mechanical appliances may be used. Pipes shall be laid true to line and grade as specified. Laying of pipe shall proceed upgrade of a slope.

If the pipes have spigot and socket joints, the socket end shall face upstream, in the case of pipe with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid. Adequate and proper expansion joints shall be provided where directed.

In cases where the natural foundation is inadequate, the pipes shall be laid either in concrete cradle supported on proper foundation or on any other suitable designed structure as specified. If a concrete cradle bedding is used, the depth of concrete below the bottom of the pipe shall extend up the sides of the pipe at least to distance of 1/4th of the outside diameter of pipe. The pipe shall be laid in this concrete bedding before the concrete has set.

When the pipe is laid in a trench in rock hard clay, shale or other hard material, the space below the pipe shall be excavated and replaced with an equalizing bed of concrete, sand or compact earth. In no place shall pipe be laid directly on such hard material.

When the pipes are laid completely above the ground, the foundations shall be made even and sufficiently compacted to support the pipe line without any material settlement. Alternatively the pipe line shall be supported on p.c.c. saddle blocks. Similar arrangement shall be made to retain the pipe line in the proper alignment, such as by shaping the top of the supports to fit the lower part of the pipe. The distance between the supports shall in no case exceed the length of the pipe. The pipe shall be supported as far as possible close to the joints. In no case shall the joints come in centre of the span. Care shall be taken to see that superimposed loads greater than the total load equivalent to the weight of the pipe when running full shall not be permitted.

5.3 Jointing of Pipes:

Joints are generally of rigid type. Where specified flexible type joints may also be provided.

5.4 Spigot and Socket Joint (rigid):

The spigot of each pipe shall be slipped home well into the socket of the pipe previously laid and adjusted in the correct position. The opening of the joint shall be filled with stiff mixture of cement mortar in the proportion of 1:2 (1 cement :2 fine sand) which shall be rammed with caulking tool.

After a day's work any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured.

5.5 Collar Joint (rigid):

The two adjoining pipes shall be butted against each other and adjusted in corrected position. The collar shall then be slipped over the joint, covering equally both the pipes. The annular space shall be filled with stiff mixture of cement mortar 1:2 (1 cement :2 fine sand) which shall be rammed with caulking tool.

After a day's work any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured.

5.6 The Testing of Joints, Refilling of Trenches:

The testing of joints, refilling of trenches for concrete pipes shall be similar to Specification for stone ware pipes.

6.0 Cement Concrete for Pipe Support:

- a) Wherever specified or shown on the drawings, all pipes shall be supported on a bed, all around or in haunches. The thickness and mix of the concrete shall be as given in the Schedule of Quantities. Width of the bedding shall be under para Width of Trenches.
- b) Unless otherwise directed by the Architect/Consultants cement concrete for bed, all around or in haunches shall be laid as follows:

	Upto 1.5 m Depth	Upto 3 m Depth	Beyond 3 m Depth
Stoneware Pipes in open ground (no sub soil water)	All round (1:5:10)	In haunches (1:5:10)	In haunches (1:5:10)
RCC or SW in sub soil water	All round (1:5:10)	In haunches (1:5:10)	In haunches (1:5:10)
CI Pipes (in all conditions)	All round (1:3:6)	In haunches (1:3:6)	In haunches (1:3:6)
RCC Pipes or CI pipes under building	All round (1:3:6)	In haunches (1:3:6)	In haunches (1:3:6)

(1=Cement, 3/5=Coarase sand, 6/10 =Stone aggregate 40 mm nominal size)

- c) RCC pipes or CI pipes shall be supported on brick masonry or precast RCC or in situ cradles as shown on the drawings or as directed by the Architect/Consultants.
- d) Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings or as directed by the Architect/Consultants.

7.0 Manholes and Chambers :

- 7.1 All manholes, chambers and other such works as specified shall be constructed in brick masonry in cement mortar 1:5 (1 cement: 5 coarse sand) or as specified in the Schedule of Quantities.
- 7.2 All manholes and chambers, etc shall be supported on base of cement concrete of such thickness and mix as given in the Schedule of Quantities or shown on the drawings.
- 7.3 Where not specified, manholes shall be constructed as follows:

(All dimensions are clear internal dimensions in mm)

Size of Manholes Type of Manhole	900x800 Rect.	1200x900 Rect.	900 dia Conical	1400 dia Conical
Maximum Depth	1000	2400	2500	5000
Average thickness of RCC slab	150	150		
Reinforcement	As directed by Architect/Consultants			
Size of Cover and Frame	600x450	500dia	500dia	500dia
Weight of Cover and Frame	38 kg light duty	116 kg medium duty	116 kg medium duty	116 kg medium duty

- 7.4 All manholes shall be provided with cement concrete benching in 1:2:4 nominal mix (1 cement: 2 coarse sand: 4 stone aggregate 20mm nominal size). The benching shall have slope of 1:10 towards the channel. The depth of the channel shall be full diameter of the pipe. Benching shall be finished with a floating coat of neat cement.
- 7.5 All manholes shall be plastered with 12/15mm thick cement mortar 1:3 (1 cement: 3 coarse sand) and finished with a floating coat of neat cement inside. Manhole shall be plastered outside as above but with rough plaster with waterproofing compound.

- 7.6 All manholes with depths greater than 1m shall be provided with 20 mm square or 25 mm round CI foot rests set in cement concrete blocks 250x100 mm in 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size), at 300 mm centre to centre vertically and staggered. Foot rests shall be coated with coal tar before embedding.
- 7.7 All manholes shall be provided with cast iron covers and frames and embedded in reinforced cement concrete slab. Weight of cover, frame and thickness of slab shall be as specified in the Schedule of Quantities or given above.

8.0 Testing :

- 8.1 All testing shall be done in accordance with IS:1172 and IS:5329 except as may be modified herein under.
- 8.2 All lengths of the sewer/drain/pipelines shall be fully tested for water tightness by means of water pressure. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 2.5m head of water. The test pressure shall, however, not exceed 6m head at any point. The pipes shall be plugged preferably with upper end shall, however, be connected to a pipe for filling with water and getting the required head. The sewer/drain/pipeline shall be filled with water and left to stand for 2 hours and topped up. The leakage over 30 minutes shall then be measure and the loss in water shall not exceed 2 litres/cm of diameter/km of pipeline measured during the last 10 minutes of the period of test.
- 8.3 Sewer lines shall be tested for straightness by:
- a) Inserting a smooth ball 12mm less than the internal diameter of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end,
 - b) means of a mirror at one end and a lamp at the other end. If the pipe line is straight the full circle of light shall be seen otherwise obstruction or deviation shall be apparent.
- 8.4 A test register shall be maintained which shall be signed and dated by the Contractor and the Architect/Consultants.
- 8.5 The pipeline shall be covered only after the testing is successfully completed.

9.0 Measurement and Rates:

- 9.1 Stoneware/RCC/CI pipes shall be measured for the finished length of the pipeline per linear metre.
- Lengths between manholes shall be recorded from inside face of one manhole to inside face of other manhole.
- Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside face of manhole. Rate shall include all items given in the Schedule of Quantities and specifications.
- 9.2 Gully Traps :
Gully traps shall be measured by the number and rate shall include all excavation, backfilling, foundation, concrete brick masonry, cement plaster inside and outside, CI grating and sealed cover and frame etc complete.
- 9.3 Manholes :
- a) All manholes shall be measure by numbers and shall include all items specified above and necessary excavation in all types of soils, refilling, compaction and disposal of surplus earth.
 - b) Manholes with depths greater than that specified under the main items shall be paid for under "extra depth" and shall include all items as given for manholes. Measurement shall be done to the nearest centimetre. Depth of the manholes shall be measured from top of the manhole cover to bottom of channel.

D) WATER SUPPLY SYSTEM [COLD WATER SUPPLY + HOT WATER SUPPLY + HOT WATER RETURN]:

1.0 SCOPE OF WORK

1.2 Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install for water supply system (Cold Water Supply + Hot Water Supply) as required by the drawings, specified hereinafter and given in the Schedule of Quantities.

1.2 Without restricting to the generality of the foregoing, the water supply system shall include the following:-

- a) Water supply works inside the building etc. including connection to vertical stack / main line.
- b) Thermal Insulation to hot water line & valves.
- c) Pipe protection and painting.
- d) Connections to all fixtures etc.
- e) Ball valve/butterfly valve/Non Return valve.

2.0 GENERAL REQUIREMENTS :

2.1 All materials shall be new and of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Project Manager.

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

2.3 Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections. As far as possible all bend shall be formed by means of a hydraulic pipe bending machine for pipe up to 65 mm dia.

2.4 Pipes shall be laid in a manner as to provide as far as possible easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passage etc.

2.5 Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

2.6 Pipe shall be securely fixed to wall and ceiling by suitable clamps at intervals specified.

3.0 CPVC PIPES & FITTINGS & VALVES FOR COLD WATER SUPPLY DISTRIBUTION SYSTEM:

CPVC Water Distribution System shall be Flowguard CPVC (Chlorinated Polyvinyl Chloride) Water Supply Piping System with pipe as per CTS SDR-11 at maximum working pressure of 400 psi (28.1 Kg/cm²) at 23°C and 100 psi (7.03 Kg/cm²) at 82°C (from 1/2" - 2"), using solvent welded CPVC fitting i.e. Tees, elbows, couplers, unions, reducers, bushing etc. including transition fitting (connection between CPVC and metal pipe / G.I.) i.e. Brass adapter (both male and female threaded) all conforming to ASTM D-2846 with only CPVC solvent cement conforming to ASTM F-493 - with only Clamps/ structural metal supports as required/directed at site including cutting chases and filling the same with cement concrete/cement mortar as required. All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of consultant/manufacturers of pipes and fittings.

☐ Outside Diameters and Wall Thicknesses for CPVC 4120, SDR 11 Plastic Pipe

Nominal Size		Outside Diameter, in. (mm)		Wall Thickness, in. (mm)	
(in.)	(mm)	Average	Tolerance	Minimum	Tolerance
1/2	15	0.625 (15.9)	± 0.003 (+ 0.08)	0.068 (1.73)	+ 0.020 (+ 0.51)
3/4	20	0.875 (22.2)	± 0.003 (+ 0.08)	0.080 (2.03)	+ 0.020 (+ 0.51)
1	25	1.125 (28.6)	± 0.003 (+ 0.08)	0.102 (2.59)	+ 0.020 (+ 0.51)
1-1/4	32	1.375 (34.9)	± 0.003 (+ 0.08)	0.125 (3.18)	+ 0.020 (+ 0.51)
1-1/2	40	1.625 (41.3)	± 0.004 (+ 0.10)	0.148 (3.76)	+ 0.020 (+ 0.51)
2	50	2.125 (54.0)	± 0.004 (+ 0.10)	0.193 (4.90)	+ 0.023 (+ 0.58)

☐ Pressure Ratings for CPVC, SDR 11 Plastic Pipe

☐

Nominal Size		Pressure Rating, PSI (Kg/cm ²)			
(in.)	(mm)	73.4°F	(23°C)	180°F	(82°C)
1/2	15	400	(28.1)	80	(7.0)
3/4	20	400	(28.1)	100	(7.0)
1	25	400	(28.1)	100	(7.0)
1-1/4	32	400	(28.1)	100	(7.0)
1-1/2	40	400	(28.1)	100	(7.0)
2	50	400	(28.1)	100	(7.0)

3.1 JOINING FLOWGUARD PIPES AND FITTINGS :

• Cutting :

Pipe shall be cut with either with a wheel type plastic pipe cutter or hacksaw blade, and care shall be taken to make a square cut, which provides optimal bonding area within a joint.

• Deburring/Beveling :

Burrs and fillings should be removed from the outside and inside of pipe with a pocket knife or file otherwise burrs and fillings may prevent proper contact between pipe and fittings during assembly.

• Fitting/Preparation :

A clear dry rag/cloth should be used to wipe dirt and moisture from the fitting sockets and tubing end. The tubing should make contact with the socket wall 1/3 or 2/3 of the way into the fitting socket.

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- Solvent Cement Application :

CPVC solvent cement conforming to ASTM - F493 should be used for joining pipe with fittings. An even coat of solvent cement should be applied on the pipe end and a thin coat inside the fitting socket, otherwise too much of cement solvent can cause clogged water ways.

- Assembly :

After applying the solvent cement on both pipe and fitting socket, pipe should be inserted into the fitting socket within 30 seconds and rotating the pipe 1/4 to 1/2 turn while inserting so as to ensure even distribution of solvent cement with the joint. The assembled system should be holded for 10 seconds (approximately) in order to allow the joint to set up.

- **Set and Cure Times :** remake the joint to avoid potential solvent cement set and cure times shall be strictly adhered to as per the below mentioned table.

Minimum cure prior to pressure testing at 150 psi :

Ambient Temperature During Cure Period	Pipe Sizes	
	1/2" - 1"	1 1/4" - 2"
Above 15 C	1 Hr	2 Hrs
4 - 15 C	2 Hrs	4 Hrs
Below 4 C	4 Hrs	8 Hrs

Special care shall be exercised when assembling flowguard systems in extremely low temperature (below 4 C) or extremely high temperature (above 45 C) in extremely hot temperatures, make sure that both surfaces to be joined are still wet with cement solvent when putting them together.

1. Testing :

Once an installation is completed and cured or per above mentioned recommendations, the system should be hydrostatically pressure tested at 150 psi (10 bar) for one hour. During pressure testing, the system should be filled with water and if a leak is found, the joint should be cut out and replacing the same with new one by using couplers.

2. Transition of flowguard CPVC to Metals :

When making a transition connection to metal threads, special Brass (Male and female adapters) should be used.

3. Threaded Sealants:

Teflon tap shall be used to make threaded connections leak proof.

4. Solvent Cement:

CPVC solvent cement conforming to ASTM F 493 should be used for joining pipe with fittings and valves. CPVC cement solvent have a minimum shelf life of 1 year. Solvent have a minimum shelf life of 1 year. Aged cement solvent will often change colour or began to thicken and become gelatinous or jelly to like and when this happens, the cement should not be used. The cement solvent should be used within 30 days after opening the company's seal and tightly close the seal after using in order to avoid its freezing. The freezed cement solvent should be discarded immediately and fresh one should be used.

- Hangers and Supports :

Most hangers designed for metal pipe are suitable for flowground. Hangers should not have rough or sharp edges which come in contact with the tubing.

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Supports should be as per the below mentioned table :

Horizontal and Vertical Support									
Spacing									
Size of pipe		21 deg. C (70°F)		49 deg. C (120°F)		71 deg. C (160°F)		82 deg. C (180°F)	
Inch	(mm)	Ft.	cm	Ft.	cm	Ft.	cm	Ft.	cm
1/2"	(15)	5.5	(167.7)	4.5	(137.16)	3.0	(91.44)	2.5	(76.2)
3/4"	(20)	5.5	(167.7)	5.0	(152.4)	3.0	(91.44)	2.5	(76.2)
1"	(25)	6.0	(182.88)	5.5	(167.7)	3.5	(106.68)	3.0	(91.44)
1 1/4"	(32)	6.5	(198.12)	6.0	(182.88)	3.5	(106.68)	3.5	(106.68)
1 1/2"	(40)	7.0	(213.36)	6.0	(182.88)	3.5	(106.68)	3.5	(106.68)
2"	(50)	7.0	(213.36)	6.5	(198.12)	4.0	(121.92)	3.5	(106.68)

4.0 COPPER PIPES & FITTINGS FOR HOT SUPPLY & DISTRIBUTION SYSTEM:

4.1 COPPER PIPE:

All domestic cold water pipe & hot water supply pipe and hot water return pipe shall be copper pipe conforming to BS : 2871 Part I & EN 1057 in half hard drawn condition as per wall thickness of Table X. All copper pipes well accompany manufacturer certificate certifying chemical composition & that 100% tubes are eddy current tested. These copper tubes will be of non arsenical copper grade C 106 i.e. DHP grade copper confirming to BS : 2871 (Part I).

Table of Metric Sizes for Copper Tubes TO BS 2871 : Part I

Table X

Size of Tube (mm)	Outside Diameter (mm)		Nominal Thickness (mm)	Maximum working Pressure at 65°C Bar
	Maximum	Minimum		
15	15.045	14.965	0.7	58
22	22.055	21.975	0.9	51
28	28.055	27.975	0.9	40
35	35.07	34.99	1.2	42
42	42.07	41.99	1.2	35
54	54.07	53.99	1.2	27
67	66.75	66.60	1.2	20
76	76.30	76.15	1.5	24
108	108.25	108.00	1.5	17
133	133.50	133.25	1.5	14
159	159.50	159.25	2.0	15

Note :

Table X specifies requirements for copper tubes in straight lengths to half hard drawn condition.

4.2 FITTINGS:

- All fitting shall be supplied & installed confirming to specification BS 864 Part II or the New European EN 1254 Part I & Part II. Fitting shall only be supplied in Dezincification resistant materials i.e. either copper or gun metal or dezincification resistant brass (alloy CZ 132). All gun metal fitting will clearly specify with the initial GM that they are gun metal & all dezincification resistant brass fittings will have the word DR embossed on the fitting itself.
- The fitting will also be embossed with the BS symbol mentioning the specification 864 to be used.

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- For internal services i.e. for sizes 15mm to 35mm the Integral Solder Ring Fitting will be used. Plain ends of these fittings will contain lead free solder embedded in the end itself. For external services, the fittings to be used will be the endex range or endfeed fittings. For sizes 15mm to 35mm lead free solder wire will be used conforming to BS 219 for jointing & for fitting of sizes 42mm & above, the fittings will be joined with copper pipes by the use of copper to copper brazing. Under no circumstances will brazing be used as a method for joining for 35mm & above.
- Jointing of Copper Fittings (such as Tees, crosses, plugs, sockets, elbows, reducers, flanges, unions, sleeves etc.) shall be as follows :
 - i) 15 mm dia to 35 mm dia - Integrated Solder Ring (ISR) Type Fittings.
 - ii) 42 mm dia & above - Endex fittings with soldering.
- Fabrication of copper pipes into fittings is not allowed including making of Tees or Elbows at site. Couplings made from copper pipes are not allowed. For all sizes of pipes separate copper fittings or copper couplings are required to be used for jointing pipe to pipe.
- For reduction of one pipe size to another it is a must to use reducing couplings & expanded pipe ends or sewaged or reduced pipe ends will not be allowed. For all tee joints it is not allowed to make a tee by making a hole in a pipe. All tee joints will have to be made by using separate copper tee fittings.
- Copper pipes will not be joined directly to GI pipes or GI fittings & Dezincification resistant (DZR brass) or Gun metal fitting will be used to join copper pipe to GI fittings or GI pipe. This is to avoid galvanic corrosion which occurs when 2 dissimilar metals are joined together in the galvanic series.

Capillary Fittings:

In these type of fittings a joint is made by the flow of solder due to capillary action along the annular space between the outside of the tube and the inside of the fittings socket.

There are two kinds of capillary fittings :

i) Integral Solder Ring Type (ISR) :

These fittings contain enough amount of lead-free solder in a recess/cavity of the fitting itself and there is no need to endfeed any solder from outside. On being heated with an ordinary blow lamp the solder in these fitting melts and flows into both sides, due to capillary action, forming a joint in the area of contact between the pipe and fitting. These fittings have a burst pressure of 5000 PSI. A 15mm OD x 0.7mm WT copper pipe will burst at its burst pressure of 3480 PSI, but a solder ring joint will not leak.

ii) Endfeed Type (Endex) :

In these fittings solder is to be end fed from outside. After heating the fitting, solder wire is end fed from the edge of the fitting enabling necessary action to take place.

DZR Fitting (De-Zincification Resistant):

It is very essential to use DZR Fittings for installation as explained above to avoid corrosion of the weaker metal before or after the Copper Plumbing System.

Above fittings are manufactured to BS 864 : part-2.

4.3 LAYING AND JOINTING OF COPPER PIPES AND CAPILLARY FITTINGS:

- The copper pipes and fittings shall run in wall chase or ceiling or as specified. The fixing shall be done by means of standard pattern holder bat clamps keeping the pipes about 1.5 cm clear of the wall where to be laid on surface. Where it is specified to conceal the pipes, chasing may be adopted or pipes fixed in the shafts, ducts etc. provided there is a sufficient space to work on the

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pipes with the usual tools. As far as possible, pipes may be buried for short distances provided adequate protection is given against damage and where so required special care to be taken at joints. Where directed by the Owner's Site Representative/Architect, pipe sleeves shall be fixed at a place the pipe is passing through a wall or floor for reception of the pipe and allow freedom for expansion and contraction and other movements. In case of pipe is embedded in walls or floors it shall be covered with a protective tape wrapped around the pipes and fittings.

- Copper pipes shall be jointed using fittings conforming to BS 864 Part 2. Care shall be taken to remove any burr from the end of the pipes after cutting. Only fittings of the size suitable to the pipe shall be used. The ends of the tube shall be cut to the correct size using a tube cutter or a fine blade hacksaw. Care shall be taken to ensure that the ends of the tube are cut perpendicular to the axis of the tube and that the ends remain undamaged and free of burrs. Any burrs remaining shall be removed with a smooth file. Clean the outside surface of the tube that shall go into the fitting ensuring even and uniform application. Insert the tube into the fittings and push home until the stop is reached. Wipe off excess flux with a soft cloth. Now the assembled joint shall be heated with a blow torch or any similar appliance that emits a clean, blue, spot free flame. The heat shall be turned off once a complete ring of solder has appeared around the mouth of the fitting.
- The joints shall be allowed to cool without disturbance.
- All copper pipes to G.I. pipe and connection with the valves and faucets shall be with De-zincified Resistance fittings (DZR).

Piping Installation :

- Tender drawings indicate schematically the size and location of pipes in the drawing on the award of the work, contractor shall prepare detailed working drawings, showing the cross-sections, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structure through which pipes are designed to pass.
- Piping shall be properly supported on, or suspended from , on stands, clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability.
- Pipe work and fittings shall be supported by hangers or brackets so as to permit free expansion and contraction. Risers shall be supported at each floor with Galvanised steel clamps. To permit free movement of common piping support shall be from a common hanger bar fabricated from Galvanised steel sections.
- Pipe hangers shall be provided at the following maximum spacings.

Size of Pipe (O.D) (mm)	For vertical runs (m)	For horizontal runs (m)
15	1.8	1.2
22	2.4	1.8
28	2.4	1.8
35	3	2.4
42	3	2.4
54	3	2.7
67	3.6	3
76.1	3.6	3
108	3.6	3
133	3.6	3
159	4.2	

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- Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation. 14 gauge metal sheet shall be provided between the insulation and the clamp, saddle or roller, extending atleast 15 cm on both sides of the clamps, saddles or roller.
- All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that area can be carried out in one stretch.
- Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements.
- Pipe sleeves, larger diameter than pipes, shall be provided wherever pipes passes through walls and slab and annular space filled with fiberglass and finished with retainer rings.
- The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate or as specified/approved by Consultants. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.
- Automatic air valves shall be provided at all high points in the piping system for venting. All valves shall be of 15mm pipe size and shall be associated with an equal size gate valves. Automatic air valves shall be provided on hot water risers.
- Discharge from the air valves shall be piped through a galvanized steel pipe to the nearest drain or sump. All pipes shall be pitched towards drain points.
- In jointing copper pipes and fittings following procedure should be followed :-
 - i) Cut the copper tube square, remove burr inside and out side.
 - ii) Properly clean the outside portion of the pipe which has to go inside the fittings and also inside of the fitting. Remove all dirt, oxide film grease and oils.
 - iii) Apply flux to the cleaned surface and insert pipe firmly upto the pipe stop. A small twist shall be given for even spreading of the flux.
 - iv) Apply heat evenly around the fittings with oxyacetylene torch until a complete ring of solder alloy appears round the mouth of the socket. Heating shall then be stopped and joint allowed to cool without disturbance.

4.4 TESTING CRITERIA FOR COPPER PIPES:

- i) To check joints of installed copper pipes & to ensure that joints from 15mm to 35mm copper pipes are done by soft soldering & copper pipes from 42mm & above are joined by the method of brazing.
- ii) To check the copper pipes at a minimum hydraulic pressure of 500 PSI to ensure that no joints are leaking. Pressure to be maintained for 30 minutes & the reading to be stagnant through out the testing period. You may also test the copper pipe work at 1000 PSI if desired but that may not be necessary.
- iii) All copper pipes to be to other copper pipes with the use of couplings. It is not allowed to join one copper pipe into another copper pipe by flaring one end & inserting another copper pipe into it. Likewise no fabricating of fittings are allowed at site & tees and elbows must be used either equal or reducing for bends / branches.
- iv) It must also be checked that any excessive flux is removed after soft soldering on the outside of the joints for size 15mm to 35mm where a chemical flux is required for soft soldering. This is necessary so that flux does not remain in the pipe line after installation &

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then starts corroding the copper pipe or the joint. Like wise the entire system must be flushed with water before closing for atleast 10 minutes so that any excessive flux in the ID the tube is washed away.

- v) It must be noted there that flux is water soluble.

5.0 GI PIPES, FITTINGS AND VALVES:

- 5.1 All pipes inside the buildings and where specified, outside the building shall be galvanized steel tubes conforming to IS: 1239 of Class specified. When Class is not specified they shall be Heavy Class.
- 5.2 Fittings shall be of malleable cast iron galvanized of approved make. Each fitting shall have manufacturer's trade mark stamped on it. Fittings for G.I pipes shall include couplings, bends, tees, reducers, nipples, unions, bushes etc. Fittings etc. shall conform to IS : 1879. (Part 1 to X) 1987.
- 5.3 Pipes and fittings shall be jointed with screwed joints using Teflon tape suitable for water pipes. Care shall be taken to remove burr from the end of the pipe after cutting by a round file. All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. Necessary vents and drains shall be provided at all high and low points respectively. G.I pipes inside toilets shall be fixed in wall chases well above the floor. No pipes shall be run inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors and other areas as shown on drawings.

5.4 Pipe Support :

- 5.4.1 All pipes clamps, supports, hangers, pipe support shall be factory made galvanized MS steel or alternatively galvanized after fabrication to suit site requirement pipe supports.
- 5.4.2 G.I pipes in shafts and other locations shall be supported by G.I clamps of design approved by the Architect/Consultants. Pipes in wall chases shall be anchored by iron hooks. Pipes at ceiling level shall be supported on structural clamps fabricated from MS structurals. Pipes in shafts shall be supported on slotted angles/ channels as specified/ as directed.

5.5 Anchor Fasteners

- 5.5.1 All pipe supports, hangers and clamps to fixed on RCC walls, beams, columns , slabs and masonry walls 230 mm thick and above by means of galvanised expandable anchor fasteners in drilled holes of correct size and model to carry the weight of pipes. Drilling shall be made only by approved type of power drill as recommended and approved by manufacturer of the anchor fasteners. Failure of any fastening devices shall be the entire responsibility and contractor shall redo or provide additional supports at his own cost. He shall also compensate the owner for any damage that may be caused by such failures.

5.6 Unions :

- 5.6.1 Contractor shall provide adequate number of unions on all pipes 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 for easy dismantling and/ or as directed by Architect/Consultants.

5.7 Flanges :

- 5.7.1 Flanged connections shall be provided on pipes as required for maintenance/ ease in dismantling or where shown on the drawings, all equipment connections as necessary and required or as directed by the Architect/Consultants. Connections shall be made by the correct number and size of the GI nuts/ bolts as per relevant IS Standards and made with 3mm thick insertion rubber

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washer/ gasket. Where hot water or steam connections are made insertion gasket shall be of suitable high temperature grade and quality approved by the Architect/Consultants. Bolt hole dia for flanges shall conform to match the specification for CI sluice valve as per IS:780. Gaskets shall conform to IS:11149.

5.8 Trenches :

5.8.1 All G.I pipes below ground shall be laid in trenches with a minimum cover of 600mm. The width and depth of the trenches shall be as follows :-

S. No.	Dia of pipe	Width of trench	Depth of trench
1	15mm to 50mm	300mm	750mm
2	65mm to 100mm	450mm	1000mm

5.9 Sand Filling :

5.9.1 GI pipes in trenches shall be protected with fine sand 150mm all around before filling in the trenches.

5.10 Painting :

5.10.1 All pipes above ground shall be painted with one coat of red oxide and two coats of synthetic enamel paint of approved shade and quality. Pipes shall be painted to standard colour code specified by the Architect/Consultants.

5.11 Pipe protection :

5.11.1 Where specified in the schedule of quantities all pipes in chase below ground shall be protected against corrosion by applying two coats of bitumen paint wrapping with polythene tape and finishing with one more coat of bitumen paint.

5.12 **PIPING INSTALLATION:**

Tender drawings indicate schematically the size and location of pipes. The contractor on the award of the work, shall prepare detailed working drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and control valves, drain valves and all pipe support, structural supports. He must keep in view the specific openings in buildings and other structures through which pipes are designed to pass.

- a. 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.
- b. Pipe supports shall be of steel, adjustable for height and primer coated with rust preventive paint and finish coated back. Where pipe and clamps are of dissimilar materials a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following:

S. No.	Pipe Size	Spacing between Supports
1	Upto 12 mm	1500 mm (1.5m)
2	15 to 150 mm	2000 mm (2.0 m)
3	150 mm & over	2500 mm (2.5m)

- c. Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars steel structural supports attached to pipe and with a 15 mm thick rubber pad or any

resilient material. Where pipes pass through the terrace floor, suitable flashing shall be provided to prevent water leakage. Risers shall have a suitable clean out at the lowest point and air vent at the highest point.

- d. Pipe sleeves, 50 mm larger diameter than pipes, shall be provided wherever pipes pass through walls and slabs, and annular space filled with fiberglass and finished with retainer rings.
- e. All pipe work shall be carried out in a workmen like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work so that particular area work shall be carried out in one trench.
- f. Cut outs in the floor slab for installing the various pipes are indicated in the drawings. Contractor shall carefully examine the cut outs provided and clearly point out wherever the cut outs shown in the drawings, do not meet with the requirements.
- g. The contractor shall make sure that the clamps, steel structural supports, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes, and include expansion joints where required.
- h. All pipes shall be accurately cut to the required sizes in accordance with relevant codes and burrs removed before laying. Open ends of the pipes shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for the piping to drain freely. In other locations, concentric reducers may be used.

5.13 BALL VALVES:

All ball valves shall be heavy duty of approved make. Valves shall have suitable for test pressure of 25 Kg/Sqcm. Ball valves shall conform to the following specifications.

Size	Construction	Ends
15 to 65 mm	Bronz body S.S. Working Part stainless steel balls, spindle, t eflon seating and gland packing	Screwed

5.14 BUTTERFLY VALVE:

All butterfly valves shall be heavy duty cast iron of approved make. The valves shall be suitable for 15 Kg/Sqcm test pressure & shall conform to the following specifications Butterfly valve shall be of best quality conforming to IS: 13095:

Size	Construction	Ends
80 mm and above	Cast iron	Flanged

5.15 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.

Size	Construction	Ends
Upto 50 mm.	Gun metal	Screwed
65 mm and above	Gun metal/cast iron	Flanged

Non-return valves shall be of approved make.

5.16 TECHNICAL SPECIFICATION OF PRESSURE REDUCING VALVE:

- PRV in brass housing (DZR) with G ¼ "pressure gauge connection part, spring bonnet with adjustable opening having adjustable knob for pressure adjustments. The diaphragm shall be in fibre- reinforced NBR and seals in NBR. The adjustment spring shall not be in touch with water at any given time.

- **WORKING:**

The force of the diaphragm shall operate against the force of an adjustable spring. The inlet pressure shall have no influence in either the opening or closing the valve, hence, inlet pressure fluctuation shall not influence the outlet pressure shall remain constant at all times.

- **ADJUSTMENT OF PRESSURE:**

The knob fitted on top of the PRV shall be turned toward (-) or (+) sign to reduce/ increase the outlet pressure as desired.

RANGE:

- a. Inlet pressure : Max 16 bar
- b. Outlet pressure : 1.5 to 6 bar adjustable
- c. Operating temperature : Max to Degree C
- d. Maximum pressure drip : 1 bar

6.0 POLYBUTYLENE (PB) PIPE AND FITTING:

6.1 General

- Providing and fixing of Polybutylene (PB) pipes and fittings for hot and cold water distribution system as per the BS 7291 with corresponding tee's , elbows, sockets, brass adaptors (Male and Female) with hot fusion jointing technology as specified by the manufacturer. All termination points should be brass only for connection with faucets.
- The Polybutylene system shall be made by PB 1 4237 grey or equal.
- Polybutylene (PB) pipe work fittings shall be used for the conveyance of Hot and Cold water distribution system and should comply with the requirements specified in (BS 7291(Parts 1 and 2) class 'S'.
- The whole of the PB pipe work installation should be installed and tested in accordance with the requirements as with the relevant manufacturer's instructions.
- Care should be exercised while off- Loading, storing and transporting about the site and while installing the pipes and fittings to ensure that no accidental damage occurs to the pipes or fittings.

6.2 Pipes

All PB piping should be to EN ISO 15876 – 1,2,3 (BS 7291: Part 182 or DIN 16968/DIN 16969.)

6.3 Pipe fittings:

- Unless specified other wise, all associated pipe fittings (viz. Manifolds, unions and flanges) should be of PB manufacture generally in accordance with (BS 7291 : Parts 1 and 2) and brass fittings manufactured generally in accordance with EN ISO 15876 -1,2,3 (BS 864, Part 2,) and be fully compatible with the pipe system they are to be installed with.
- Valves for PB work should be fully compatible with the pipe system to which they are to be connected, comprising variously.
- Brass valves should be suitable for connection with PB pipe directly, or with adaptors to flanged or threaded connectors.
- Only pipe cleaner and sealant specifically approved by the pipe end fittings manufacturer should be .

6.4 SELECTION OF PB PIPE SYSTEMS:

• **OUTER & INTERNAL DIAMETER:**

S.NO.	OUTER DIAMETER	INNER DIAMETER
1	16	11.6
2	20	14.4
3	25	20.4
4	32	26.0
5	40	32.6
6	50	40.8
7	63	51.4
8	75	61.4
9	90	73.6
10	110	90.0

• **HORIZONTAL SUPPORT SPACING:**

All PB pipe work sizes stated on the drawings refer to outside diameter.

S.NO.	External Diameter	Temperature of the Flowing Water in Degree Centigrade					
		20	30	40	50	60	80
1	16 mm	75 cm	70 cm	70 cm	65 cm	65 cm	55 cm
2	20 mm	80cm	75cm	70cm	70 cm	65 cm	60 cm
3	25 mm	85 cm	85 cm	85 cm	80 cm	75 cm	70 cm
4	32 mm	100 cm	100 cm	95 cm	90 cm	85 cm	75 cm
5	40 mm	110 cm	110 cm	105 cm	100 cm	95 cm	85 cm
6	50 mm	125 cm	125 cm	115 cm	110 cm	105 cm	90 cm
7	63 mm	140 cm	140 cm	130 cm	125 cm	120 cm	105 cm
8	75 mm	155 cm	155 cm	145 cm	135 cm	130 cm	115 cm
9	90 mm	170 cm	170 cm	160 cm	155 cm	150 cm	145 cm
10	110 mm	190 cm	190 cm	180 cm	175 cm	160 cm	155 cm

6.5 WORKMANSHIP, FINISH AND APPEARANCE:-

The finished tube shall be smooth, free of internal and external mechanical imperfections and internally shall have smooth appearance.

6.6 PIPE JOINTS:

- The pipe and fittings should be entirely compatible with each other and the jointing should be carried out in strict accordance with the manufacturer's printed instructions.
- Unless indicated otherwise, the pipe joints in PB pipe work should be made by electro fusion. The assembly of these should be carried out in strict accordance with the manufacturer's instructions.
- Only fully trained installers should be used for assembling PB pipe systems. Trained and Certified by Manufacturer.

6.7 JOINTING PROCEDURE:-

- The Polybutylene pipes and fittings are joined through a hot fusion welding machine and the below mentioned.
- Steps need to be adhered to while installing the system:

STEP 1: First the pipe need to be cut through a sharp cutter and the two end of the pipe need to be cleaned with the tangit cleaner provided by the manufacturer. The pipe cut should be a proper square cut only. Then the corresponding. Fitting to be connected with the fitting should also be cleaned with the same tangit cleaner. Cleaning removes all the dust particles on the pipe and the fitting for proper jointing. Then use the chamfering tool on the pipe to peel off a thin layer out of the pipe.

STEP 2: Then the corresponding heating dyes should be mounted on the machine and tightened properly. Connect the machine with the mains of 220 volt and wait for 3 minutes for the machine to attain the temperature of 260 degree centigrade. As soon as it attains this temperature, the cut off in the machine will give the indication in terms of red light blinking which give the indication that machine is ready for operation.

STEP 3: Then hold the pipe in one hand and fitting in another and insert the pipe and the fitting simultaneously in the respective dyes Hold it for some seconds and remove it and insert the melted portion of the pipe into the fitting and insert it deep till you get the two melted rings joined together. If the two rings are uniform, the joint made with be a hundred percent leak proff joint. Hold this operation for few seconds till it cools off completely.

Testing: Once the assembly is made pressure test it at double the working pressure so as to confirm the leakproff jointing of the system.

This pressure testing should be done for 12 hours and then put into operation on regular basis.

Required Depths, fusion time, holding time and cooling time for the elements of PB system

External diameter	Depth of weld	Fusion Time	Holding time	Cooling time
16mm	17mm	6 sec	15sec	2sec
20mm	17mm	7sec	15sec	2sec
25mm	20mm	7sec	15sec	2sec
32mm	22mm	10sec	20sec	4sec
40mm	24mm	14sec	20sec	4sec
50mm	28mm	18sec	30sec	4sec
63mm	32mm	22sec	30sec	4sec
75mm	36mm	28sec	30sec	6sec
90mm	38mm	35sec	35sec	6sec
110mm	42mm	37sec	35sec	8sec

6.8 INSTALLING THE PIPE WORK SYSTEM:

- The Contractor should:-
 - (ii) Check that the exterior of the piping is marked at intervals not exceeding one meter with the manufacturer's name, type of material, pipe size and standard with which it complies.
 - (iii) Check that all the piping and fittings supplied are uniform in colour density.
 - (iv) Exercise particular care in their storage, handling and installation to avoid deterioration due to ultraviolet light and impact damage.
- The piping manufacturer's printed instructions should be rigidly adhered to in all respects of storage, stacking, handling and installation. The pipe work should be supported as indicated upon the drawings and as detailed within the contract documents.
- It is essential that cleaners are correctly applied to the pipe ends and sockets prior to fusion and electro fusion jointing with cleaning pads changed regularly in accordance with manufacture's instructions. After fusion jointing, a ring of Polubutylene will be visible on the outside of the pipe as evidence that a joint has been completed. After electro fusion an indicator pipe will raise above the surface of the fitting as evidence that a joint has been completed.
- Grease care should be taken to ensure that only the manufacturer's installation procedures are followed and , in particular, that the full cooling period is maintained before any joint is considered to be complete.
- No pipe work, or section thereof, shall have wafer pressure applied until the manufacturer's stipulated setting period has elapsed (a minimum of at least one hour after the last fusion point).
- Where an existing heat source has to be maintained, with pipes either running parallel or crossing each other, thermal insulation should be applied.
- On no account should ladders scaffold or other building items be propped up against the PB pipe work installation.
- Changes in direction can be achieved using the pipes flexibility, in accordance with the manufacturer's instructions. No thermally induced bending of PB pipes through the application of local heating should be permitted.
- All PB pipes should be supported by pipe clips or supports brackets, the spacing of which should not exceed the maximum intervals as advised and confirmed by the pipe manufacturer.

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- Where a pipe clip or support bracket is being used to support a number of pipes, of different materials and sizes, the spacing interval between such clips and brackets should not exceed the smallest of the maximum intervals stated or advised for each of the pipes being supported.
- PB pipe work in exposed positions (or where distortion is likely to occur) should be supported using the piping manufacturer's standard pipe clip or support pipe carriers.
- Where PB piping is supported using other than standard PB pipe clips, the supports should comprise steel split pipe rings with rubber insert, napping rod nuts and washers with back plate as required, either fixed to rail support or building fabric.
- The test pressure should be maintained throughout the period of time of not less than one hour and not less than one and a half times working pressure.
- There should be no loss of pressure above that detailed in the manufacturer's handbook, to allow for the expansion and the setting in period of PB pipes, during the period, the test is being carried out. The results of the pressure test should be recorded on the log sheet.

6.9 EXPANSION:

- Expansion Loops or changes in pipe direction should be allowed for regular intervals in accordance with manufacturer's guidelines.
- Where expansion Loops and changes in direction are impractical fixed point assembly may be used on pipes up to 75mm diameter to prevent the PB pipes from expanding or contracting, in accordance with manufacturer's guidelines.
- If fixed point brackets are being used to avoid longitudinal expansion of PB pipes, the installation instruction of both the pipe and bracket manufacturers should be adhered to. Fixed point brackets should be located at fittings and must grip the pipe on both sides of the fittings, or according to manufacturer's instructions.
- Fixed point supports should be located at fusion or electro fusion fittings and meet with the manufacturer's requirements, to absorb forces and transfer them to the structure. Fixed points should not be located more than a maximum of 6m apart.
- Pipe support carriers must be used to support the pipes between fixed points, to prevent buckling. Normal supports for the pipes and carrier, between fixed points should not be more than 1.5m apart, in accordance with the manufacturer's guidelines.
- Pipe support carriers shall be of semicircular shape to closely match the pipes outside diameter. Manufactured from galvanized or size plated steel. The coating inside and outside are to be of the same standard. The finish is to be smooth along the surfaces and edges to prevent damage to the pipes. When cut the edges of the carrier are to be filed smooth. The carrier is to be attached to the pipe by approved cable ties suitable to support the forces, at intervals recommended by the manufacturer's (never more than 500mm). The carrier is not to be run over fittings, but to terminate 10-15mm short both sides with adequate support through cable ties and brackets.

7.0 HIGH DENSITY POLYETHYLENE PIPES (HDPE):

7.1 PE

Indian Standard lays down requirements for high polyethylene pipes from 16 mm to 1000 mm diameter of pressure rating from 0.25 MPa to 1.60 MPa in material graders of PE 63, PE80 and PE 100 for buried water mains and services and for supply above ground both inside and outside.

7.2 REFERENCES:

Indian Standards listed below are necessary to this standard:

To	Title
963	Methods of test for polyethylene moulding materials and polyethylene compounds.
968	Methods for random sampling.
992	High density polyethylene materials for moulding and extrusion (first revision)
986	Method of analysis for the determination of specific and /or overall migration of constituents of plastics materials and articles intended to come into contact with food stuffs (first revision)
1982	Positive list of constituents of polyethylene in contact with foodstuffs, pharmaceuticals and drinking water.
1982	Polyethylene for its safe use in contact with foodstuff, pharmaceutical and drinking water.

Table-I Classification of Pipe Material

(Clause 5)

Material Grade	MRS (Minimum Required Strength) of Material in MPa, at 20°C, 50 years.	Maximum Allowable Hydrostatic Design Stress (O), MPa	
		At 20°C	At 30°C
(2)	(3)	(4)	(5)
PE 63	6.3	5.0	4.0
PE 80	8.0	6.3	5.0
PE 100	10.01	8.0	6.3

7.3 DESIGNATION:

7.3.1 Pipes shall be designated according to the grade of material (4.2.2) followed by pressure rating (see 4.2.3) and nominal diameter (see 4.2.4). For example, PE 63 PN 10 DN 200 indicates a pipe pertaining to material grade 63, pressure rating 1.0 MPa and outside nominal diameter 200 mm.

7.3.2 Grade of Material.

7.3.2.1 Pipes shall be classified according to the grade of materials as given in Table-I.

7.3.2.2 The maximum allowable hydrostatic design stress © of a pipe is obtained by a applying the design co-efficient of 1/25 (min) to the MRS value of the material, taking into consideration the temperature at which the pipe is to be designed for.

7.3.2.3 The material grading shall be given by the raw material supplier and in case of master batch, by the pipe manufacturer.

7.3.3 Pressure Rating:

Pipes shall be classified by pressure rating (PN) corresponding to the maximum permissible working pressure at 30°C, as follows:

Pressure Rating of Pipe	Maximum permissible Working Pressure
PN 2.5	0.25 MPa
PN 4	0.40 MPa
PN 6	0.60 MPa
PN 10	1.00 MPa
PN 12.5	1.25 MPa
PN 16	1.60 MPa

Note: These pipes are recommended for maximum water temperature of +45°C. The pipes may also be used up to ambient temperature of –40°C. The recommended maximum working pressure for the material at 20°C in a pipe form is 5 MPa for 50 years of life. The creep rupture strength of the pipe diminishes with the increase in temperature above 27 °C and the working pressure should be modified.

7.3.4 High Density Polyethylene:

High density polyethylene (HDPE) used for the manufacturer of pipes shall conform to designation PEEWA-45-T-006 of IS 7328: 1992. HDPE conforming to designation PEEWA-45-T-012 of IS 7328:1992 may also be used with the exception that melt flow rating (MFR) shall not exceed 1.10 g/10 minutes. In addition the material shall also conform to 5.6.2 of IS 7328:1992.

7.3.4.1 The specified base density shall be between 940.5 Kg/m³ and 946.4 Kg/m³ (both inclusive) when determined at 27°C according to procedure prescribed in Annex A of IS 7328:1992. The value of the density shall also not differ from the nominal value by more than 3Kg/m³ as per 5.2.1.1 of IS 7328:1992.

7.3.4.2 The MFR of the material shall be between 0.41 and 1.10 (both inclusive) when tested at 190°C with nominal load of 5 Kgf as determined by method prescribed in 7 of IS 2530:1963. The MFR of the material shall also be within ± 20 percent of the value declared by the manufacturer.

7.3.4.3 The resin shall be compounded with carbon black. The carbon black content in the material shall be within 2.5 ± 0.5% and the dispersion of carbon black shall be satisfactory when tested according to the procedure described in IS 2530:1963.

7.3.5 Anti-oxidant:

The percentage of anti-oxidant used shall not be more than 0.3 percent by mass of finished resin. The anti-oxidant used shall be physiologically harmless and shall be selected from the list given in IS 10141:1982.

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Dimension of HDPE Pipes for Material Grade PE-63 as per IS 4984 : 1995

All Dimensions in Millimeters

WALL THICKNESS OF PIPES FOR PRESSURE RATINGS OF														
Nominal Dia	PN 2.5		PN 4		PN 6		PN 8		PN 10		PN 12.5		PN 16	
	DN	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
20	-	-	-	-	-	-	-	-	2.3	2.8	2.8	3.3	3.4	4.0
25	-	-	-	-	-	-	2.3	2.8	2.8	3.3	3.4	4.0	4.2	4.9
32	-	-	-	-	2.3	2.8	3.0	3.5	3.6	4.2	4.4	5.1	5.4	6.2
40	-	-	2.0	2.4	2.8	3.3	3.7	4.3	4.5	5.2	5.5	6.3	6.7	7.6
50	-	-	2.4	2.9	3.5	4.1	4.6	5.3	5.6	6.4	6.8	7.7	8.4	9.5
63	2.0	2.4	3.0	3.5	4.4	5.1	5.8	6.6	7.0	7.9	8.6	9.7	10.5	11.8
75	2.3	2.8	3.6	4.2	5.3	6.1	6.9	7.8	8.4	9.5	10.2	11.5	12.5	14.0
90	2.8	3.3	4.3	5.0	6.3	7.2	8.2	9.3	10.0	11.2	12.2	13.7	15.0	16.7
110	3.4	4.0	5.3	6.1	7.7	8.7	10.0	11.2	12.3	13.8	14.9	16.6	18.4	20.5
125	3.8	4.4	6.0	6.8	8.8	9.9	11.4	12.8	13.9	15.5	16.9	18.8	20.9	23.2
140	4.3	5.0	6.7	7.6	9.8	11.0	12.8	14.3	15.6	17.4	19.0	21.1	23.4	26.0
160	4.9	5.6	7.7	8.7	11.2	12.6	14.6	16.3	17.8	19.8	21.7	24.1	26.7	29.6
180	5.5	6.3	8.6	9.7	12.6	14.1	16.4	18.3	20.0	22.2	24.4	27.1	30.0	33.2
200	6.0	7.0	9.6	10.8	14.0	15.6	18.2	20.3	22.3	24.8	27.1	30.1	33.4	37.0
225	6.0	7.8	10.8	12.1	15.7	17.5	20.5	22.8	25.0	27.7	30.5	33.8	37.5	41.5
250	7.6	8.6	12.0	13.4	17.5	19.5	22.8	25.3	27.8	30.8	33.8	37.4	41.7	46.1
280	8.5	9.6	13.4	15.0	19.6	21.8	25.5	28.3	31.2	34.6	37.9	41.9	46.7	51.6
315	9.6	10.8	15.0	16.7	22.0	24.4	28.7	31.8	35.0	38.7	42.6	47.1	52.5	58.0
355	10.8	12.1	17.0	18.9	24.8	27.5	32.3	35.8	39.5	43.7	48.0	53.0	59.2	65.4
400	12.2	14.3	19.1	22.2	28.0	32.4	36.4	42.1	44.5	51.4	54.1	62.5	-	-
450	13.7	16.0	21.5	25.0	31.4	36.4	41.0	47.4	50.0	57.7	-	-	-	-
500	15.2	17.7	23.9	27.7	34.9	40.4	45.5	52.6	55.6	64.2	-	-	-	-
560	17.0	19.8	26.7	31.0	39.1	45.2	51.0	58.9	-	-	-	-	-	-
630	19.1	22.2	30.0	34.7	44.0	50.8	57.3	66.1	-	-	-	-	-	-
710	21.6	25.1	33.9	39.2	49.6	57.3	-	-	-	-	-	-	-	-
800	24.3	28.2	38.1	44.1	55.9	64.5	-	-	-	-	-	-	-	-
900	27.3	31.6	42.9	49.6	-	-	-	-	-	-	-	-	-	-
1000	30.4	35.2	47.7	55.1	-	-	-	-	-	-	-	-	-	-

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Dimension of HDPE Pipes for Material Grade PE-80 as per IS 4984 : 1995

WALL THICKNESS OF PIPES FOR PRESSURE RATINGS OF														
Nominal Dia	PN 2.5		PN 4		PN 6		PN 8		PN 10		PN 12.5		PN 16	
DN	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
20	-	-	-	-	-	-	-	-	-	-	2.3	2.8	2.8	3.3
25	-	-	-	-	-	-	-	-	2.3	2.8	2.8	3.3	3.5	4.1
32	-	-	-	-	-	-	2.4	2.9	3.0	3.5	3.6	4.2	4.5	5.2
40	-	-	-	-	2.3	2.8	3.0	3.5	3.7	4.3	4.5	5.2	5.6	6.4
50	-	-	2.3	2.8	2.9	3.5	3.8	4.4	4.4	5.3	5.6	6.4	6.9	7.5
63	-	-	2.5	3.0	3.6	4.2	4.7	5.4	5.3	6.6	7.0	7.9	8.7	9.8
75	-	-	2.9	3.4	4.3	5.0	5.6	6.4	6.3	7.8	8.4	9.5	10.4	11.7
90	2.3	2.8	3.5	4.1	5.1	5.9	6.7	7.6	8.2	9.3	10.0	11.2	12.5	14.0
110	2.7	3.2	4.3	5.0	6.3	7.2	8.2	9.3	10.0	11.2	12.3	13.8	15.2	17.0
125	3.1	3.7	4.9	5.6	7.1	8.1	9.3	10.5	11.4	12.8	13.9	15.5	17.3	19.3
140	3.5	4.1	5.4	6.2	8.0	7.0	10.4	11.7	12.8	14.3	15.6	17.4	19.4	21.6
160	4.0	4.6	6.2	7.1	9.1	10.3	11.9	13.3	14.5	16.3	17.8	19.8	22.1	24.6
180	4.4	5.1	7.0	7.9	10.2	11.5	13.4	15.0	16.4	18.3	20.0	22.2	24.9	27.6
200	4.9	5.6	7.7	8.7	11.4	12.8	14.9	16.6	18.0	20.3	22.3	24.8	27.6	30.6
225	5.5	6.3	8.7	9.8	12.8	14.4	16.7	18.6	20.0	22.8	25.0	27.7	31.1	34.5
250	6.1	7.0	9.7	10.9	14.2	16.9	18.6	20.7	22.0	25.3	27.8	30.6	34.5	38.2
280	6.9	7.8	10.8	12.1	15.9	17.7	20.8	23.1	25.5	28.3	31.2	34.6	38.7	42.8
315	7.7	8.7	12.2	13.7	17.9	19.9	23.4	26.0	28.7	31.8	35.0	38.7	43.5	48.1
355	8.7	9.8	13.7	15.3	20.1	22.4	26.3	29.2	32.3	35.8	39.5	43.7	49.0	54.1
400	9.8	11.5	15.4	18.0	22.7	26.4	29.7	34.4	36.4	42.1	44.5	51.4	55.2	63.7
450	11.0	12.9	17.4	20.3	25.5	29.6	33.4	38.7	44.0	47.4	50.0	57.7	-	-
500	12.2	14.3	19.3	22.4	28.4	32.9	37.1	42.9	45.5	52.6	55.6	64.2	-	-
560	13.7	16.0	21.6	25.1	31.7	36.7	41.5	48.0	51.0	58.9	-	-	-	-
630	15.4	18.0	24.3	28.2	35.7	41.3	46.7	54.0	57.3	66.1	-	-	-	-
710	17.4	20.3	27.4	31.8	40.2	46.5	52.6	60.7	-	-	-	-	-	-
800	19.6	22.8	30.8	35.7	45.3	52.3	-	-	-	-	-	-	-	-
900	22.0	25.5	34.7	40.2	51.0	58.9	-	-	-	-	-	-	-	-
1000	24.4	28.3	38.5	44.5	56.7	65.5	-	-	-	-	-	-	-	-

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Dimension of HDPE Pipes for Material Grade PE-100 as per IS 4984 : 1995

Wall Thickness of Pipes for Pressure Rating of										
Nominal Dia	PN 6		PN 8		PN 10		PN 12.5		PN 16	
DN	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
20	-	-	-	-	-	-	-	-	2.3	2.8
25	-	-	-	-	-	-	2.3	2.8	2.9	3.4
32	-	-	-	-	2.4	2.9	2.9	3.4	3.7	4.3
40	-	-	2.4	2.9	3.0	3.5	3.7	4.3	4.6	5.3
50	2.3	2.8	3.0	3.5	3.7	4.3	4.6	5.3	5.7	6.5
63	2.9	3.4	3.8	4.4	4.7	5.4	5.7	6.5	7.1	8.1
75	3.5	4.1	4.5	5.2	5.6	6.4	6.8	7.7	8.5	9.6
90	4.1	4.8	5.4	6.2	6.7	7.6	8.2	9.3	10.2	11.5
110	5.0	5.7	6.6	7.5	8.1	9.2	10.0	11.2	12.4	13.9
125	5.7	6.5	7.5	8.5	9.2	10.4	11.3	12.7	14.1	15.8
140	6.4	7.3	8.4	9.5	10.3	11.6	12.7	14.2	15.8	17.6
160	7.3	8.3	9.6	10.8	11.8	13.2	14.5	16.2	18.1	20.2
180	8.2	9.3	10.8	12.1	13.3	14.9	16.3	18.2	20.3	22.6
200	9.1	10.3	12.0	13.4	14.8	16.5	18.1	20.2	22.6	25.1
225	10.3	11.6	13.5	15.1	16.6	18.5	20.4	22.7	25.4	28.2
250	11.4	12.8	15.0	16.7	18.4	20.5	22.6	25.1	28.2	31.3
280	12.8	14.3	16.8	18.7	20.6	22.9	25.3	28.1	31.6	35.0
315	14.4	16.1	18.9	21.0	23.2	25.8	28.5	31.6	35.5	39.3
355	16.2	18.1	21.2	23.6	26.2	29.1	32.1	35.6	40.0	44.2
400	18.2	21.2	23.9	27.7	29.5	34.2	36.2	41.9	45.1	52.1
450	20.5	23.8	26.9	31.2	33.1	38.3	40.7	47.1	50.8	58.7
500	22.8	26.5	29.9	34.6	36.8	42.6	45.2	52.2	56.4	65.1
560	25.5	29.6	33.5	38.8	41.2	47.6	50.6	58.4	-	-
630	28.7	33.3	37.7	43.6	46.4	53.6	56.9	65.7	-	-
710	32.3	37.4	42.4	49.0	52.3	60.4	-	-	-	-
800	36.4	42.1	47.8	52.2	58.9	68.0	-	-	-	-
900	41.0	47.4	53.8	62.1	-	-	-	-	-	-
1000	45.5	52.6	-	-	-	-	-	-	-	-

7.4 INSTALLATION FOR HDPE PIPES:

7.4.1 BUTT WELDING: A RELIABLE METHOD FOR LEAKPROOF JOINTS OF HDPE PIPES:

BUTT WELDING is the most important jointing method in HDPE pipes. This method is known as a heat pressure related process by which the pipe end material of two pipes are melted together under pressure creating a homogenous pipe structure. Simple in its idea, the butt fusion process demands high accuracy to give the final product i.e. a BUTT WELD. However, the method is very simple and reliable.

1. The two pipes to be welded are clamped in a welding machine & are brought in axial alignment.
2. Ends of pipes are cleaned using damp cloth and scraper to ensure that welding faces are free from dust and other foreign materials.
3. The pipe ends are pressurised against the hot plate with a specified temperature (between 200⁰- 210⁰C), pressure and specified time. The pipe material melts forming a circular bead on periphery of both the pipe ends.
4. When the ends of pipes melted and bead formation is over, the hot plate is removed and the melted ends are pressed against each other to make a Butt Weld. The welding pressure is specified and welded time as well.

When the weld has been cooled down the pipes are taken out from the machine and preparation of next joint can start.

8.0 AUTOMATIC AIR VENT (AAV):

- Automatic air vents, shall be furnished at the top of main water risers, supply and return pipes.
- A shut-off valve shall be provided at the inlet of each automatic air vent. The outlet shall be piped to the nearest drain.
- Air Release Valves shall be capable of automatically releasing accumulated air from a fluid system while that system is in operation and under pressure.
- To assure drop tight shut-off, a viton orifice button shall be used to seal the valve discharge orifice when the valve is in a closed position. The orifice diameter will be sized for use within a given operating pressure range to insure maximum discharge capacity.

9.0 INSULATION OF HOT WATER PIPES:

a) Hot Water Pipes inside the building:

All concealed and exposed hot water supply pipes. shall be wrapped with 9 mm thick thermal insulation tubing, light weight closed cell polyethylene foam conforming to BS 476 Part 7 and ASTM E84.

Specification for Thermal insulation for Hot water pipes running above False Ceiling/exposed.

i) MATERIAL

- Thermal conductivity of material shall not exceed 0.038 W/m²K at an average temperature of 40°C. The material should have a density in the range of 30 ± 5 kgs/cu. m. The water vapour resistance factor should be higher than 5300.
- Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer test certificate for thermal conductivity values. Samples of insulation material from each lot delivered at site may be selected by project manager and gotten tested for thermal conductivity and density at contractor's cost. All joints shall be sealed properly with adhesive, which shall provide vapour barrier as the original insulating material.
- Insulation material shall be strong mechanical strength to prevents during installation and in use.
- Does not contain harmful CFC's.
- Insulation material have very low smoke index and non-existence of poisonous gases.
- Very small cell structure to prevent water ingress.

ii) PIPING INSULATION:

All hot water piping shall be insulated in the manner specified herein. Before applying insulation, all pipe shall be brushed and cleaned. Thermal insulation shall be applied as follows or as specified in drawings or schedule of quantity.

Thickness of Insulation :

Pipe size (mm)	Thickness of Insulation
15 mm to 54 mm	9 mm
67 mm to 108 mm	13 mm

Insulating material in tube form shall be sleeved on the pipes. On existing piping - opened tube from insulating material shall be placed over the pipe and adhesive (as recommended by the manufacturer) shall be applied as suggested by the manufacturer. Adhesive must be allowed to tack dry and then press surface firmly together starting from butt end and working towards centre.

Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. The insulation shall be continuous over the entire run of piping, fittings and valve. All valves, fittings, joints, strainers etc. in hot water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

iii) APPLICATION:

1. Clean the surface of the pipe to be insulated free from dust, grease and other matter.
2. Select the correct ID of the pipe suitable for the pipe to be insulated and slit the pipe along its length using a sharp knife. Ensure that the cut is straight.
3. Apply a thin coat of adhesive on both the cut surfaces of the tubing and leave it for 2-3 minutes for drying.

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4. Once the adhesive is dry but tacky to touch bring both the ends of tubing where is adhesive is applied in contact and stick them well. Ensure that both the surfaces are matched properly.
 5. Apply Self Adhesive Black Cotton tape on both the longitudinal and the circumferential joints. Before fixing the tapes it must be ensured that all the joints are sealed properly and free of dust, loose particles etc. to provide good adhesion.
 6. In case of pipes exposed to the atmosphere one layer of **Polyshield** Protective Coating has to be applied over the insulation.
 7. Generally sheets are recommended for insulating the pipes of 4" NB above. In this case the adhesive has to be applied on the pipe surface as well as the inside surface of the sheet. Once the adhesive is tacky to touch bring them together to stick. Care must be taken that the joints are sealed properly before fixing the self adhesive tape.
- iv) Supplying and fixing Thermal Insulation in the form of tubing/sheeting depending on the size of the pipe and as per the thickness recommendation given in the tender. The application procedure mentioned in the tender should be strictly adhered to and the ancillary material to be used should also be as mentioned in the application procedure.
- v) POLYSHIELD PROTECTIVE COAT:

APPLICATION:

- Since material i.e. Nitrile foam is a soft resilient product, coating cannot be directly carried out on the surface of the insulation material. A reinforcement layer has to be provided to sustain the coating system and to attain a tough finish. One layer of polyglass tape has to helically wound on the insulated surface with an over lap of 5 mm to 8 mm. The tape winding has to be firm and not exceedingly tight as the insulation material will get compressed which is not desirable, as insulation values will get affected.
- After winding of polyglass tape, the first coat of polyshield is applied with the help of a brush & care should be taken to ensure that the first coating is spread evenly thoroughly wetting the tape. The material spreads itself and therefore, only a thin layer should be applied by dipping the brush in the mixed liquid only upto 10 mm. The first coat will cure/dry in 2 hrs in dry & hot conditions, excessively high humidity inhibits the curing process. Therefore, this coating should not be applied during monsoons. The second coat should be applied over the first coat evenly & allowed to dry. The coating achieves hard cure in 8 hrs to 10 hrs. on total drying the coating will attain a semi glossy to glossy finish.

PREPARATION METHOD:

- 'Polyshield' coating consists of resin & hardener (part 'A' & part 'B'). take a clean plastic container (Mugs, small bucket), mix the part 'A' & part 'B' thoroughly before pouring into the container as the solids tend to settle down to the bottom of the can. Pour only one Kg at a time (since the pot life is limited) of part 'A' and add only 0.6 Kgs of part 'B' to part 'A' and thoroughly mix both the parts. Care should be taken while mixing the liquid as improper mixing will result in improper cure and colour dispersion. The measurement of part 'A' & part 'B' should be accurate with proper measurement devices as less or excess of hardener will change the property of the cured system. Care should be taken to avoid inhalation of vapours as the system is solvent based.

TOOL & STORAGE:

Store the material in a cool dry place and away from direct sunlight as per-gelation may occur. Brushes can be cleaned with NC thinner of acetone, and reused (mixed coating material should not be stored as the fluid will gel).

vi) MEASUREMENT OF INSULATION:

- Unless otherwise specified measurement for pipe insulation for the project shall be on the basis of centre line measurements described herewith.
- Pipe Insulation shall be measured in units of length along the centre line of the installed pipe strictly on the same basis as the piping measurements. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement all valves orifice plates and strainers shall not be separately measurable by their number and size. It is to be clearly understood that for the insulation measurements all these accessories including valves, orifice plates and strainers etc shall be considered strictly by linear measurements along the centre line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

10.0 **Hot Water Pipes external(Buried):**

10.1 **General Specifications for external (Buried) Hot water Supply and Return**

For buried application, providing and fixing Pre-insulated Flexalen (prefabricated) pipe systems in accordance with BRL "Quality Assurance" or another equivalent external monitoring system, and verification of the PB medium pipe production in accordance with EN-ISO 15876. The medium pipes and fittings are manufactured of the plastic polybutene in accordance with EN ISO 15876. It should allow a radius of curvature of 0.40 to 1.25 meter up to DN 100, from DN 100 to DN 200 a radius of 16 to 20 mtr. It should be corrosion-resistant and maintenance-free; shutdown (outside the season) can be performed without special measures. No compensators or compensation tube bends should be used during laying as the pipe system should itself compensates for linear expansion on its own. system should consists exclusively of the components belonging to a system of a single manufacturer that can be used for a district distribution of thermally active fluid (chilled / hot water) , a secondary network to the connection of the point of usage area. The prefabricated thermal insulation consists of flexible, closed-cell flexible polyolefin foam that is bonded to the casing pipe, having density of 30 - 40 kg/m³, capable of operating for the temperature range of - 80 to + 95°C, the thermal conductivity: of the prefabricated (pre-insulated) system should be 0.031 W/mK at 50°C. The casing pipe should be of HDPE and should be water tight while being bonded with insulation. For hot water application the system should withstand maximum operating pressure of 12 bar @ 60°C. All termination points should be either brass fittings / HDPE flanges as per the manufacturer's recommendation

10.2 **Laying for buried pipes:**

A sand bed of at least 10 cm in any direction must surround the pipeline after the sand has been compressed. The granulation of the sand (= riddle line) is determined by the pipe manufacturer. There must be no coarse grains. After the back filling, the sand is compressed. Thus some small air holes remain in the sand which are only connected by narrow channels (high flow resistance - no air convection in the sand). For those areas that must bear transport loads, a minimum cover of 0.8 m; in areas without transport load a minimum cover of 0.5 m is required. Further back filling is normally undertaken using spoil from the trench. Coarse-grain gravel or road metal with or without a small soil portion are not suitable for the filling as they produce air channels with relatively big cross-sections and thus encourage the convection of the encircled air or the water which has invaded the trench. The filling must have a portion of fine-grained material, which prevents the development of continuous air channels. After the filling has been poured in, it must be compressed to produce a compact packing of the material.

10.3 Laying as exposed line:

For exposed lines, flexible and highly flexible pipes are supported over their entire lengths (e.g. with angle irons) and fastened to the supporting structure with tightening straps. For pipe segments of polybutene, DA 110 to 160, point-wise support and fastening can take place with a maximum spacing of 1.5 m. The pipe ends of the medium pipes of polybutene are secured with fixed point clamps before the transition (e.g. at the house service connection) to prevent expansion forces from being transferred through the transition.

For vertical lines, flexible pipes are fastened to the medium pipe with fixed point clamps with a maximum spacing of 3 m. The creation of fixed points, including anchoring to the structure with the necessary strength, is accounted for in separate items.

10.4 Wall entries:

Wall entries can be executed according to the guidelines of the manufacturer depending on the structural situation and pipe dimensions. Lines with corrugated outer pipe can either be directly concreted in or installed through an additional seal in the wall entries as for smooth casing pipes. The use of typical wall entries at the contractor's discretion is permitted.

10.5 Welding process:

The PB medium pipes are connected to each other or to fittings in the dimension range of 25 – 100 mm by polyfusion socket welding or electric socket welding, at the contractor's discretion. For dimensions over 110 mm, the connection will be executed as a butt weld.

10.6 Pressure testing:

The pressure testing (preliminary and main testing) is performed after completion of all welding work and before application of the final insulation according to the guidelines of the manufacturer at no separate cost.

10.7 Thermal insulation in the welding area:

In the area of welded connections, the pipe system is provided with additional insulation according to the manufacturer guidelines after completion of the pressure test in the form of Insulation half shells, slide-over tube and shrinking sleeves or "final insulation parts" with insulation material ("final insulation"). The costs for the subsequent insulation are not charged separately.

11.0 STERILIZATION OF INSTALLATION:

11.1 The water supply installation shall be sterilized as per standards and as follows:-

- a) Tanks and pipes shall be filled and flushed out.
- b) All bibcocks (taps) shall be closed.
- c) Tanks and pipes shall be re-filled while adding a sterilizing admixture containing 50 parts chlorine to one million parts water.
- d) When the installation is filled all bib cocks (taps) shall be opened progressively and each allowed to run until the water smells of chlorine.
- e) The installation shall be topped up and more sterilizer added.
- f) The installation shall then be left for three hours and shall then be tested for residual chlorine, if none is found, the installation shall be drained and the process repeated.
- g) The installation shall be finally drained and flushed with potable water before use.

IV) LIST OF APPROVED MAKES FOR PLUMBING/SANITARY & FIRE PROTECTION WORKS:

S.No.	MATERIAL DESCRIPTION	APPROVED MAKES
1	Sanitaryware	: a) Imported b) Hindustan Sanitaryware/Parryware/Cera
2.	Seat covers (Heavy Duty)	: Commander/Diplomet/Admiral
3.	C.P fittings & Bathroom accessories	: a) Imported b) Jaquar/Gem/ ESS/Ceramix
4.	Stainless Steel Sink	: Neelkant/AMC/Jayna
5.	Infra red based electronic Flusing system for urinal/ wash basin	: TOSHI /Utec/ Euronics
6.	Hand Drier	: TOSHI /Utec/ Euronics
7.	UPVC Pipe & Fitting	: Supreme/Astral/Prince/Jain PVC Pipe
8.	CPVC Pipe & Fitting	: Astral Flow guard/ Supreme/ Ajay Flow guard
9.	PB Pipe &Fittings/Pre-insulated Pipes):	Thermaflex/ Flexalen
10.	COPPER Tube	: Rajco/ Max Flow/ Viega
11.	COPPER Fittings	: Flow Flex/IBP
12.	HDPE Pipe	: Dura line /oriplast
13.	HDPE Fittings	: Dura line/oriplast
14.	G.I. Pipes/M.S. Pipe	: Tata/Jindal (Hissar)
15.	G.I. fittings (malleable cast iron)	: Unik/Zoloto 'M'/Jainsons Industries (JSI)
16.	SFRC Manhole Cover/Grating	: K.K.Manhole/Jain spun pipe/Pragati
17.	CI Pipes/fittings (I.S: 3989-1984)	: SKF/NECO
18.	CI Pipe / fittings (I.S: 1729)	: SKR/NECO
19.	CI pipes 'Class LA'	: Kesoram/Electrosteel/NECO
20.	Stoneware pipes/Gully traps	: Perfect/R.K/ Anand
21.	R.C.C Pipe	: Jain Spun Pipe/Pragati/Daya Spun Pipe

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S.No.	MATERIAL DESCRIPTION	APPROVED MAKES
22.	C.P. Grating	: Camry/Chilly/Neer
23.	Cast Brass Clean Out Plugs	: Camry /Neer
24.	C.I Manhole Cover (IS: 1726–1991)	: SKF/NECO/RIF
25.	C.I. Grating	: NECO/RIF/BC
26.	Gully Traps	: Perfect/RK/Anand
27.	Ball Valve /Globe Valve	: Zoloto / Leader
28.	Butterfly valves	: Audco/Advance/KSB
29.	Non return valve	
a)	G.M	: Zoloto/ Leader
b)	C.I (Dual Plate Type)	: Advance
30.	Automatic Air Vent Valve	: OR/Jainsons Industries (JSI)/VB, Tiemme/ Anergy
31.	Pipe Supports, Hangers	: Intello Tech/Camry
32.	Flanges	: Table 'H'/Class 150
33.	Thermal Insulation	: Thermaflex
34.	Anti Corrosive Bitumastic Paint	: Asian/Burger/J&N
35.	Epoxy Paint	: Asian/Berger /J&N
36.	C.I. S&S / Double flanged fittings specials	: Kartar/National/ Kesoram/Kapilansh
37.	Pressure Reducing Valves	: RBM (Italy)/Honeywell
38.	Ductile Iron Manhole Cover & Frame/Grating	: NECO/RIF
39.	WC Pan Connector	: MC Alpine (UK)/Multikwin

V) (I) NOTES ON BILL OF QUANTITIES

- 1) All items of work shall be executed strictly in accordance with the description of the item in the bill of quantities, equipment schedule, drawings and standard specifications read in conjunction with the appropriate Indian Standard specifications and conditions of contract.
- 2) The rate for each item of work included in the bill of quantities shall unless expressly stated otherwise, include cost of:
 - a) All materials, equipment's fixing materials, accessories operations, tools plant, equipment, transport, labour and incidentals required in preparation for in the full and entire execution and completion of the work called for in the item and as per specifications and drawings completely.
 - b) Wastage on materials and labour.
 - c) Loading, transportation, unloading, handling/double handling, hoisting to all levels, setting, fitting and fixing in position protecting, disposal of debris and all other labourers necessary in and for the full and entire execution and to fully complete and job in accordance with contract documents, good practice and recognized principles.
 - d) Liabilities, obligations and risks arising out of conditions of contract.
 - e) All requirements of specifications whether such requirements are mentioned in the item or not. The specification and drawings are to be read as complimentary to and part of the schedule of quantities and any work called for in one shall be taken as required for all.
 - f) In the event of conflict between the bill of quantities and other documents, the most stringent shall apply and interpretation of the Construction manager/Consultants shall be final and binding.
- 3) The contractor shall be paid for the actual quantity of work executed by him in accordance with the drawings at the contract rates.
- 4) The bill of quantities shall be fully priced and the extensions and totals duly checked. The rates for all items shall be filled in ink. The entries under the amount column shall be rounded off to the nearest rupee.
- 5) Unless otherwise stated all measurements shall be carried out in accordance with IS 1200 (Latest Edition).
- 6) The terms "Equivalent or Equal" shall mean the equivalents as approved in writing by the Construction manager/Consultants. The question of "Equivalent" material/equipment shall be considered only if, the specified make is not available in the market or discontinued by the manufacturer. The consultant will reserve the right to choose any of the particular make given in the approved manufacturers list.

7) **Supply of Materials:**

Supply of materials shall mean supply of materials at site. The rate for supply shall include all taxes, octroi, insurance, packing and forwarding charges, transportation, unloading at site and overheads & profit.

- 8) The quantities indicated in the bill of quantities are provisional and the contractor is required to measure the actual quantity at site and as per construction drawing and procure the same only after getting the approval of consultant.
- 9) The rates quoted shall include all taxes/duties.
- 10) The owner reserves the right to supply any materials/ Equipment's indicated as supply items in the Bill of Quantities. The contractor shall not have any extra claim or objection to such items supplied by the owner.
- 11) Before any material or equipment is supplied at site contractor shall submit samples/technical details etc, for consultant's/owners approval.
- 12) Shop drawings shall be prepared to get approval before start of any work.
- 13) For the items in the opinion of the consultant requires inspection at the place of manufacturer, contractor shall arrange for such inspection.

**PROJECT: CONSTRUCTION/ EXTENSION OF GURU RAMDAS
LANGAR HALL AT SRI HARMINDER SHAB, AMRITSAR****VII) LIST OF TENDER DRAWINGS**

S.No.	Description	Drawing No.
	PLUMBING DRAWINGS :	
1	BASEMENT FLOOR PLAN DRAINAGE LAYOUT	PHE - 1
2	GROUND FLOOR PLAN DRAINAGE LAYOUT	PHE - 2
3	FIRST FLOOR PLAN DRAINAGE LAYOUT	PHE - 3
4	SECOND FLOOR PLAN DRAINAGE LAYOUT	PHE - 4
5	TERRACE PLAN DRAINAGE LAYOUT	PHE - 5
6	BASEMENT FLOOR PLAN WATER SUPPLY LAYOUT	PHE - 6
7	GROUND FLOOR PLAN WATER SUPPLY LAYOUT	PHE - 7
8	FIRST FLOOR PLAN WATER SUPPLY LAYOUT	PHE - 8
9	SECOND FLOOR PLAN WATER SUPPLY LAYOUT	PHE - 9
10	WATER SUPPLY SCHEMATIC DIAGRAM	PHE - 10

PROJECT: CONSTRUCTION/EXTENSION OF GURU RAMDAS LANGAR HALL AT SRI HARMANDER SAHIB, AMRITSAR		
VI) SUMMARY OF COST FOR PLUMBING/SANITARY WORKS		
S. NO.	DESCRIPTION	Amount
BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS		
A.	FIXTURES & FITTINGS : (KITCHEN]	
B.	BASEMENT DRAINAGE	
C.	INTERNAL DRAINAGE (WASTE (VENT PIPE & FITTINGS FOR (KITCHEN & GURU RAMDAS LANGER HALL)	
D.	RAIN WATER DRAINAGE	
E.	COLD WATER SUPPLY SYSTEM (INTERNAL)	
F.	HOT WATER SUPPLY SYSTEM (INTERNAL)	
G.	EXTERNAL COLD WATER SUPPLY SYSTEM (INTERNAL)	
H.	EXTERNAL SEWERAGE	
I.	EXTERNAL STORM WATER DRAINAGE	
J.	MISCELLANEOUS ITEMS	
TOTAL PLUMBING AMOUNT		

**PROJECT: CONSTRUCTION/EXTENSION OF GURU RAMDAS LANGAR HALL AT
SRI HARMANDER SAHIB, AMRITSAR**

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS

Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
A)	FIXTURES & FITTINGS : (KITCHEN]				
	NOTE:-				
i)	Models/makes of all sanitary fixture shall be selected by the Owner/Architect from the list of approved make.				
1.0	Fixing of stainless steel kitchen sink with R.S. or CI bracket (painted white), 40 mm dia C.P. brass waste of standard pattern, C.P. brass chain and rubber, 40 mm dia caste brass bottle trap with necessary union, C.P. pipe to wall & CP wall flange including 15mm C.P. brass wall mounted mixing fitting (sink mixture) fitting for kitchen sink with swinging spout complete with cutting and making good the walls where required (Location : Pantry, Kitchen, Coffee				
2.0	Single bowl with single drain board. Overall size 1145 mm x 510 mm / bowl size 550 mm x 404 mm x 200 mm.	Each	8		
3.0	Double bowl with double drain board. Overall size 1765 mm x 465 mm / bowl size 428 mm x 378 mm x 225 mm.	Each	6		
4.0	Fixing of 15 mm dia angle valve with flanges including 600 mm long copper connecting pipe with nuts complete.	Each	175		
	TOTAL OF FIXTURES & FITTINGS : (KITCHEN]				
B)	BASEMENT DRAINAGE				
1.0	Providing, fixing, testing and commissioning of S & S cast spun pipes (class `LA') conforming to IS : 1536 & fittings conforming to IS : 1538 like elbows, tees, bends, crosses etc lead caulked joints conforming to IS : 3144, tyton joints clamps/ structural steel supports as required/directed at site including cutting & making good the walls, floors, R.C.C. work etc, cutting chases & filling the same with cement conc. 1:3:6 (1 cement :3 coarse sand :6 graded stone aggregate 20 mm nominal size) or cement mortar 1:4 (1 cement :4 coarse sand) as required, painting with approved paint protection.(Sump Pump discharge).				
a)	65 mm dia	RM	30		
b)	80 mm dia	RM	60		
c)	100 mm dia	RM	R.O		
a)	Ductile Iron grating 400mm wide 40mm thick placed over 40 x 40x 6mm M.S Angle Iron Frame (For 300mm wide drain channel) [LOCATION: RAMP AREA/ PLANT ROOM AREA]	RM	60		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
2.0	Providing, fixing, testing and commissioning of UV stabilized UPVC SWR type; 'A' as per IS 13592-1992 with all fittings such as bends, tees, clamps, cowls, elbow, 'Y', offset, cleaning pipe door, clamps and structural supports etc. including cutting the floor, walls and making good the same in cement concrete 1:2:4 & cement mortar 1:4. The wall thickness of the pipe and the technical characteristic conform to IS 13592-1992 type 'A'. The fitting dimension conforming to IS : 14735-99. The jointing to be completed with rubber lubricant. [For Sump Vent]				
a)	75 mm OD	RM	R.O		
b)	90 mm OD	RM	R.O		
c)	110 mm OD	RM	R.O		
d)	160 mm OD	RM	R.O		
	TOTAL OF BASEMENT DRAINAGE [PART-I B] CARRIED OVER TO SUMMARY				
C)	INTERNAL DRAINAGE (WASTE, VENT PIPE & FITTINGS FOR (KITCHEN & GURU RAMDAS LANGAR HALL):				
1.0	Providing, fixing, testing and commissioning of cast iron centrifugally spun soil and waste pipes (IS: 3989 - 1984) including all fittings (plain or door) such as bends, junctions, inspection doors, with 3 mm thick rubber washer; offsets, cowls, access pieces /plugs etc clamps/structural steel supports as required/directed at site, jointing with drip seal joint including tarred spun yard packing, cutting holes in walls and floors and making good where required and testing complete.				
a).	75 mm dia (IS: 3989-1984)	RM	70		
b)	100 mm dia (IS: 3989-1984)	RM	772		
c)	150 mm dia (IS: 3989-1984)	RM	95		
d)	200 mm dia (IS: 3989-1984)	RM	R.O		
2.0	Providing and laying cement concrete 1:2:4 mix (1 cement :2 coarse sand :4 graded stone aggregate, 20 mm down gauge) 75 mm in bed and all around CI soil and waste pipes under floor, including shuttering and centering for: -				
a)	75 mm dia	RM	70		
b)	100 mm dia	RM	1200		
c)	150 mm dia	RM	700		
d)	200 mm dia	RM	R.O		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
3.0	Providing painting on cast iron spun soil and waste pipes and fittings with two coats of synthetic enamel paint of approved shade as per pipe colour code over a coat of red oxide primer including surface preparation (of approved quality).				
a)	75 mm dia	RM	60		
b)	100 mm dia	RM	1165		
c)	150 mm dia	RM	200		
d)	200 mm dia	RM	R.O		
4.0	Providing and fixing testing and commissioning of cast iron centrifugally spun 'P' or 'S' trap of self cleansing design without vent arm conforming to (IS: 3989-1984) setting in cement concrete 1:2:4 mix complete in all respects including cutting and making good the walls, floors & RCC work. (Floor Trap)				
a)	150 mm inlet & 150 mm outlet	Each	R.O		
b)	100 mm inlet & 100 mm outlet.	Each	216		
c)	100 mm inlet & 75 mm outlet.	Each	10		
5.0	Providing and fixing cast brass clean out plug with suitable insert keys for opening in brass cap, male threaded joint/reducer with G.I. socket caulked to Pipe/fittings of CI pipe including cost of drip seal joints including tarred spun yard packing etc. complete in all respect.				
a)	50 mm dia.	Each	R.O		
b)	75 mm dia.	Each	R.O		
c)	100 mm dia.	Each	62		
d)	150 mm dia	Each	23		
e)	200 mm dia	Each	R.O		
6.0	Providing & fixing 4 mm thick stainless steel grating with rim of approved design including setting in floor with cement mortar. (For Floor Trap/Floor Drain)				
a)	125 mm dia	Each	125		
b)	80 mm dia	Each	R.O		
7.0	Providing and fixing floor drain with 65mm x 50mm GI Elbow with cement mortar, complete in all respect.	Each	R.O		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
8.0	Providing, fixing, testing and commissioning of GI pipes (Class 'C') of approved make conforming to IS 1239-1982 complete with G.I. fittings such as tees, crosses, plugs, sockets, elbows, reducers, unions, sleeve pieces, check nuts etc including jointing with C.I. pipes (wherever required), cutting & making good the walls, floors, R.C.C. work etc. cutting chases & filling the same, painting the GI pipes with two or more coats of synthetic enamel paint of approved quality over a coat of oxide zinc chromate primer as directed by the Project Manager (shade as per pipe colour code) (for waste connection).				
a)	25 mm dia	RM	R.O		
b)	32 mm dia	RM	R.O		
c)	40 mm dia	RM	R.O		
d)	50 mm dia	RM	130		
9.0	Providing and fixing G.I Inlet fitting with maximum 3 inlets 32, 40 or 50 mm size fabricated from 100 mm dia G.I pipes and welded G.I sockets, fixed to CI trap with lead caulked joint and set in 1:2:4 cement concrete block, painting G.I. pipe (from inside and outside) two coats of anti-corrosive paint as per standard drawing complete.	Each	130		
10.0	Connection of PVC FCU and AHU Drain to CI Floor Trap/CI Waste Pipe located at shaft including all fitting and accessories complete with jointing and civil work.	RM	150		
	TOTAL OF INTERNAL DRAINAGE (SOIL, WASTE, VENT, AHU DRAIN, SUMP RISER AND RAIN WATER PIPES & FITTINGS) [PART-I C] CARRIED OVER TO SUMMARY				
D)	RAIN WATER DRAINAGE :				
	UPVC RAIN WATER PIPE:				
1.0	Providing, fixing, testing and commissioning of UV stabilized UPVC SWR type; 'A' as per IS 13592-1992 with all fittings such as bends, tees, clamps, cowls, elbow, 'Y', offset, cleaning pipe door, clamps and structural supports etc. including cutting the floor, walls and making good the same in cement concrete 1:2:4 & cement mortar 1:4. The wall thickness of the pipe and the technical characteristic conform to IS 13592-1992 type 'A'. The fitting dimension conforming to IS : 14735-99. The jointing to be completed with rubber lubricant. [For Rain Water Pipe running outer periphery+ Terrace Garden/Water Body Drainage]				
i)	110 mm OD UPVC SWR Pipe (IS 13592-1992 Type 'A')	RM	25		
ii)	160 mm OD UPVC SWR Pipe (IS 13592-1992 Type 'A')	RM	150		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
iii)	200 mm OD (IS : 4985-2000 class III 6 Kg/cm ²)	RM	R.O		
5.0	Making rain water khurras 45 x 45 cm with average minimum thickness 5 cm cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) over PVC sheet 1 m x 1 m x 400 micron, finished with 12 mm plaster in cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement including rounding of edges and finishing of outlet complete in all	Each	5		
6.0	Making rain water khurras 30 x 30 cm with average minimum thickness 5 cm cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) over PVC sheet 1 m x 1 m x 400 micron, finished with 12 mm plaster in cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement including rounding of edges and finishing of outlet complete in all	Each	21		
	TOTAL OF RAIN WATER DISPOSAL/DRAINAGE/WATER BODIES DRAINAGE [PART-I D)] CARRIED OVER TO SUMMARY				
E)	COLD WATER SUPPLY SYSTEM (INTERNAL) :				
1.0	<u>CPVC Pipe in Chase/Embedded in Wall :</u>				
	Providing, fixing, testing and commissioning of CPVC (Chlorinated Polyvinyle Chloride) pipe as per CTS SDR-11 & fittings such as tees, elbows, reducers, male/female connector, clamps etc. as per ASTMD-2846, jointing with CPVC solvent cement as per manufacturer recommendations conforming to ASTM-F493. Cutting and making good the walls, floors, R.C.C. work etc. cutting chase and filling the same with cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) or cement mortar (1 cement : 4 coarse sand) as required. [Location : Pipe chase/embedded in wall].				
i)	15.9 mm (OD) SDR 11	RM	160		
ii)	22.2 mm dia (OD) SDR 11	RM	90		
iii)	28.6 mm dia (OD) SDR 11	RM	70		
iv)	34.9 mm dia (OD) SDR 11	RM	30		
v)	41.9 mm (OD) SDR 11	RM	10		
vi)	54.0 mm (OD) SDR 11	RM	20		
2.0	<u>CPVC Pipe (Exposed) :</u>				

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
	Providing, fixing testing, and commissioning of CPVC (Chlorinated Polyvinyle Chloride) pipe as per CTS SDR-11 & fittings such as tees, elbows, reducers, male/female connector, clamps etc. as per ASTMD-2846, jointing with CPVC solvent cement as per manufacturer recommendations conforming to ASTM-F493. Steel structural support as required/directed at Site including all civil work, cutting and making good the walls, floors, R.C.C. work etc. (Exposed Pipe) [Pipe running in false ceiling].				
i)	15.9 mm (OD) SDR 11	RM	120		
ii)	22.2 mm (OD) SDR 11	RM	110		
iii)	28.6 mm (OD) SDR 11	RM	90		
iv)	34.9 mm (OD) SDR 11	RM	100		
v)	41.9 mm (OD) SDR 11	RM	20		
vi)	54.0 mm (OD) SDR 11	RM	100		
3.0	Providing, fixture, testing and commissioning of CPVC (Chlorinate of polyvingle chloride) SCH - 80 pipe and fitting such as tees, elbows, reducers. Male/female connector, clamps etc. Jointing with CPVC solvent cement as per manufacture recommendation Clamps /steel structural support as required / directed at site, water hammer protection as per manufacture recommendation including all civil work, cutting and making good the walls floors, R.C.C work etc.				
i)	2 1/2" dia Nominal Size	RM	30		
ii)	3" dia Nominal Size	RM	80		
iii)	4" dia Nominal Size	RM	90		
iv)	6" dia Nominal Size	RM	R.O		
4.0	<u>BALL/Globe Valve :</u>				
	Providing, fixing, testing and commissioning Ball/Globe valve PTFE (Teflon) seat and ring with chrome plated centre handle with female BSP threads complete in all respect. Minimum working pressure 15 Kg/cm ² .				
a)	15 mm dia	Each	3		
b)	20 mm dia	Each	46		
c)	25 mm dia	Each	16		
d)	32 mm dia	Each	9		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
e)	40 mm dia	Each	8		
f)	50 mm dia	Each	1		
5.0	<u>Butterfly Valve :</u>				
	Providing and fixing wafer type cast iron butterfly valves tested to 15kg/sqcm pressure including flanges.				
a)	65mm dia	Each	4		
b)	80mm dia	Each	1		
c)	100mm dia	Each	R.O		
6.0	<u>Auto Air Vent:</u>				
	Providing and fixing forged brass auto air vent valve PN 10 rating complete suitable for domestic cold water supply.				
a)	15 mm dia	Each	2		
7.0	<u>Flow Meter/Water Meter :</u>				
	Providing, fixing, testing and commissioning of Hydrodynamically balance Flow meter/multi-jet magnetic drive (turbine type) water meter with direct reading dia in Kilo-liter with all internal part in Gun metal or brass, strainer, flanged distance pieces for easy removal, 100 mm dia burden type pressure gauge with isolation cock including necessary test certificates for the meter from authority. The water meter shall complies with EEC Directive/ISO standards. [Make : ACTARIS /Equivalent].				
a)	15 mm dia	Each	R.O		
b)	20 mm dia	Each	R.O		
c)	25 mm dia	Each	R.O		
d)	32 mm dia	Each	R.O		
e)	50 mm dia	Each	R.O		
f)	65 mm dia	Each	R.O		
g)	80 mm dia	Each	R.O		
h)	100 mm dia	Each	R.O		
8.0	<u>NON RETURN VALVE :</u>				

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
	Providing and fixing gun metal non-return valve tested to 15 Kg/Sq.cm pressure including flanges.				
a)	40 mm dia	Each	R.O		
b)	50 mm dia	Each	R.O		
9.0	Pressure Reducing Valve:				
	Providing and fixing pressure reducing valve with compensation chamber in forged brass body suitably nickle plated, NBR nitrile elastomer diaphragm, EPDM seals and O ring, DZR brass road, stainless steel AISI 303 seal seat, pressure gauge connection FG 1/4" capable of handling inlet pressure to a maximum of 16 bars and outlet pressure 0.5 to 7 bars adjustable [Make :RBM (Italy)/Honeywell].				
a)	15 mm dia	Each	R.O		
b)	20 mm dia	Each	R.O		
c)	25 mm dia	Each	R.O		
d)	32 mm dia	Each	2		
e)	40 mm dia	Each	2		
f)	50 mm dia	Each	2		
	TOTAL OF COLD WATER SUPPLY (INTERNAL) [PART-I E)] CARRIED OVER TO SUMMARY				
F)	HOT WATER SUPPLY SYSTEM (INTERNAL):				
1.0	CPVC Pipe in Chase/Embedded in Wall :				
	Providing, fixing, testing and commissioning of CPVC (Chlorinated Polyvinyle Chloride) pipe as per CTS SDR-11 & fittings such as tees, elbows, reducers, male/female connector, clamps etc. as per ASTMD-2846, jointing with CPVC solvent cement as per manufacturer recommendations conforming to ASTM-F493. Cutting and making good the walls, floors, R.C.C. work etc. cutting chase and filling the same with cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) or cement mortar (1 cement : 4 coarse sand) as required. [Location : Pipe chase/embedded in wall].				
a)	15.9 mm (OD) SDR 11	RM	120		
b)	22.2 mm dia (OD) SDR 11	RM	80		
c)	28.6 mm dia (OD) SDR 11	RM	50		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
d)	34.9 mm dia (OD) SDR 11	RM	30		
e)	41.3 mm OD SDR 11	RM	5		
f)	54.0 mm OD SDR 11	RM	40		
2.0	CPVC Pipe (Exposed) :				
	Providing, fixing testing, and commissioning of CPVC (Chlorinated Polyvinyle Chloride) pipe as per CTS SDR-11 & fittings such as tees, elbows, reducers, male/female connector, clamps etc. as per ASTMD-2846, jointing with CPVC solvent cement as per manufacturer recommendations conforming to ASTM-F493. Steel structural support as required/directed at Site including all civil work, cutting and making good the walls, floors, R.C.C. work etc. (Exposed Pipe) [Pipe running in false ceiling].				
a)	15.9 mm OD SDR 11	RM	450		
b)	22.2 mm OD-SDR 11	RM	220		
c)	28.6 mm OD-SDR 11	RM	130		
d)	34.9 mm OD-SDR 11	RM	80		
e)	41.3 mm OD-SDR 11	RM	85		
f)	54.0 mm OD-SDR 11	RM	160		
	Providing, fixture, testing and commissioning of CPVC (Chlorinate of polyvingle chloride) SCH - 80 pipe and fitting such as tees, elbows, reducers. Male/female connector, clamps etc. Jointing with CPVC solvent cement as per manufacture recommendation Clamps /steel structural support as required / directed at site, water hammer protection as per manufacture recommendation including all civil work, cutting and making good the walls floors, R.C.C work etc.				
a)	2 1/2" dia Nominal Size	RM	70		
b)	3" dia Nominal Size	RM	130		
c)	4" dia Nominal Size	RM	20		
d)	6" dia Nominal Size	RM	R.O		
3.0	Thermal Insulation on Copper Pipe Embedded in Wall :				

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
	Providing & fixing thermal insulation in hot water pipes a polyolefin foam of closed cells crossed linked insulation having thermal conductivity of 0.036 W/M.K at an average temperature of 40°C. The density of material shall be 30 ± 5 Kg/m3 capable to operate in the range of -80°C to +95° C fire propagation material shall be self extinguishing and Class I certified as per BS 476 Part 7. Material shall be CFC free on combustion it should not emit HCN, NO + NO2 and SO2 + H2S gases. Smoke generated should be lighter than air and white in colour so as to allow easy exit passage in case of fire including all accessories e.g. adhesive and ape on joint complete as per specification. All joints shall be sealed with adhesive & cotton tape.				
l)	15.9 mm (OD) [6mm thick insulation]	RM	140		
ii)	22.2 mm (OD) [6mm thick insulation]	RM	150		
iii)	28.6 mm (OD) [6mm thick insulation]	RM	130		
iv)	34.9 mm (OD) [6mm thick insulation]	RM	60		
v)	41.3 mm (OD) [6mm thick insulation]	RM	15		
vi)	54.0 mm (OD) [6mm thick insulation]	RM	70		
4.0	<u>Thermal Insulation on CPVC Pipe (Exposed) :</u>				
	Providing & fixing thermal insulation in hot water pipes a polyolefin foam of closed cells Crossed linked insulation having thermal conductivity of 0.036 W/M.K at an average temperature of 40°C. The density of material shall be 30 ± 5 Kg/m3 capable to operate in the range of -80°C to +95° C fire propagation material shall be self extinguishing and Class I certified as per BS 476 Part 7. Material shall be CFC free on combustion it should not emit HCN, NO + NO2 and SO2 + H2S gases. Smoke generated should be lighter than air and white in colour so as to allow easy exit passage in case of fire including all accessories e.g. adhesive and ape on joint complete as per specification. All joints shall be sealed with adhesive & cotton tape.				
a)	15 mm [OD] [9 mm thick insulation]	RM	600		
b)	22 mm [OD] [9 mm thick insulation]	RM	300		
c)	28 mm [OD] [9 mm thick insulation]	RM	250		
d)	35 mm [OD] [9 mm thick insulation]	RM	180		
e)	42 mm [OD] [9 mm thick insulation]	RM	160		
f)	54 mm [OD] [9 mm thick insulation]	RM	290		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
g)	2 1/2" dia Nominal Size (SCH - 80)	RM	160		
h)	3" dia Nominal Size (SCH - 80)	RM	140		
i)	4" dia Nominal Size (SCH - 80)	RM	10		
j)	6" dia Nominal Size (SCH - 80)	RM	R.O		
5.0	<u>BALL/Globe Valve with Insulation :</u>				
	Providing, fixing, testing and commissioning of Globe valve with hard chrome plated ball inside PTFE (Teflon) seat and ring with chrome plated center handle with female BSP thread complete in all respect complete with thermal insulation. Minimum working pressure 15.0 Kg/Sq.cm.				
a)	15 mm dia	Each	15		
b)	20 mm dia	Each	40		
c)	25 mm dia	Each	30		
d)	32 mm dia	Each	10		
e)	40 mm dia	Each	8		
f)	50 mm dia	Each	20		
6.0	<u>Butterfly Valve:</u>				
	Providing and fixing water type cast iron butterfly valves tested to 15kg/sqcm pressure including flanges.				
a)	65 mm dia	Each	8		
b)	80 mm dia	Each	7		
c)	100 mm dia	Each	1		
7.0	<u>GM Non Return Valve :</u>				
	Providing & fixing GM type non return valve of approved make and tested to 15kg/sq.cm pressure complete with thermal insulation.				
a)	15 mm dia	Each	1		
b)	20 mm dia	Each	2		
c)	25 mm dia	Each	5		
d)	32 mm dia	Each	2		
e)	40 mm dia	Each	3		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
f)	50 mm dia	RM	1		
8.0	<u>Auto Air Vent :</u>				
	Providing and fixing forged brass Auto Air Vent Valve PN 10 rating complete suitable for hot water supply.	Each	6		
9.0	<u>Pressure Reducing Valve:</u>				
	Providing and fixing pressure reducing valve with compensation chamber in forged brass body suitably nickle plated, NBR nitrile elastomer diaphragm, EPDM seals and O ring, DZR brass road, stainless steel AISI 303 seal seat, pressure gauge connection FG 1/4" capable of handling inlet pressure to a maximum of 16 bars and outlet pressure 0.5 to 7 bars adjustable [Make :RBM (Italy)/Honeywell].				
a)	15 mm dia	Each	R.O		
b)	20 mm dia	Each	R.O		
c)	25 mm dia	Each	R.O		
d)	32 mm dia	Each	R.O		
e)	40 mm dia	Each	2		
f)	50 mm dia	Each	2		
10.0	<u>Flow Meter/Water :</u>				
	Providing, fixing, testing and commissioning of Hydrodynamically Balanced Flow Meter/Multiget magnetic drive (turbine type) water meter with direct reading dia in Kilo liter with all internal part in Gun metal or brass, strainer, flange distance pieces for easy removal, 100 mm dia burden type pressure gauge with isolation cock including for the meter from municipal authority. The water meter shall complies with EEC Directives/ISO Standard (For Hot Water Application) [Make : ACTARIES/Equivalent].				
a)	15 mm dia	Each	R.O		
b)	20 mm dia	Each	R.O		
c)	25 mm dia	Each	R.O		
d)	32 mm dia	Each	R.O		
e)	40 mm dia	Each	R.O		
f)	50 mm dia	Each	R.O		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
g)	65 mm dia	Each	R.O		
h)	80 mm dia	Each	R.O		
i)	100 mm dia	Each	R.O		
	TOTAL OF HOT WATER SUPPLY (INTERNAL) [PART-I F)] CARRIED OVER TO SUMMARY				
G)	EXTERNAL COLD WATER SUPPLY SYSTEM :				
1.0	Earth Work in Excavation of required width for water supply pipes including excavation for sockets and dressing of sides, ramming of bottom depth upto 1.5 m including getting out the excavated soil and then returning the soil as required in layer not exceeding 20 cms in depth including consolidating each deposited layers by ramming, watering etc. and disposing of surplus excavated soil as directed within a lead of 50 m. for all kinds of soil.		R.O		
2.0	Providing, fixture, testing and commissioning of CPVC (Chlorinate of polyvingle chloride) SCH - 80 pipe and fitting such as tees, elbows, reducers. Male/female connector, clamps etc. Jointing with CPVC solvent cement as per manufacture recommendation Clamps /steel structural support as required / directed at site, water hammer protection as per manufacture recommendation including all civil work, cutting and making good the walls floors, R.C.C work etc. [Location : From Tube well TO Water Tank].				
	CPVC Pipe (Burried) :				
a)	73.30 mm (OD)	RM	25		
b)	88.90 mm (OD)	RM	25		
b)	114.30 mm (OD)	RM	100		
3.0	Butterfly Valve :				
	Providing and fixing wafer type cast iron butterfly valves tested to 15 kg/sq.cm pressure (including flanges).				
a)	65 mm dia	Each	4		
b)	80 mm dia	Each	3		
c)	100 mm dia	Each	3		
d)	150 mm dia	Each	R.O		
4.0	Float Valve:				

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
	Providing and fixing gunmetal equilibrium float valve with S.S. rod and 2 mm thick copper float, tested for 5 Kg/Sq.cm complete including companion flanges, nuts, bolts, washer etc. complete in all respect.				
a)	100 mm dia	Each	R.O		
b)	80 mm dia	Each	R.O		
c)	65 mm dia	Each	R.O		
d)	50 mm dia	Each	R.O		
e)	40 mm dia	Each	R.O		
f)	32 mm dia	Each	R.O		
5.0	Non Return Valve:				
	Providing and fixing Dual plate wafer type non return valve tested to 15 Kg/Sq.cm pressure complete with all fitting and accessories.				
a)	65 mm dia	Each	1		
b)	80 mm dia	Each	1		
c)	100 mm dia	Each	1		
	TOTAL OF EXTERNAL WATER SUPPLY [PART-I G] CARRIED OVER TO SUMMARY				
H)	EXTERNAL SEWERAGE :				
1.0	Earth Work in Excavation of required width for sewerage pipes including excavation for sockets and dressing of sides, ramming of bottom depth upto 1.5 m including getting out the excavated soil and then returning the soil as required in layer not exceeding 20 cms in depth including consolidating each deposited layers by ramming, watering etc. and disposing of surplus excavated soil as directed within a lead of 50m for all kinds of soil.				
a)	Pipes, exceeding 80 mm dia but not exceeding 300 mm dia.	RM	78		
b)	Pipes, exceeding 300 mm dia but not exceeding 700 mm	RM	180		
2.0	Extra for excavating trenches for sewerage pipes in all kind of soil for depth exceeding 1.5 m, but not exceeding 3.0m.				
a)	Pipes, exceeding 80 mm dia but not exceeding 300 mm dia.	RM	30		
b)	Pipes, exceeding 300 mm dia but not exceeding 700 mm	RM	20		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
3.0	Providing, laying and jointing testing and commissioning of glazed stoneware pipes grade 'A' with stiff mixture of cement mortar in the proportion of 1:1 (1 cement :1 fine sand) and spun yarn including testing of joints.				
a)	100 mm dia.	RM	R.O		
b)	150 mm dia.	RM	R.O		
c)	200 mm dia.	RM	R.O		
d)	250 mm dia.	RM	R.O		
e)	300 mm dia.	RM	R.O		
4.0	Providing, fixing, testing and commissioning of Foamcore uPVC pipes of SN4/ SN 8 class confirming to ISO 21138 -2 and its latest ammendments, in underground (burried) non-pressure gravity drains at all depths, including jointing of pipes using elastomeric sealing rings or solvent cement in accordance with recomended type as per IS 5382, all complete as per direction of engineer in charge..				
a)	160 mm OD	RM	135		
b)	200 mm OD	RM	135		
c)	250 mm OD	RM	R.O		
5.0	Constructing brick masonry manhole with 1st class brick in cement mortar 1:4 (1 cement : 4 coarse sand) R.C.C. top slab with 1:2:4 mix (1 cement :2 coarse sand :4 graded stone aggregate 20 mm nominal size), foundation concrete 1:4:8 mix (1 cement :4 coarse sand :8 graded stone aggregate 40 mm nominal size) inside and outside plastering 12 mm thick with cement mortar 1:3 (1 cement :3 coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished complete as per standard design including excavation, refilling and disposal of surplus earth.				
a)	Inside size 90x80 cm and 75 cm deep including C.I. Cover with frame (light duty) 455 x 610 mm internal dimensions total weight of cover and frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg).				
l)	With F.P.S. bricks with class designation 75	Each	8		
b)	Inside size 120x90 cm and 100 cm deep including C.I. Cover with frame (medium duty) 500 mm internal diameter, total weight of cover and frame to be not less than 116 kg (weight of cover 58 kg and weight of frame 58 kg).				
l)	With F.P.S. bricks with class designation 75	Each	10		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
7.0	Extra for additional depth for manholes beyond 750 mm depth for 900 x 800 mm and 1000 mm depth for 1200 x 900 mm.				
a)	Size 900 x 800 mm	Each	8		
b)	Size 1200 x 900 mm	Each	10		
8.0	Providing and fixing square-mouth S.W. gully trap grade 'A' complete with C.I. Grating, brick masonry chamber with bricks of class designation 75 in cement mortar 1:5 (1 cement : 5 coarse sand) inside plaster above trap 12 mm thick m cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement outside plaster 12 mm thick in cement mortar 1:3 (1cement :3 coarse sand) 10 cm thick foundation concrete 1:5:10 mix (1cement :5 coarse sad : 10 graded stone aggregate 40 mm nominal size) space between chamber, and trap filled-with cement concrete 1:2:4 (1cement :2 coarse sand :4graded stone aggregate 20 mm nominal size) and water tight C.I. cover with frame of 300 x 300 mm size (inside) the weight of cover to be not less than 4.50 kg frame to be not less than 2.70 kg as per standard design.				
a)	100 x 100 mm size 'P' type trap with 300 x 300 mm chamber .	Each	R.O		
b)	150 x 100 mm size 'P' type trap with 300 x 300 mm chamber.	Each	5		
c)	180 x 150 mm size 'P' type trap with 450 x450 mm chamber	Each	10		
9.0	Making connection of sewer line with existing sewer man hole including breaking into & making good the walls, floors, road etc. Proper water proofing to ensure no. ground water seepage in the man hole PVC foot rest at 300 mm spacing and making channels in 1:2:4cement concrete neatly finished including SFRC cover & frame with necessary centering and shuttering, reinforcement, excavation in all kind of soil de-watering, refilling, watering, ramming and removing of surplus excavated earth making good the same complete as required. Contractor submit the structural design & drawing for approval of project manager.				
a)	For 100 to 300mm dia pipe	Job	1		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
10.0	Constructing water tight brick masonry grease trap with first class bricks in cement mortar 1:6 (1 cement :6 coarse sand), R.C.C. top slab with 1:2:4 mix (1 cement :2 coarse sand :4 graded stone aggregate 20 mm nominal size, foundation concrete 150 mm thick 1:4:8 (1 cement :4 coarse sand :8 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement :3 coarse sand) finished with a floating coat of neat cement & M.S. foot rests including fixing in 20 x 20 x 10 cm cement concrete blocks 1:3:6 (1 cement :3 coarse sand :6 graded stone aggregate 20 mm nominal size), two brick masonry baffle walls each of 500 mm depth deep each of 115 mm thickness, 2 Nos C.I. double seal medium duty covers each of 450 x 450 mm size including excavation, backfilling & disposal of surplus earth with a lead upto 50m complete as per standard design.				
	(Note: Cost shall include dewatering & water proofing of Grease trap as directed at site).				
a)	Grease Trap (Size 1000 x 2000 x 1200 mm liquid depth).	Each	R.O		
b)	Grease Trap (Size 2500 x 1200 x 1200 mm liquid depth).	Each	2		
11.0	Providing and fixing precast steel fiber reinforced concrete (SFRC) manhole cover and frames shall be firmly embedded to correct alignment and level in R.C.C. slab on top of masonry. The concrete for fixing the frame shall be 1:2:4(1cement :2 coarse sand :4 graded stone aggregate 20 mm nominal size). This concrete shall be laid in one operation integral with R.C.C. slab.				
a)	Light duty circular of 560 mm internal diameter conforming to the latest relevant IS specification.	Each	R.O		
b)	Medium duty circular of 560 mm internal diameter conforming to the latest relevant IS specification.	Each	R.O		
c)	Heavy duty circular of size 560 mm internal diameter conforming to the latest relevant IS specification.	Each	R.O		
12.0	Providing and fixing of orange colour safety rest of minimum 6 mm thick plastic encapsulated as per IS:10910 on 12 mm dia steel bar conforming to IS: 1786 having minimum cross section as 23 mm x 25 mm and over all minimum length 263 mm width as 165 mm with minimum 112 mm space between protruded legs having 2 mm as per standard drawing and suitable to withstand the bend test and chemical resistance test as per specifications and having manufacturer's permanent identification mark to be visible even after fixing, including fixing in manholes with 30 x 20 x 15 cm cement concrete block 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) complete as per design.	Each	R.O		
	TOTAL OF EXTERNAL SEWERAGE [PART-I H] CARRIED OVER TO SUMMARY				

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
I)	EXTERNAL STORM WATER DRAINAGE :				
1.0	Earth Work in Excavation of required width for storm water drainage pipes including excavation for sockets and dressing of sides, ramming of bottom depth upto 1.5 m including getting out the excavated soil and then returning the soil as required in layer not exceeding 20 cms in depth including consolidating each deposited layers by ramming, watering etc. and disposing of surplus excavated soil as directed within a lead of 50 m. for all kinds of soil.				
a)	Pipes, exceeding 80 mm dia but not exceeding 300 mm dia.	RM	350		
b)	Pipes, exceeding 300 mm dia but not exceeding 600 mm	RM	57		
2.0	Extra for excavating tranches for storm water drainage pipes for all kind of soil for depth exceeding 1.5m, but not exceeding 3.0 m.				
a)	Pipes, exceeding 80 mm dia but not exceeding 300 mm dia.	RM	10		
b)	Pipes, exceeding 300 mm dia but not exceeding 600 mm	RM	5		
3.0	Providing, laying and jointing light duty non-pressure NP2 class S/S R.C.C. pipes with collars jointing with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including curing, testing of joints etc.complete.				
a)	150 mm dia R.C.C pipe	RM	100		
b)	200 mm dia R.C.C pipe	RM	65		
c)	250 mm dia R.C.C pipe	RM	55		
d)	300 mm dia R.C.C pipe	RM	103		
e)	350 mm dia R.C.C pipe	RM	120		
f)	400 mm dia R.C.C pipe	RM	R.O		
g)	450 mm dia R.C.C pipe	RM	R.O		
4.0	Providing and laying 150 mm thick cement concrete 1 : 3 : 6 mix (1 cement : 3 fine sand : 6 graded stone aggregate 40 mm nominal size) around of R.C.C/ CILA pipes including bed concrete 150 mm thick as per standard design complete.				
a)	150 mm dia R.C.C pipe	RM	100		
b)	200 mm dia R.C.C pipe	RM	65		
c)	250 mm dia R.C.C pipe	RM	55		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
d)	300 mm dia R.C.C pipe	RM	130		
e)	350 mm dia R.C.C pipe	RM	120		
f)	400 mm dia R.C.C pipe	RM	R.O		
g)	450 mm dia R.C.C pipe	RM	R.O		
5.0	Constructing Road gully chamber with bricks of class designated 75 in cement mortar 1:5 (1 cement : 5 coarse sand), foundation concrete 1:4:8, inside & outside 12 mm thick cement plaster 1:3 (1 cement : 3 coarse sand) finished with a coat of neat cement including excavation, refilling and disposal of surplus earth as directed by Engineer-in-charge complete as per standard design.				
a)	500 x 450 x 450 mm size with precast R.C.C. horizontal grating with frame (500 x 450 mm) fixed in 15 cm thick cement mortar 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size).	Each	15		
b)	500 x 450 x 450 mm size with precast R.C.C. vertical	Each	8		
c)	Extra depth for road gully chamber				
i)	500 x 450 mm	RM	5		
6.0	MANHOLE FOR STORM WATER DRAINAGE:				
	Constructing brick masonry man hole for storm water drainage with bricks of class designation 75 in cement mortar 1:5 (1 cement : 5 coarse sand) with RCC top slab of 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size), 200 mm thick foundation concrete 1:4:8 mix (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size), inside and outside plastering 12mm thick in cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement inside and rough plaster on outside and making channel in cement concrete 1:2:4 mix, (1cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) neatly finished complete M.S plastic coated foot rests, complete as per standard design and approved drawings, including the cost of excavation, back filling, disposal of surplus earth and				
	other associated civil works with S.F.R.C cover and frame (heavy duty, HD- 20 grade designation) 560 mm internal diameter conforming to I.S. 12592, total weight of cover and frame to be not less than 182 kg., fixed in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) including centering shuttering all complete.				
a)	900 x 800 x 600mm deep.	Each	5		

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
b)	1200 x 900 x 1000mm deep.	Each	10		
c)	Extra over item no 6 (a) for depth exceeding 60 cm to 100 cm.	RM	2		
d)	Extra over item no 6 (b) for depth exceeding 100 cm.	RM	2		
7.0	Making connection of storm water line with existing storm water manhole or storm water drain including breaking into and making good the walls, floors, road etc. with cement concrete 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate, 20 mm nominal size) cement plastered on both sides with cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement and benching, fixing pipe & making necessary channel.				
a)	For pipe 400 to 600 mm dia pipes.	Job	1		
TOTAL OF EXTERNAL STORM WATER DRAINAGE [PART-I I)] CARRIED OVER TO SUMMARY					
J)	MISCELLANEOUS ITEMS :				
1.0	WATER TANK COVER :				
	Providing and fixing 600 mm dia Ductile iron water tank manhole cover and frame grade B-125 conforming to EN - 124 standard tank cover and lockable arrangement complete in all respects including all fitting & accessories.	Each	R.O		
2.0	G.I VENT PIPE :				
	Providing and fixing G.I. Vent Pipe class 'B' (medium duty) for R.C.C water storage tanks comprising of 600 mm long vertical pipe, return bend with mosquito grating & cast brass perforated coupling including all associated civil work.				
a)	65 mm dia	Each	2		
b)	80 mm dia	Each	2		
b)	100 mm dia	Each	5		
3.0	UNLOADING POINT ASSEMBLY :				
	Providing and fixing unloading point assembly (for water tanker supply) consisting of 100 mm dia. G.M. instantaneous. Female inlet coupling with brass plug complete.(Truck fill point shall be housed in suitable lockable chamber).	Each	1		
4.0	M.S. STRUCTURAL WORK :				

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
	Providing and fixing M.S. structural work fabricated from standard sections, (MS rounds, angles, channels etc.) including cutting to size, drilling, welding, including cost of fasteners, clamps in RCC structural members as directed, including two or more coats of synthetic paint over one coat of primer after surface preparation including cutting and making good walls.	Kg	10000		
5.0	MOSQUITIO OVER FLOW GRATING:				
	Providing and fixing of mosquito overflow grating /Jali of the following diameters including all fittings & accessories :-				
a)	150 mm dia	Each	R.O		
b)	100 mm dia	Each	R.O		
6.0	CIVIL WORKS / MISCELLANEOUS ITEMS:				
6.1	Providing and fixing 600 mm long MS hot dip galvanized PUDDLE FLANGES fabricated out of 6 mm thick MS plates of suitable size and IS:1239 heavy class pipes properly fixed in walls & top slab of tanks. The entire fittings shall be hot dipped galvanized after fabrication. Length shall be minimum 600 mm or wall thickness plus 200 mm on either side (which ever is more).				
6.2	20 mm dia (screwed ends)	Nos.	R.O		
6.3	25 mm dia (screwed ends)	Nos.	R.O		
6.4	32 mm dia (screwed ends)	Nos.	R.O		
6.5	40 mm dia (screwed ends)	Nos.	R.O		
6.6	50 mm dia (flanged ends)	Nos.	R.O		
6.7	65 mm dia (flanged ends)	Nos.	R.O		
6.8	80 mm dia (flanged ends)	Nos.	5		
6.9	100 mm dia (flanged ends)	Nos.	15		
6.10	150 mm dia (flanged ends)	Nos.	R.O		
6.11	200 mm dia (flanged ends)	Nos.	R.O		
6.12	250 mm dia (flanged ends)	Nos.	R.O		
6.13	300 mm dia (flanged ends)	Nos.	R.O		
	<i>Contractor to review the shop drawing and consider the same in the quote. Sample to be approved by XEN SGPC and Consultant before the supply of all Puddle Flanges at Site.</i>				

BILL OF QUANTITIES FOR PLUMBING & WATER SUPPLY WORKS					
Sr. NO	DESCRIPTION	UNIT	Qty.	Rate	Final amount
	TOTAL OF MISCELLANEOUS ITEMS [PART-I J] OVER TO SUMMARY				