

SUBJECT
SANITARY ENGINEERING SERVICES

TECHNICAL SPECIFICATIONS - PLUMBING INSTALLATIONS

SECTION - I SANITARY FIXTURES AND FITTINGS

1. SCOPE OF WORK

- 1.1 Work under this section shall consist mainly fixing only of all Sanitary Fixtures, brass and chromium plated fittings and accessories as required by the drawings and specified hereinafter or given in the Schedule of Quantities.
- 1.2 Without restricting to the generally of the foregoing the Sanitary Fixtures shall include all Sanitary Fixtures, C.P. fittings and Accessories etc. necessary and required for the building.

2. GENERAL REQUIREMENTS

- 2.1 All Fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Architectural/ Interior designer's requirements. Wherever necessary the fittings shall be centered to dimensions and pattern desired.
- 2.2 Fixing screws shall be half round head Chromium Plated brass with C.P. washers wherever required as per directions of Engineer-in-Charge / Owner.
- 2.3 All Fittings and Fixtures shall be fixed in a neat workmanlike manner true to Levels and Heights shows on the drawings and in accordance with the manufacturer's 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, tiling or terrace shall be made good at Contractors cost.
- 2.4 When directed, Contractor shall install Fixtures and accessories in a mock-up room for the approval of the Engineer-in-Charge/Owner. Sample room Fixtures may be reused on the works if undamaged, but no additional payment for fixing or dismantling shall be admissible.
- 2.5 For specifications of sanitary fixtures and fittings please refer the attached table showing the selected model number.

3. MEASUREMENT

- 3.1 Rates for fixing of Sanitary Fixtures Accessories, urinal partitions shall include all items and operations stated in the respective specifications and Schedule of Quantities and nothing extra is payable.
- 3.2 Rates for all items under specifications above shall be inclusive of cutting holes and chases and making good the same, C.P. screws, nuts, bolts and any fixing arrangements required and recommended by Manufacturers, Testing and Commissioning.

END OF SECTION - I

SECTION - II SOIL, WASTE & VENT PIPES

1. **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 and rainwater pipes as required by the drawings, specified hereinafter and given in the Schedule of Quantities.
- 1.2 Without restricting to the generally of the foregoing, the soil, waste, vent and rainwater pipes system shall include the followings:
- a) Vertical and horizontal Soil, Waste and Vent Pipes, Rainwater Pipes and Fittings, Joints Clamps and connections to Fixtures.
 - b) Connection of pipes to Gully Traps & Manholes etc.

2. **GENERAL REQUIREMENTS**

- 2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of Engineer-in-Charge / Owner.
- 2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- 2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in 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 works shall be executed as directed by Engineer-in-Charge / Owner.

3. **UPVC SWR PIPES & FITTINGS FOR SOIL & WASTE PIPE**

- 3.1 All pipes shall be straight and smooth and inside free from irregular bore, blowholes, cracks and other manufacturing defects. Pipes shall be uPVC SWR conforming to IS: 13592.

UPVC SWR RANGE PIPES CONFORMING TO IS 13592

Nominal Outside Diameter	Tolerance On Outside Diameter	Wall Thickness Type-A		Wall Thickness Type-B	
		Min.	Max.	Min.	Max.
63	+0.3	1.8	2.2	3.2	3.8
75	+0.3	1.8	2.2	3.2	3.8
90	+0.4	1.9	2.3	3.2	3.8
110	+0.4	2.2	2.7	3.2	3.8

3.2 **Fittings**

Fittings shall conform to IS: 14735 and Rubber Ring to IS: 5382.

3.3 **Fixing**

- (a) All vertical pipes shall be fixed by pipe clips truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. Each stack shall be terminated at top with a Cowl (terminal guard).
- (b) Horizontal pipes running along ceiling shall be fixed on metal adjustable clamps with rubber seal of special design shown in the brochure. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.
- (c) 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 to restore the surface.

3.4 **Jointing**

Jointing of SWR pipes shall be using rubber ring joints or solvent cement joints, as approved by the engineer – in – charge.

3.4.1 **Rubber Ring Joints**

- a) Wherever used, the rubber ring joint shall be a flexible joint which can be opened and closed whenever required.
- b) The joint shall consist of an internal socket and spigot with elastomeric sealing ring, and shall allow for axial contraction and expansion as well as angular deflection.
- c) Rubber ring used shall be rated for adequate working pressures.

3.4.2 **Solvent Cement Joints**

Wherever used. the solvent cement shall be thixotropic and shall consist of substantial quantity of Solvents that will swell unplasticised PVC resin and stabilize as per Manufacturer's specifications. Dibutyl Tin Maleate shall used as stabilizer for preventing discolouration and for maintaining self stability of the Cement.

5. **UPVC PIPES (I.S. 4985) For Rain Water**

5.1 6/10 kg/cm² Class selection shall be as per Bill of Quantities.

All fittings for uPVC pipes up to 200 mm O.D. size shall be injections moulded as per manufacturer, confirming to IS: 4985 and as specified in bill of quantities.

5.2 For Fittings of sizes which are not injection moulded but fabricated (Locally/ Imported) sample of the same shall be submitted for approval.

6. **TRAPS**

6.1 Floor traps shall be of uPVC, deep seal with an effective seal of 50 mm as given in bill of quantities. The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size) and extended to 40 mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30x30 cm of the required depth. Where traps are suspended below ceilings, they shall be provided with proper structural supporting arrangements.

6.2 **Floor Trap Inlet**

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, Contractor shall provide a special type pvc. inlet hopper without or with one, two or three inlet sockets to receive the waste pipe. Hopper shall be connected to trap with at least 50 mm seal (Hopper and traps shall be paid for separately). For plastic pipes the hopper & trap shall be of the specified material as in bill of quantities & shall be jointed with the recommended specifications / instructions of the manufacturer.

6.3 **C.P/Stainless Steel Gratings**

Floor Traps shall be provided with 100-150 mm square or round C.P/Stainless steel grating, with rim of approved design and shape. Minimum thickness shall be 4-5 mm or as specified in the Schedule of Quantities.

7. **CLEANOUT PLUGS**

Contractor shall provide brass cleanout plugs as required. Cleanout plugs shall be threaded and provided with key holes for opening. Cleanout plugs shall be fixed to the pipe by a male threaded adaptor.

8. **WASTE PIPE FROM APPLIANCES**

8.1 Waste pipe from appliances e.g. wash basins, sinks, etc shall be of UPVC as given in the Schedule of Quantities or as shown on the drawings.

8.2 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 run at ceiling level in suitable gradient and supported on structural clamps at approved spacing.

9. **CEMENT CONCRETE**

Cast Iron Hubless Soil and Waste pipes under floors in sunken slabs and in wall chases (When cut specially for the pipe) shall be encased in cement concrete 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm size) 75 mm in bed and around. When pipes are running well above the structural slab, the encased pipes shall be supported with suitable cement concrete pillars of required height and size at intervals as directed by Engineer-in-Charge/Owner.

10. **PAINING**

- 10.1 Paint shall be of approved quality and shade, pipes shall be painted in accordance with approved pipe color code.
- 10.2 Waste pipes in chase shall be painted with two coats of Bitumen paint, covered with polythene tape and a final coat of bitumen paint. Exposed pipes shall be painted with two or more coats of Synthetic enamel paint.
- 10.3 C.I. pipes below ground and covered in cement concrete shall not be painted.

11. **CUTTING AND MAKING GOOD**

Pipes shall be fixed and tested as buildings proceeds. Contractor shall provide all necessary holes cutouts and chases in structural members as 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 aggregate 20 mm nominal size) or cement mortar 1:2 (1 cement: 2 coarse sand) and the surface restored as in original condition.

12. **INSPECTION & TESTING**

12.1 **Inspection**

Work should be inspected during installation and tests applied on completion, care being taken that, all work which is to be encased for concealed is tested before it is finally enclosed.

Inspection should be carried out to ensure the following:

- (a) Work accords with the drawing and specifications.
- (b) All pipe brackets, clips etc. are securely fixed.
- (c) Fixtures are correctly spaced.
- (d) Pipe is protected where necessary by Thermal Insulation.
- (e) Embedded pipe work is properly protected before sealing-in
- (f) All access covers, caps or plugs.
 - Are accessible
 - Are so made that the internal faces truly complete in internal bore.
 - Cause no obstruction in the pipe bore
 - Are well joined.

12.2 **Testing**

The soil, waste piping system and rain water should be tested after installation as follows:

(a) **Water Test**

The pipes shall be tested after installation & before the appliances are connected, preferably in sections so as to limit the static head of 4.5m. The pipe shall be filled with water for at least 10 minutes. After filling, pipes shall be struck with a hammer and inspected for blow holes and cracks. Then it will be necessary to seal all openings and leaks at joints immediately as observed during the test and all defective pipes shall be rejected and removed from the site. Pipes with minor sweating shall be accepted at the discretion of the Engineer-in-Charge/Owner.

(b) **Smoke Test**

Alternatively, the Contractor may test all Soil, Waste and Rainwater stacks by smoke testing machine. The smoke test shall be carried out as under:

Smoke shall be pumped into the stack after plugging all inlets and connections at the lowest points from a smoke testing machine which consists of a bellow & burner. The material usually burnt is greasy cotton waste which gives out a clear pungent smoke which is easily detected by sight as well as by smell, if there is leak at any points of the pipe. The top end shall however be left open. The stack shall then be observed for leakiness and all defective pipes and fittings removed or repaired as directed by the Engineer-in-Charge / Owner.

12.3 A test register shall be maintained and all entries shall be signed and dated by Contractors and Engineer-in-Charge/Owner.

13. **MEASUREMENTS**

13.1 **General**

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

13.2 **Pipes** (Unit of measurement. Linear meter to the nearest centimeter)

Pipes shall be measured overall along the center line correct to a centimeter including all fittings along its length. The rate for these pipes shall be inclusive of all fittings, holder bat clamps, lead caulked joints and all other items described in the Schedule of Quantities. Traps structural clamps and cement concrete shall however be paid separately under the relevant item.

G.I., PVC & all pipes shall be measured per running meter correct to a centimeter for the finished work, which shall include fittings e.g. Bends, Tees, Elbows, Reducers, Crosses, Sockets, Nipples and Nuts but exclude brass or Gunmetal Taps (Cocks), Valves lead connection pipes and shower rose. 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 diameter shall be nominal diameter of internal bore. The pipes shall be described as

including all cutting and waste. In case of fittings of unequal bore, the largest bore shall be measured.

- 13.3 Cement concrete around pipes shall be measured along the center of the pipe line measured per linear meter and include any Masonry Supports, Shuttering and Centering Cutting complete as described in the relevant specifications.
- 13.4 Slotted angles/channels shall be measured per linear metre of finished length and shall include support bolts and nuts embedded in masonry walls with cement concrete blocks and nothing extra will be paid for making good the same.
- 13.5 **Painting**: Painting of pipes shall be measured per running metre and shall be inclusive of all fittings and clamps. No deduction for fittings shall be made.
- 13.6 **Structural Clamps/Supports**: Individual MS holder beds, clamps & fixing arrangements will not be paid extra & will be a part of fixing the pipes.

In case of main supporting structure for vertical & horizontal pipes, where number of pipes are clamped, as per approved shop drawings, then the structural supports shall be paid extra.

Structural supports consisting of structural steel members / fabricated and U clamps shall be paid extra for by weight per kg. Rates shall be inclusive of all nuts, bolts, dash fasteners, drilling, cutting, welding. Weight of clamps shall be calculated from the actual length used in structural members multiplied by its theoretical weight given in manufacturers catalogues. Weight of nuts, bolts, shall not be taken into account.

- 13.7 **Excavation for soil pipes**: No extra payment shall be admissible with respect to excavation, refilling and disposal of surplus earth for Cast Iron Soil and Waste Pipes.

END OF SECTION - II

SECTION - III WATER SUPPLY SYSTEM

1. SCOPE OF WORK

- 1.1 Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the Schedule of Quantities.
- 1.2 Without restricting to the generality of the foregoing, the water supply system shall include the following:-
- a) All water lines to different parts of building and making connection from source etc.
 - b) Pipe protection and painting.
 - c) Providing Hot water supply lines and insulation of hot water pipe lines.
 - d) Heat pump with hot water tank, recirculation and return pumps
 - e) Hydropneumatic system for supply water to fixtures
 - f) Water storage tank at underground/ Over head level
 - g) Electrical panel, cable and related accessories
 - h) Control valves, masonry chambers and other appurtenances.
 - i) Connections to all toilets, kitchen equipments, storage tanks and appliances.
 - j) Excavation and refilling of pipe trenches, wherever required.
 - k) Trenches for taking pipe lines for these services.

2. GENERAL REQUIREMENTS

- 2.1 All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Engineer-in-Charge / Owner.
- 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 bends shall be formed by means of a hydraulic pipe bending machine for pipes up to 65mm dia.
- 2.4 Pipes shall be fixed in a manner so as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.
- 2.5 Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified.
- 2.6 Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

5. G.I. PIPES & FITTINGS

- 5.1 All pipes inside the buildings and where specified, outside the building shall be galvanized steel tubes conforming to I.S. 1239-1979 of class specified. When class is not specified they shall be medium class.
- 5.2 Fittings shall be malleable iron galvanized fittings, of approved make. All fittings shall have manufacturer's trade mark stamped on it. Fittings for G.I. pipes shall

include Couplings, Bends, Tees, Reducers, Nipples, Unions, Bushes, Fittings shall be of I.S:1879 - (part I to X) 1975.

- 5.3 Pipes and fittings shall be jointed with screwed fittings. Care shall be taken to remove burr from the end of the pipe after cutting by a round file. Genuine red lead with grumet and a few strands of fine hemp shall be applied. All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. 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 as shown on drawings.

6.0 **UNIONS**

Contractor shall provide adequate number of unions on all pipes to enable dismantling later. Unions shall be provided near each Gunmetal Valve, Stop Cocks, or Check Valves and on straight runs as necessary at appropriate locations as required and/or directed by Engineer-in-Charge / Owner.

7. **CLAMPS**

G.I. pipes in shafts and other locations shall be supported by M.S. clamps of design approved by Engineer-in-Charge / Owner. Pipe in wall chases shall be anchored by iron hooks. Pipes at ceiling level shall be supported on structural clamps fabricated from M.S. structural as described in the sub section. Pipes in typical shafts shall be supported on Slotted Angles/Channels as specified elsewhere.

8. **FLANGES**

Flanged connections shall be provided on pipes where shown on the drawings, all equipment connections as necessary and required or as directed by Engineer-in-Charge / Owner. Connections shall be made by the correct number and size of the bolts and made with 3 mm thick insertion rubber washer. Where hot water or steam connections are made insertion gasket shall be of suitable high temperature grade and quality approved by Engineer-in-Charge / Owner. Bolt hole dia for flanges shall conform to match the specification for C.I. Sluice Valve to I.S. 780.

9. **TRENCHES**

The galvanized iron pipes and fittings shall be laid in trenches. The width and depth the trenches for the different diameters of the pipes shall be as follows:

Dia of Pipe	Width of Trench	Depth of Trench
15mm to 50mm	30 cms	60 cms
65mm to 100mm	45 cms	75 cms

At joints the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for earthwork in trenches.

When excavation is done in rock, it shall be cut deep enough to permit the pipes to be laid on a cushion of sand minimum 7.5 cm deep.

10. **PAINTING**

- 10.1 All surfaces shall be thoroughly cleaned before painting.
- 10.2 All pipes above ground shall be painted with one coat of Red Lead and two coats of Synthetic Enamel paint of approved shade and quality. Pipes shall be painted to standard color code specified by Engineer-in-Charge/Owner.
- 10.3 All pipes in chases and below floor shall be provided Anti-corrosive treatment.

11. **PIPE PROTECTION**

Where specified in the Schedule of Quantities all pipes below ground shall be protected against corrosion by wrapping 100mm wide and 4mm thick layer of material of approved make over the pipe.

12. **GUNMETAL VALVES**

- 12.1 Valves 65mm dia and below shall be heavy Gunmetal Fullway Valves or Globe Valves or Ball valves conforming to I.S. 778-1971 of 20 Kg/cm² class. Valves shall be tested at manufacturer's works and the same stamped on it.
- 12.2 All Valves shall be approved by the Engineer-in-Charge / Owner before they are allowed to be used on work.

13. **BALL VALVES**

Ball Valves have body material as Forged Brass Chrome plated with Spindle Brass Nickel Plating & Lever handle Steel Chrome plated with green plastic cover. The valve is suitable for water maximum working pressure up to 25 bar (PN 25). The valve is operated by turning. The rotation from open to close is a quarter turn (90°) which closes in a clock-wise direction.

14. **BUTTERFLY VALVES**

- a) Butterfly valves of approved quality for pressure rating of 230 P.S.I. with locking arrangement and gearbox with handle operated or gearbox with lid shall be provided or as given in the Bill of Quantities.
- b) Butterfly valves shall be of specified quality conforming to IS: 13095 or BS: 5155.
- c) Joints for butterfly valves shall be made with suitable tail /socket pieces on the pipe line and flanged joints made with 3mm thick insertion rubber gasket with appropriate number of bolts, nuts and washers.
- d) Butterfly valves shall be provided on all branches as shown in the drawings or as specified.

15. **SLUICE VALVES**

- 15.1 All valves 80mm dia and above shall be C.I. Double Flanged Sluice Valves. Sluice valves shall be Cast Iron double flanged, with rising spindle. Each sluice valve shall be provided with wheel for valves in exposed positions and Cap Top for underground valves. Contractor shall provide suitable operating keys for Sluice Valves with Cap Tops.
- 15.2 Sluice valves shall be of best quality conforming to I.S: 780-1969 of class specified.
- 15.3 Sluice valves shall be socketed type or double flanged type conforming to I.S: 780.

- (a) Joints for socketed valves shall be lead-caulked joints as specified above.
- (b) Joints for double flanged sluice valves shall be made with suitable tail/socket pieces on the pipeline and flanges joints made with 3 mm thick insertion rubber gasket with appropriate number of bolts, nuts and washers.
- (c) Sluice valves shall be installed at all branches and as shown on the drawings.

16. **SCOUR VALVES**

Scour valves shall be C.I. sluice valves as specified above. They shall be installed at the lowest level or tail end of the system as shown on drawings and directed by Engineer-in-Charge / Owner.

17. **AIR RELEASE VALVES**

- (a) Air release valves shall be single acting type air valves with cast iron body and bronze/gunmetal internal parts and plastic float.
- (b) Each air release valve shall be provided with a cast iron isolating sluice valve of specification given above.

18. **INSULATION**

The insulation for hot water pipes shall be done as specified in Bill of Quantities and accordingly following guidelines shall be followed:

18.1 **For Internal Pipes (Chased / Exposed)**

Hot water pipes fixed in chase shall be insulated by wrapping 6 mm/9 mm thick thermal insulation tubings & jointed as per manufacturer's specifications complete as per requirement and finishing it with 6mm rough cement plaster 1:3 mixed with Rapid Hardening Cement for the chased pipes or specified protection for the exposed pipes as per the bill of quantities.

18.2 **For External Piping**

External hot water line laid in trenches, exposed in shafts, on terrace and along ceiling level shall be insulated with either thermal tubings of specified thickness or fibre glass wool blankets/mats, as specified in Bill of Quantities. After the insulation, all the pipes shall be protected with either 12mm thick smooth finished cement plaster (two layers of 6 mm thick of mix 1:2 Portland cement and fine sand) or they shall be cladded with 24 SWG aluminum sheet as specified in Bill of Quantities.

18.3 The specifications of the material shall be generally as follows, unless specified:

- (a) Elastomeric Flexible Material -- Thermal Insulation tubings of 6/9/12mm thickness with density of 60-90 Kg/m³.

18.4 Generally, following procedure shall be adopted for external insulation:

- (a) Cleaning the pipe surface to be insulated to make it free from dust & oil.
- (b) Applying a layer of zinc chromate/anti-rust Japanese primer.
- (c) Fixing fibre glass wool blankets or mats/Elastomeric Flexible Tubings as specified.
- (d) Covering it around with 24 gauge wire netting with proper butt joint and tightly wrapped.
- (e) Applying two layers of 6 mm thick each cement plaster in the ratio of 1:2 (1 cement: 2 fine sand).
- (f) Applying weatherproofing coating of Insulkote OR of approved material over the cement plaster.
- (g) For certain places, where exposed insulation is not to be plastered as specified in item (v) and (vi), then aluminum foil sheet of 24 gauge with 50 mm overlapping, fixed with self tapping recessed screwed shall be provided.

19. **CAST IRON PIPES**

19.1 Pipes for water supply mains where specified shall be cast iron pipes, centrifugally cast spun iron pipes, class LA conforming to I.S. 1536. Quality certificates shall be furnished.

19.2 **Fittings and Inspection Chambers**

Fittings and chambers shall be provided as required.

19.3 **Anchor Block**

Suitable anchor blocks shall be provided at all bends and tees to encounter the excessive thrust developed due to water hammer.

19.4 **Rubber Joints**

Joints between two pipes shall be made by pre moulded rubber joints with suitable tackles in a manner recommended & approved by the manufacturer. No joints shall be covered until the lines are hydraulically tested.

20. **VALVE CHAMBERS**

20.1 Contractor shall construct chambers for all full way valves, butterfly valves and other type of valves as specified in the Bill of Quantities. These shall be made, in brick masonry in cement mortar 1:4 (1 cement: 4 coarse sand) on cement concrete foundations 150mm thick 1:5:10 mix (1 cement: 5 coarse sand: 10 graded stone aggregate 40mm nominal size) 12 mm thick cement plaster 1:3(1 cement : 3 coarse sand) inside finished with a floating coat of neat cement with 8mm thick M.S surface box with hinged cover and locking arrangement, 150 mm thick reinforcement cement concrete top slab of 1:2:4 (1 cement : 2 coarse sand: 4 graded stone aggregate 20mm nominal size), as specified and shown in drawings, including excavation, back filling rammed complete or as specified in Bill of Quantities.

20.2 Valve chambers shall be constructed as specified in BOQ but generally shall be of following sizes:

	Length (mm)	Width (mm)	Depth (mm)
For pipes dia. Up to 80 mm	600	600	1000
For pipes dia. 80 mm and above	750	750	1000

21. **TESTING**

- 21.1 All pipes, fittings and valves shall be tested by hydrostatic pressure of min. 1.5 times, the working pressure and subject to minimum of 7 kg/cm² in any case and with the consent of Engineer-in-Charge / Owner.

Pressure shall be maintained for a period of at least two hours without appreciable drop in the pressure after fixing at site. ($\pm 10\%$). A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and Engineer.

- 21.2 In addition to the sectional testing carried out during the construction, Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages, and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and Fixtures shall be made good during the defects liability period without any extra cost.

- 21.3 After completion of the water supply system, Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above.

22. **MEASUREMENT**

22.1 **Pipes**

Pipes shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. couplings, tees, bends, elbows, unions, deduction for valves shall be made, cutting holes chases and making good the same and all items mentioned in the specifications and Schedule of Quantities.

- (a) Gunmetal and cast iron valves shall be measured by numbers.
- (b) Single flanges shall be measured by numbers (per single flange) and shall include bolts, nuts, washers and 3mm thick rubber gasket complete.
- (c) Pair of flanges shall be measured by number of pairs and shall include bolts, nuts, washers, and 3 mm thick rubber gaskets complete.

22.2 **Insulation**

Insulation for hot water pipes shall be measured per linear metre (to the nearest cm) along the centre line of pipe and shall be measured over all fittings and flanges. No separate or additional payment shall be made for insulation of Bends, Tees, Flanges or Other Fittings and Valves. The rate shall include all items specified in the Schedule of Quantities and given in the specifications.

Aluminum cladding/Plaster over the insulated pipes shall be measured in metres or as specified for the area of the finished surface. The rate shall be inclusive of all items given in the Schedule of Quantities.

22.3 **Painting**

Painting for Pipes and over insulation shall be measured per linear metre over finished surface and shall include all valves and fittings for which no deduction shall be made.

23. **DISINFECTION**

23.1 After completion of the work Contractor shall flush clean the entire system with the city's filtered water after connection has been made.

23.2 After the first flushing, commercial bleaching powder is to be added to achieve a dosage of 2 to 3 mg/l of water in the system added and flushed. This operation should be performed twice to ensure that the system is fully disinfected and usable.

24. **PRE COMMISSIONING**

24.1 Ensure that all pipes are free from debris and obstructions.

24.2 Check all valves and fire hydrant for effective opening and closing action. Defects should be rectified or valves replaced.

24.3 Ensure that all Connections to Branches have been made.

24.4 Ensure that mains have been connected to the respective pumps, underground and overhead tanks.

24.5 Water supply should be available at main Underground tank.

24.6 All main line Valves should be closed.

25. **COMMISSIONING**

25.1 Fill Underground tank with water. Add 1kg fresh bleaching powder after making a solution to be added near inlet.

25.2 Start Water Supply Pump and allow water to fill main Underground tank. Water will first fill the fire tank and then overflow to the Raw Water tanks.

25.3 After filling Overhead Reservoir drain the same to its one fourth capacity through tank scour valve. (This is to ensure removal of all mud, debris etc. from the tank).

25.4 Fill Overhead tank to full.

25.5 Release water in the main lines by opening Valves in each circuit. Drain out water in the system through scour valves or fire hydrant in lower regions. Ensure clean water is now coming out of the system.

25.6 Open valves for individual clusters. Observe for leakages or malfunctions, check pressure & flow at end of line by opening Hydrants etc. Remove and rectify defects noticed.

25.7 Check all outlet points for proper operation by opening each valve and allowing water to flow for a few minutes. Also check for effective closure of valve.

- 25.8 The entire water supply system should be disinfected with bleaching powder and system flush cleaned.
- 25.9 Send four samples of water drawn from four extreme locations for testing for bacteriological test in sterilized bottles obtained from the concerned laboratory. (Laboratory personal may collect the samples themselves).

26. **RESPONSIBILITY**

Responsibility for various activities in pre-commissioning and commissioning procedures will rest with the Contractor.

END OF SECTION - III

SECTION - IV SEWERAGE / DRAINAGE SYSTEM AROUND THE BUILDING

1. SCOPE OF WORK

1.1 Work under this section shall consist of furnishing all Labour, Materials, Equipments and Appliances necessary and required to completely finish Sewerage/Drainage system as required by the drawings and specified hereinafter or given in the Schedule of Quantities.

1.2 Without restricting to the generality of the foregoing, the sewerage system shall include:

- Installation of all sewer lines / effluent lines
- Installation of all storm water drainage lines
- Construction of all catch basins, chambers, manholes & other related civil works
- Rain water harvesting system

2. GENERAL REQUIREMENTS

2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of the Engineer-in-Charge / Owner.

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

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

2.4 Location of all manholes, catch basins etc., shall be got confirmed by the Contractor from the Engineer-in-Charge / Owner before the actual execution of work at site.

2.5 All works shall be executed as directed by Engineer-in-Charge / Owner.

3. ALIGNMENT AND GRADE

The sewer pipes shall be laid to alignment and gradient shown on the drawings but subject to such modifications as shall be ordered by the Engineer-in-Charge / Owner from time to time to meet the requirements of the works. No deviations from the lines, depths of cutting or gradients of sewers shown on the plans and sections shall be permitted except by the express direction in writing of the Engineer-in-Charge / Owner.

5. GULLY TRAPS

5.1 Gully traps shall be of the same quality as described for stoneware pipes in Clause 4.

5.2 Gully traps shall be fixed in cement concrete 1:5:10 mix (1 cement: 5 coarse sand: 10 stone aggregate 40mm nominal size) and a brick masonry chamber 45x45 cms inside in cement mortar 1:3 with 15 x 15 cms grating inside and 45x45 cms C.I. sealed cover and frame weighting not less than 14 kg to be constructed as per standard drawing. Where necessary, sealed cover shall be replaced with C.I. grating of the same size.

6. HDPE 14333 PIPES

6.1 HDPE(High density polythene black) pipes conforming IS: 14333, for Sewerage effluents with material grade PE-80 with working pressure 4 Kg / Cm² or as specified in bill of Qty.

6.2 Laying and Jointing of HDPE Pipes

Laying and jointing of the pipes shall be done as specified in IS: 14333

While laying the pipe in trenches the bed of the trench should be level and free from sharp edged stones. While lying in rocky areas suitable bed of sand or gravel should be provided. The initial back fill about 10 to 15 cm above the pipe should be fine sand or screened excavated material. Where hard rock is met with, bed concrete M-100, 15 cm shall be provided, before putting in the soft sand/gravel.

Jointing of two pipes shall be done through BUTT-Welding. The method of butt-welding shall be as below:

- a) The ends of the pipes to be joined are cut vertically at right angles with a fine toothed saw and trimmed with a file to make both ends smooth so that the pipes when pressed together are without leaving any gap.
- b) Both the inside and outside surfaces of the ends of the pipes are scraped (up to about 1/2" from the end) with a sharp scraper to remove the thin oxidized layer.
- c) It is necessary to see that there are no extraneous particles of dust, mud, grease, polyethylene powder etc. at the joining portion of the pipes.

An electrical HEAT MIRROR (Hot Plate) is used for heating the ends of the pipes. The pipes are pressed flush against the flat surface of the Heat Mirror, one on each side horizontally, and held in that position under slight pressure. The Heat Mirror is maintained at a steady temperature of 200 deg C. with the help of THERMOSTAT. After a while, a slight rim is formed at the ends of the pipes both inside and outside. When a rim of about 1/10" to 1/8" is formed, the pipes are pulled apart and the Heat Mirror is quickly withdrawn. Then the two ends of the pipes are brought together face to face so that the molten portions come into contact with each other. Then the pipes are drawn back very slightly (without separating the joined molten portion) and then again the pipes are pressed together with a moderate pressure of about (1 to 1.5 kg/cm sq). This ensures that any air bubbles are squeezed out. The pipes are held in that position until the pipe-joint cools off naturally in atmospheric air. When a perfect joint is made, the rims cohere in such a way that there is only a very fine slight depression between the two rims. If the top surface of the rim is too flat, it will be because the pipe is overheated. If there is too much of depression (groove) between the rims, the pipe is under-heated. The rims should not be cut off or erased from the joints. Also, correct alignment of the pipes will help in joining the pipes perfectly, as otherwise there will be reduction in the area of the joining surface rendering the joint weak and imperfect.

7. **CEMENT CONCRETE AND MASONRY WORKS FOR MANHOLES AND CHAMBERS ETC.**

7.1 **Materials**

(a) **Water**

Acidity , Alkalinity and percentage of Solids shall be in accordance with IS: 3025. The Ph value shall generally be not less than 6. In general potable water is considered satisfactory for use.

Sea water shall not be used.

Testing shall be done individually for different source points before the start of the work and there after once in every three months.

(b) **Aggregate for Concrete**

It shall be strong, durable and free from adherent coatings, sea shell, organic impurities, disintegrated pieces.

If dirty, shall be washed with water before actual use. Flaky and elongated piece shall be avoided. It shall confirm to IS: 383 and IS: 2386.

(c) **Sand**

It shall be hard, durable, chemically inert, clean and free from adherent coatings, organic matter etc. and shall not contain any appreciable amount of clay bald harmful impurities and shall confirm IS: 231 or pellets an86. It shall not contain more than 8 % of silt as per the field test.

Grading for masonry, plaster and concrete shall be as per IS: 2116, IS: 1542, IS: 383 respectively, Sea sand shall not be used.

Testing for bulkage to be done and allowance be made at the time of use.

(d) **Cement**

The cement used for all the constructional purposes shall be Portland pozzolana cement conforming to I.S. 1489 OR rapid hardening, Portland cement conforming to I.S. 269.

Different types of Cement shall not be mixed together, shall be stacked and stored separately. Cement Bags shall be stacked in a manner to facilitate their removal and use in the order in which they are received.

The site where it is stored shall be dry, leak proof and as far as possible moisture proof.

Necessary precautions to be taken to avoid dampness through floor and walls. Stacking shall not be more than 10 bags high.

(e) **Mild Steel Reinforcement**

The mild steel for the reinforcement bars shall be in the form of round/ twisted/ deformed bars conforming to all requirements of I.S. 432 (Grade I).

(f) **Bricks**

Brick shall have uniform color, thoroughly burnt, smooth rectangular faces, with parallel slab, sharp and right angled edges, but not over-burnt.

When struck should give clear ringing sound.

The maximum permissible area of perceptible deposit of efflorescence shall be 50% of the surface area of the Bricks. The affected bricks should not be more than 80% of the lot. There shall be no powdering or flaking of the surface.

The average water absorption shall not exceed 22% by weight after 24 hours immersion in water.

The average minimum compressive strength for bricks of class designation 75 shall not be less than 75 kg / cm².

(g) **Other Materials**

Other materials not fully specified in these specifications and which may be required in the work shall conform to the latest I.S. All such materials shall be approved by the Engineer-in-Charge / Owner before use.

7.2 **Cement Concrete (Plain or Reinforced)**

- (a) Cement concrete pipes bedding, cradles, foundations and RCC slabs for all works shall be mixed by a Mechanical mixer where quantities of the concrete poured at one time permit. Hand mixing on properly constructed platforms may be allowed for small quantities by the Engineer-in-Charge / Owner. Rate for cement concrete shall be inclusive of all shuttering and centering at all depth and heights.
- (b) Concrete work shall be of such thickness and mix as given in the Schedule of Quantities.
- (c) All concrete work shall be cured for a period of at least 7 days. Such work shall be kept moist by means of gunny Bags at all times. All pipe trenches and foundations shall be kept dry during the curing period.

7.3 **Masonry Work**

Masonry work for manholes, chambers, brick masonry pipe trench and such other works as required shall be constructed from 1st class bricks as specified in the Schedule of Quantities in cement mortar 1:4 mix (1 cement: 4 coarse sand). All joints shall be properly raked to receive plaster.

7.4 **Cement Concrete for Pipe Support**

- (a) Wherever specified or shown on the drawings, all pipes shall be supported in concrete bed all round or in haunches. The thickness and mix of the concrete shall be given in the Schedule of Quantities. Type of the bedding is as described as follows:
- (b) Unless otherwise directed by the Engineer-in-Charge / Owner cement concrete for bed, all round or in haunches shall be laid as follows:-

Description	Upto 3 M depth
Pipes in open ground (No sub soil water)	All round (1:4:8)

(1=1 =1 cement, 2-3-4 coarse sand, 4-6-8) stone aggregate 20 / 40mm nominal size)

- (c) R.C.C. pipes or C.I. pipes may be supported on brick masonry or precast R.C.C or Cast insitu cradles. Cradles shall be as shown on the drawings.
- (d) Pipes in loose soil or above ground shall be supported on brick or RCC anchor blocks as shown on the drawings.

8. MANHOLES AND CHAMBERS

- 8.1 All manholes, chambers and other such works as specified shall be constructed in brick masonry in cement mortar 1:4 (1 cement: 4 coarse sand) or as specified in the Schedule of Quantities.
- 8.2 All Manholes, 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.

Where not specified, Manholes may be constructed as follows:-

(All dimensions internal clear in cms) (As / BMC Regulation)

Size of Manhole Type	90x80 Rect.	90X120 Rect.
Maximum depth	120	150
Average thickness of R.C.C slab	15	15
Size of cover and frame (Internal dia)	61x45.5	50 dia
Weight of cover and frame not less than	38 Kg. or as specified	116 Kg. or 170 Kg. or 208 Kg. or as specified in BOQ
Type of Cover & Frame	C.I. or SFRC as specified in BOQ.	C.I. or SFRC as specified in BOQ.

- 8.3 All manholes shall be provided with cement concrete benching in 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20mm nominal size). The benching shall have a slope of 10cm 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.
- 8.4 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.
- 8.5 All manholes with depths greater than 1 M. shall be provided with plastic encapsulated 20mm square or 25mm round rods foot rungs set in cement concrete blocks 30 x 20 x 15cms in 1:3:6 mix 30 cms vertically and staggered. Foot rests shall be coated with coal tar before embedding.
- 8.6 All manholes shall be provided with cast iron covers and frames and embedded in reinforced cement concrete slab or SFRC precast concrete covers as per instructions of the Engineer-in-Charge / Owner. Weight of cover, frame and thickness of slab shall be as specified in the Schedule of Quantities or as given above.

8.7 All catch basins shall be having C.I. grating or SFRC precast Gully Grating as per instructions of Engineer-in-Charge / Owner. The grating along with frame shall be of approved design and quality as per instruction of Engineer-in-Charge/ Owner.

9. **MAKING CONNECTIONS**

Contractor shall connect the new sewer line to the existing manhole by cutting the , benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manhole for the new connection. Contractor shall remove all sewage and water if encountered in making the connection without additional cost.

10. **MEASUREMENT**

10.1 **Pipes**

Pipes for Sewerage & Drainage shall be measured for the finished length of the pipe line per linear metre i.e. (a) lengths between Manholes shall be recorded from inside of one manhole to inside of other manhole, (b) length between socket of pipe near gully trap and inside of manhole. Rate shall include all items given in the Schedule of Quantities and specifications.

10.2 **Gully Traps**

Gully traps shall be measured by the number and rate shall include all Excavation, Foundation, Concrete Brick Masonry, Cement Plaster inside and outside, C.I. Grating and sealed cover and frame.

10.3 **Manholes**

- (a) All manholes shall be measured by numbers and shall include all items specified above and necessary Excavation, Refilling & Disposal of surplus earth.
- (b) Manholes with depths greater than specified under the main item shall be paid for under "extra depth" and shall include all items as given for manholes. Measurement shall be done to the nearest cm. Depth of the manholes shall be measured from top of the manhole cover to bottom of Channel.

10.4 **Drop Connections**

Drop connections shall be measured by number for a depth of 60 cms or part thereof between invert levels. Additional depth shall be paid for as extra per meter depth as per the actual length of the drop connection, measured to the nearest cm.

10.5 **Making Connections**

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

10.6 **Masonry Drains**

Payment for masonry drains shall be made under individual items of Masonry, Cement concrete and plaster by volume or area as given in the Schedule of Quantities.

10.7 Brick Masonry and Cement Concrete shall be measured per cubic metre and shall include all items as given in the Schedule of Quantities.

10.8 For Cement Plaster, Length and breadth shall be measured correct to a Centimeter and it's area shall be calculated in Sq. M. correct to two places of decimal.

11. **COMMISSIONING**

11.1 After successful testing of the different sewerage and drainage pipes in parts, the Contractor shall provide all facilities including necessary pipings, labours, tools and equipments etc. for carrying out testing and commissioning of the entire external sewerage and drainage system complete as per requirement in the presence of Client representative/Consultant, whenever and as may be required. Generally, the following test/inspection has to be carried out:-

- (a) For any Leakages/seepages in the external sewerage and drainage pipes.
- (b) For checking the functioning of the entire external sewerage and drainage system including rainwater harvesting system and to ensure that the waste water is continuously flowing towards outfall without any intermediate stagnation.
- (c) For the functioning of the valves and accessories etc. by putting ON/OFF the controlling valves of the various diversions in the sewerage and drainage and rain water harvesting system.

END OF SECTION - IV