
**Tender Technical Specification for Factory buildings -
Plumbing and Sanitary works**

PART-1: GENERAL**1. GENERAL SPECIFICATIONS & REQUIREMENTS:**

- 1.1 The contractor shall furnish all skilled and unskilled labour, plant and equipment, scaffolding all materials, etc, required for complete executions of the work in accordance with the drawings and as described herein and / or as directed by the Engineer.
- 1.2 Contractor shall set out the drainage, soil, waste and water pipes lines and other fittings and fixtures in accordance with the plans and instructions of the Engineer, The contractor shall be responsible for the correctness of the above and inaccuracies are to be rectified at his own expenses. He will be responsible for taking levels of the site before setting out and putting them on record without extra charge.
- 1.3 The drawings, specifications and schedule of quantities forming the part of the contract are explanatory and are complementary to one another, representing together the works / Installation to be carried out . If neither the specifications nor the schedule of quantities include any provision specifically But if such provision is necessary to complete the work as per drawing the contractor shall provide the same without extra cost,

In case of any discrepancy in-between the bill of quantities and drawings, the same has to be brought notice to the Architect/consultant and it can be executed by the contractor as per the instruction by the Architects /consultant.

1. Comply with requirements of Mechanical General Provision's and Mechanical Basic Materials and Methods.
2. It is the Contractors responsibility to be fully aware of and comply with all of the requirements of the project.
3. water supply system including connections to the external domestic water supply pipe network, water meter, valve chambers, water tanks, booster and lifting water pumps, valves, fittings and ready connections to sanitary wares as indicated on the drawings.
4. The domestic water supply system to include but not be limited to the following:
 1. All coordination, road crossings (by auger boring method), pipes, fittings, excavation, back filling, securing permits and clearances
 2. Construction of flow meters chamber or cabinets and piping to the potable water tanks.
 3. Float valve
 4. Water tank, sumps vents
 5. potable water lift and booster pump sets
 6. Ready connections to each plumbing fixture
 7. Connections to hose bibs
 8. Connections to make up water system
 9. Connections to kitchen equipment
 10. Pressure reducing valves ,Supply to hot water heaters (Geysers & solar system).
5. The plumbing equipment to include but not be limited to the following:

1. Water closets western style with concealed cistern.
2. Wash basins
3. Showers
4. Sinks
5. Janitor sinks
6. Urinals
7. Bib taps
8. water hammer arrestors
9. Solar Water Heater
10. Lifting, booster

6. The sanitary drainage system to include but not be limited to the following:

1. Traps, pipes and fittings
2. Floor drains with floor drain covers
3. Parking drains
4. Kitchen grease interceptors
5. Cleanouts
6. Gulley traps
7. Sewage manholes
8. Connections to foul drainage network as shown on drawings

7. The storm drainage system to include but not be limited to the following:

1. Roof drains, pipes and fittings
2. Clean outs
3. Balcony and planter drains irrigation requirements
4. Road inlet gullies, catch basins
5. Channel and gutter drains
6. Storm water manholes
7. Connections to external storm water drainage network as shown on drawings

8. Contractor shall provide plumbing and drainage piping with capped off connections for any future drainage connection and ball valve of required size with plug for water supply connection for equipment as indicated on drawings and which required drainage or water service connections.

1.4. **QUALITY ASSURANCE**

1. Execute work of this section only by skilled tradesmen regularly employed in the installation of plumbing and drainage systems and site external water supply and drainage services.
2. Contractor must be registered with and acceptable to Local municipality and drainage department.

1.5 **SUBMITTALS**

1. Contractor shall submit the Method statement for installation procedure, testing procedure, commissioning procedure for all the drainage, water supply & All the pump installations, and the same shall be reviewed by the consultant.
2. Contractor should submit the material Submittals for all the materials for the plumbing system that are going to be used in the project approval of the consultant.
3. Submit shop drawings with double line drawings with sections and elevation details for each piece of pumps and equipment supplied by this section including but not limited to:
4. Contractor to submit complete design package for approval.
5. Contractor has to submit the as built drawing after the full installation is complete and the same shall be send to the consultant for approval
 1. Plumbing fixtures.
 2. Pressure reducing valves, gate valves and globe valves
 3. Backflow preventer
 4. Expansion joints and water hammer arrestor
 5. Localized water heater, Solar water heaters.
 6. Sump pumps and performance data
 7. Floor drains and roof drains
 8. Float valves
 9. Filters
 10. Manholes
 11. Level devices
 12. Lifting, booster and circulating pumps with performance data, make and model.
6. Product Data

Submit manufacturer's specifications for each type of appliance including dimensions, materials of construction, detailed installation instruction, and electric wiring diagrams.

PART-2: PRODUCTS

2.1 SANITARY WARE AND ACCESSORIES

- (a). Lead and lift to convey the materials with in the site for installation of materials in their position as needed.
- (b). Cutting the masonry or concrete surfaces to facilitate fixing
- (c). Restoring damaged portions to their original condition with supply of materials like cement, river sand, stone chips, brick etc;
- (d). Convey all the broken materials taken out of damaged portion within the toilet & shaft area by head load via staircase, to be dumped out of the work site.
- (e). All the works are to be carried out as per description mentioned against each item of work mentioned in schedule of quantities
- (f). All tools and plants needed for the job to be brought in by the contractor at their cost including maintenance expenses, replacement at cost wherever required – either in full or in part
- (g). Fixing materials screws, bolts, nuts etc shall be provided by the contractor:

1.EWC fixing should be in the C.I chair bracket, rag bolts and extension WC pan connector

- 2 Concealed flushing cistern of Dual flush Technology and thermo cool cover, EWC connection pipe, fixing material for brick wall installation, actuating plate, making required size cutout in wall, and fixing the flushing cistern properly.
- 3 Sanitary wares like Physically challenged toilet Floor mounted European Water closet with cistern & fittings and seat cover one hinged SS rail, of SS grab bar-600mm, necessary accessories like pan connector, brass screws and one set of wash basin without faucet, 32mm dia waste coupling, 32mm dia bottle trap. The side gap between EWC mouth and pan connector to be filled with silicon sealant.
- 4 Sanitary wares like under counter washbasin fixing with following accessories: 15mm cp brass pillar cock, 15mm cp brass angular stop cock, 32mm dia cp brass waste coupling, 32mm dia cp brass bottle trap with extension pipe including necessary supporting brackets, connection tube .
- 5 single lever Faucet of wash basin approved make supply & installation by the contractor, storing, leading, installing, testing and commissioning of Sensor faucet -self powered-self-adjusting sensor, solenoid valve, function unit and controller for basins including necessary accessories etc; complete. Works include making required size cutout in wall, and fixing the control box properly, redoing the same .
- 6 Rectangular washbasin of approved make with 32mm dia cp brass waste coupling, 32mm dia cp brass bottle trap with extension pipe including necessary supporting brackets,

- 7 Sanitary wares like urinal of approved make supply & installation by the contractor, storing, leading, installing, testing and commissioning of white color/colors urinal with connection pipe, nipple, fisher bolt/necessary fixing screws etc; complete. Works include making required size cutout in wall, and fixing the sensor unit connections properly, redoing the same etc; complete including conveyance of all materials to the site, all labour charges, all taxes .
- 8 CP fittings - 15mm CP angle valve with flange including necessary TEFLON TAPES for water cooler and other equipment in kitchen, dining and break out area .
- 9 CP fittings -Health Faucet with stop valve and flexible tube with wall hook, Teflon tapes
- 10 Accessories-hand towel dispenser with waste receptacle, (Recessed type-concealed in the wall) for all group toilets fixing with necessary SS screws .
- 11 Accessories - of Liquid soap dispenser including liquid soap for all wash basin, dining wash basin area fixing with necessary SS screws as per the approved drawing.
- 12 Accessories -Automatic Hand drier fixed near wash basin for hand drying purpose for all toilet, physically challenged toilet as per the approved drawing.
- 13 SS Square sink with waste coupling - single or double bowl stainless steel sink, under the drain board will be packed with C.C 1:2:4 using 6mm chips before fixing sink and drain board to perfect level to match with platform in Kitchen, cutting grooves in masonry, restoring the damaged portions to their original condition . cutting and making good the walls /floor wherever required .
- 14 CP fittings of approved make installation by the contractor and fixing of CP brass Long body bib tap with wall flange.
- 15 single lever divertor for bath and shower system fixed shower head and shower arm etc complete. Works including cutting and making good the walls /floor wherever required

2.2. ROOF DRAINS

Roof drain these shall be sidewall or flat deck type as indicated on the drawings. They shall be cast iron with 100/ 200mm dia. Outlets.

2.3 FLOOR DRAINS

All floor drains shall be provided with deep seal traps

1. Floor Drain FD1

For use in the finished areas made of chrome plated, cast brass 150x150mm square floor plate with inlet grid and heavy duty stainless steel cover plate for floor gully.

2. Floor Drain FD2

For use in indirect drain as a combination of funnel and floor drains FD 2 made brass body with adjustable collar, clamping device and 150mm diameter grate, the funnel for indirect drain shall be round 100mm diameter or oval type epoxy coated 100x230mm. The indirect waste floor drains, shall be used for locations where the drainage received the drip, condensate or waste water from indirect waste lines. The funnel shall prevent the splashing and directs the waste into the drain. The exposed portion of the grate shall be used as a drain for any other water on the floor. The funnel shall be attached to the grate by means of concealed screws and it may be moved to any grate desired. The round funnel shall be used for single pipe. The oval funnel is ideal for multiple pipes. The indirect waste drains shall be made of brass ,grate and funnel.

2.4 CLEANOUTS (C.O)

1. Wall and floor cleanouts:

Wall cleanouts:

Where cleanouts are concealed behind tiled walls or finished: use round stainless steel plate and slotted flat head S.S screws.

2. Floor Cleanouts:

1. In unfinished areas use epoxy coated cast iron body with integral clamp device, plug with gasket, bonded to plug cast iron cover secured with stainless steel screw and adjustable top.
2. In tiled areas: same as above, with nickel bronze cover recessed to receive floor finish / coating.

3. Ceiling Cleanouts:

Ceiling cleanouts shall be of the material and size of the pipe it is serving.

2.5 WATER HAMMER ARRESTERS

1. water hammer arresters shall be sized according manufacturer's recommendations and shall be provided throughout the domestic system in locations determined.

2.6 HOSE BIB

Provide 20mm hose bib tap where shown on drawings for cleaning & other purposes.

2.7 MANHOLES

Constructing brick masonry chamber size as per the drawing (for housing valves, meters etc) of brick work with bricks of class 75 with cement mortar 1:5(1 cement:5 fine sand) plastering internal face with cement mortar 1:3(1 cement:3 fine sand) and rough plaster on outer face with a floating coat of neat cement. RCC top slab with 6mm thick MS checkered plate of required size with two side openings, lifting hook etc complete. Works including excavation, dewatering, refilling, watering, ramming and removing the surplus excavated material complete as required.(All sizes are clear internal sizes)

2.8 SUBMERSIBLE PUMPS

1. Pumps as listed in the equipment schedules shown on drawings complete with manufacturer supplied control panel and door interlocked isolator.

submersible pumps located in sump and well areas of adequate HP capable of giving a required discharge at suitable head.

2. Submersible pumps of required HP against the capacity given below.

All the pumps Control panels: Pre-wired with the following:

- General purpose enclosure
- Panel mounted disconnected, door interlocked
- Circuit breaker and earth leakage breaker for each pump
- Magnetic starters with 3 leg O.L. protection.
- Selector switches (H&A) for each pump.
- 24 volt control transformer.
- Pressure switches for low suction shut down and operation
- Pilot lights for power on, lead pump failure alarm, low suction pressure.
- Potential free contactor to control through BMS
- IP-55/IP65 protection to control panels.

3. Sump and sump pump requirements.

- Sumps and valve chambers DI-Manhole frames and cover(Heavy Duty)of approved make
- Float controls
- Contract for remote high level alarm
- Switches for pump operations
- Pilot light
- Relay
- Motor starter
- Electric cable
- SS Lifting chain and guide rail, pump Auto coupling Arrangement in side the pumping well ,

2.9. DOMESTIC WATER LIFTING AND HYDRO PNEUMATIC BOOSTER PUMPS

1. Vertical/horizontal Multistage centrifugal pump set package complete requiring field connections only for piping and electrical power. Each booster pump set package shall consist of 2 pumps (min. one duty and one standby), interconnecting SS pipe work with valves and flexible connections, all mounted in a common base plate and factory supplied control panel. And adequate capacity pressure vessel as per manufacturers recommendations .
1. Centrifugal monoblock Pumps of approved make Electrically operated with control panel by the pump manufacturers discharging water from UG Sump to Overhead Tank at terrace, aligning the pump set to match and delivery ends of pipe work, interconnecting both the pumps, including Electrical cable work up to panel board, providing and fixing electrical starter for on & off, earthing, testing and commissioning etc; complete. Works including of electrical works, such as provision of related electrical cabling and wiring, panel, starter to be done by the vendor. Before purchasing of pumps the flow, head, make and model to be checked and approved by the plumbing consultant.

2.10. WATER SUPPLY PUMPS

1. Pumps for DWS water supply

Supplying, fixing, testing and commissioning of Booster Pumps of approved make Electrically operated with control panel as per specification

2. All the pumps Control panels: Pre-wired as per manufacturer's recommendation and as per IS: Codes with the following specification:
 - General purpose enclosure
 - Panel mounted disconnected, door interlocked
 - Circuit breaker and earth leakage breaker for each pump
 - Magnetic starters with 3 leg O.L. protection.
 - Selector switches (H&A) for each pump.
 - 24 volt control transformer.
 - Pressure switches for low suction shut down and operation
 - Pressure gauges for discharge for each pump and for common headers
 - Pressure switches for pumps starting and cycling.
 - Provide a disconnect switch mounted adjacent to each pump.
 - Potential free contactor To control through BMS.
 - All motors should be Efficiency 1 type motors.
3. Valves and Piping: SS piping headers, with a regulating valve on each pump discharge to provide constant pressure sized to suit the application; check valve on each pump discharge; gate valve on each pump suction. Provide, control valve with flexible bellow, flow meter and PRV after the manifold.
4. Hydraulic accumulator of pressed welded steel sheet construction shall be provided with renewable flexible impermeable diaphragm membrane rated for a working pressure of 16 bars, initial charge pressure of 2.5 bar.
5. Pump capacities as indicated on the on drawings and boq and technical specification.
6. All pumps shall be provided with temperature relief facility for protection against overheating.

7. Pump sets to be suitable for 415 volt, 3 phase 50 Hz power supply and 240V, 1 phase, 50 Hz control.

2.11. WATER LEVEL CONTROLER /INDICATORS – WATER TANKS & SUMPS

1. Provide multi water level, side mount indicators for installation inside each water reservoir to suit the operation requirements indicated in the equipment schedules of pump sets.
2. Indicators shall indicate high, intermediate, and low water levels.
3. Level indicator to comprise of:
 4. Float
 5. 316 stem of length suitable for depth of reservoir
 6. 6mm (1/4") NPT mounting thread
7. Single pole single throw switches to indicate
 8. Low level
 9. Intermediate level
 10. High level
11. Foot for resting on bottom of reservoir
12. Provide top supports and mounting flange.
13. Level indicators to be suitable for 240 volt/4ph/50Hz source of power.
14. Provide transparent pipe water level indicator in the treated water, raw water sumps.

2.12 VALVES-PLUMBING SERVICES:

1. Isolating (Gate) Valves

For sizes up to and including 50mm shall be bronze to IS, PN 20. Valves shall be complete with position indicator and locking device; of approved make. Valves above 50mm dia shall be of butterfly valve with brass or stainless steel disc inside conforming to IS.

2. Strainers

Strainers, in addition to where shown on drawings shall be fitted upstream of all major items of plant,

Shall be bronze IS "Y" type strainer PN 20 Series B. with perforated stainless steel screen 0.75mm diameter perforations for 'fine' straining free flow area per the square cm. of element area. strainer shall be with screwed cap and shall be fitted with gland cock (hose union type) for blow down connection and shall also have drilled and tapped bosses on each side of the body fitted with 2 test points and 2 plugged points, flanged to IS PN25 or with ends threaded .

3. Non Return Valves

Non-return valves shall be fitted where plant operates on an automatic changeover basis or where flow reversal can occur.

Sizes up to and including 50mm shall be bronze to IS check valve to IS PN 20. Kitemarked, horizontal swing pattern with threaded cover, nitrile disk, and shall be suitable for mounting in horizontal and vertical pipe (with vertical flow upwards) end threaded internal.

Provide backflow preventer between all the equipment and domestic water lines including:

. Bronze body

Replaceable seats

4. Butterfly Valves

Butterfly valves shall be cast steel, long necked wafer pattern, to IS PN 16, with locking device and EPDM liner bonded to the body by the transfer molding process, aluminum bronze or stainless steel disc, stainless steel shaft, for sizes up to and including 150mm shall be wrench operated

5. Float Valves

Float valves with all floats shall be manufactured in copper shall be installed as indicated on drawings to provide consistent level control in reserve supply water storage tanks. The valve shall meet the requirements of the water Byelaws for air gaps and shall be constructed throughout required materials and shall prevent back siphonage, inlet flow shall be coaxial with the piston movement, to ensure high discharge capacity and smooth, quiet operation. The valve shall have 'O' ring piston seals, resilient seated disk, dezincification resistant bronze body and disk components. All floats shall be manufactured in copper to IS and fabricated using required solder and shall be hydraulically tested to ensure buoyancy and constructed in accordance with IS. Brass float valves up to 3" and above shall be flanged and BS4504 PN 16.

Provide float valve in each of the water reservoirs.

Construction

1. Bronze body to size 50mm (2")
2. Brass piston with 'O' ring seal
3. Threaded end with lock nuts
4. Removable phosphor bronze seats
5. Copper ball.

6. Drain valves.

Drain valves shall be installed in all the risers bottom level to drain the water in the riser in case of maintenance and shall be plugged after the ball valve. The plugs shall have square head with a slot to indicated plug position.

7. Flow Measurement

For the purpose of the flow measurement and the proportional balancing of water distribution system, the contractor shall provide a digital electro magnetic flow metre at the required location, set and shall be suitable for portable

8. Air Vents

Automatic air vents shall have gunmetal or brass bodies-UNI EN: 12165 :98, with inlet pressure of 10 bar, with temperature of 110 degree C. Nonferrous or stainless steel floats and guides and non-corrodible valves and seats. Each automatic air vent valve shall be provided after the ball valve. with plug in Brass UNI EN :12165:98

9. Pressure Gauges

Gauges shall be having 100mm diameter dials with black enameled steel case and dust proof, chromium plated bezel. Gauges shall have indicating black pointed and loose red index pointer. pressure gauges shall be installed in pipe work with ball valve.

Pipe work connections shall be 15mm or 10mm nominal bore with welding or screwed sockets.

10. Pressure Test Plugs.

Plugs shall be of brass construction and shall be fitted into a 15mm B.S.P. female boss. plugs shall be supplied complete with cap.

11. PRESSURE REDUCING VALVES

Provide pressure reducing valves where indicated on drawings.
Pressure reducing valves shall maintain required leaving pressures in floors

Part -3 WATER SUPPLY AND DRAINAGE

3.1. **Internal Drainage:**

Pipe Fittings.

1. **Poly propylene pipes – as per EN/DIN standards for internal sewage network.**

Poly propylene pipes (available MOLDED fittings in market) such as tee, 45'bend, 90'bend 'y', P-trap, reducer, reducing bush, nipple, coupler, adapter etc; for underground drainage and sewerage systems - pipes in trenches to required gradients, buried in ground level . forming bottom surface to required level, refilling selected excavated earth around the encasing, watering, consolidating and disposing off the surplus earth. Pump out water from the trenches using required nos of dewatering pumps with complete shoring arrangements wherever necessary. Pipes and fittings shall be cleaned with pipe cleaners push fit type joint with the fittings using lubricant.

2. Providing and Laying Plain cement concrete (1:4:8) encasing for internal pipes laid in sunken floor in toilet areas, 100mm thick all-round the pipes .

3. 4mm wall thickness Poly propylene Floor traps, made out of 110mm dia PVC Pipe with single or multiple inlets of size 40mm to 75mm dia.(boss tee), outlets of sizes 50mm to 100mm, with min.2" water seal, fixing in position, using cement concrete 100 mm all-round to full depth of trap, including providing FRP matting at bottom.

4. Poly propylene 'P' trap used in suspended ceiling level(With proper Hitech Pipe supports), 110mm dia extension boss tee arrangements with female thread fix with the Stainless steel heavy duty clean out in male thread with gasket and three ss screws heavy duty clean out for urinals.

5. CP Anti cockroach floor trap gratings which consisting floor drain grating, inner filter and out filter and rim, fixed over the floor trap. Works including cleaning of floor traps before fixing the gratings. While fixing the gratings, flooring should be cut to required size of grating, (not more than 2mm of the grating sizes) using tile cutter etc; complete. The gap should be filled silicon sealant to match the flooring color. To avoid damage of the cp gratings, acid cleaning of flooring shall be done before fixing of gratings.

6. **HDPE pipes – as per EN/DIN standards for internal & external Effluent network.**

Poly propylene pipes (available MOLDED fittings in market) such as tee, 45'bend, 90'bend 'y', P-trap, reducer, reducing bush, nipple, coupler, adapter etc; for underground /suspended Effluent drainage systems - pipes in trenches to required gradients, buried in ground level . forming bottom

surface to required level, refilling selected excavated earth around the encasing, watering, consolidating and disposing off the surplus earth. Pump out water from the trenches using required nos of dewatering pumps with complete shoring arrangements wherever necessary. Pipes and fittings shall be cleaned and the joint type shall be but weld /fusion joint using hot plate /electro fusion joint using electro fusion socket /push fit type joint for expansion coupling with the fittings using lubricant.

7. Fabricating brackets using Mild Steel flats or angles, 10mm thick ms plate, cutting, welding, forming shapes, **providing hot dip galvanizing for brackets**, cutting pockets in masonry / concrete surfaces, grouting brackets in concrete of 1:2:4 mix. necessary **"U" bolts, nuts & washers wherever required in vertical, horizontal supports. provide solid Rigid supports for every 3 m length of MS hot dip galvanized supports at the suspended level in basement area .**
8. core cutting on slabs, beams, retaining wall etc; for taking drainage and water pipes, and redoing the core cut area with water proofing materials and Sealent, fire sealant .
9. Heavy duty Roding Eye in suspended floors, with female thread fix with the heavy duty clean out plug in male thread with gasket .
10. Pipe sleeves up to 300 dia fixed to all the walls where ever drainage /water supply pipe passing the wall, beams, and provide fire stop sealant both the side of the walls and beams as per the approved make and depth of the fire sealant shall be as per the manufacturers recommendation the rest of the space shall be filled with rock woll .

3.2. External drainage:

1. General
1. Contractor to prepare and be totally responsible for a Complete sewerage collection as outlined herein and shown on plans.
2. Contractor to provide all sewers and manholes as shown on drawing and connect into city sewers network or existing site network as shown on drawings and approved by local authorities having jurisdiction.
3. All piping running below traffic areas such as roadways, parking areas and loading docks shall be minimum 0.90m below finished grade.
4. The pipe work should be sized and run at a slope to achieve a water velocity of 0.75 m/s during peak flows.
5. Contractor shall check and verify all inverts of pipe work, as per site conditions to maintain Proper slope. The contractor shall obtain the Engineer approval for all pipe runs and invert levels prior to backfilling.
6. Temporary Access

Design, construct and maintain in a safe condition at all times temporary roadways, walkways and bridges all with appropriate railing if required to facilitate pedestrian and vehicular movement near the excavation.

6. Disposal of Unwanted Material

Remove and dispose surplus excavated material from the area of the excavation and dispose from site if not otherwise required by the owner.

7. Additional Excavation

Refill any over-excavation beneath structures or pipes with lean concrete to the specified excavation level.

8. Existing Utilities and Services

10 Contact the various utility authorities and become informed of the exact location of utilities and services and assume liability for damage to these utilities.

11. where existing pipes, ducts or other underground services intersect the pipe trench, support them to the approval of authorities having jurisdiction.

12. Provide adequate support to all structures in the vicinity of all excavation and assume full responsibility for any damage to such structures.

13. Pipe Fittings

UPVC PIPES – SN-8 Pipes as per IS standards External sewage network.

UPVC-SN 8 PIPES (available MOLDED fittings in market) such as tee, 45° bend, 90° bend 'y', P-trap, reducer, reducing bush, nipple, coupler, adapter etc; for underground drainage and sewerage systems - pipes in trenches to required gradients, buried in ground level. forming bottom surface to required level, refilling selected excavated earth around the encasing, watering, consolidating and disposing off the surplus earth. Pump out water from the trenches using required nos of dewatering pumps with complete shoring arrangements wherever necessary. Pipes and fittings shall be cleaned with pipe cleaners and using jointing/detachable joints/inserted transition joints, PVC saddle type joint with the fittings.

14. Providing and Laying Plain cement concrete (1:4:8) encasing for External pipes laid in Ground level, 100mm thick all-round the pipes with the help of necessary wooden shuttering

15. Necessary cover slab to be laid in R.C.C.1:1.5:3, with manhole cover provision (SFRC cover-600X600, medium duty for landscaped area, Heavy duty SFRC cover 600X600 for Road area, vehicle movement area), PVC insulated footrest to be provided 300 mm c/c as per the drawing. Reinforcement for RCC bed and wall is 12 mm TMT bars 150 mm C/C on both ways and both faces of concrete. Earth backfilling to be done after completion of all works with selected earth with water consolidation.

16. Construction of inspection chamber in R.C.C due to water table is high in the ground level, with 200mm wall thickness, 1:1 1/2:3 using reinforcement of 12mm dia TMT bar at 150mm centre to centre in both ways and both faces. Provide cover slab of 200 mm thickness in 1:1 1/2:3 using 12mm bar in both ways and double matt. Provide 200mm thick foundation in 1:1 1/2:3. All the inside, outside walls and floors plastered with water proofing compound. Provide a bed of 150mm thick PCC 1:4:8 over the 100 thick sand bed. Necessary excavation and refilling in any type of soil after the completion of chamber work. Cover slab shall be 600mm dia round SFRC cover with frame of 220 kg weight with bearing of 20 metric ton loads.

Insulated CI steps at 300mm interval for depth more than 0.8M. wall plastering shall be of smooth in CM1:3 inside, and outside with rough plastering with water proofing compound. Necessary benching

and channeling in PCC1:3:6. Make connection from the soil pipe and water pipes coming from toilet and GT. making necessary holes in R.C.C walls to enter the soil and waste pipes from toilets, and refilling with water proofing compound. Pump out water from trenches with shoring wherever necessary. Water proofing compound is used in the inside and out side plastering of side walls.

17. Construction of gully chamber with pvc gully with CI grating set in 75mm thick PCC1;4;8 bed, in 115mm thick masonry chamber in CM 1:4, internal and external plastering 12mm thick in CM1:6, supply and fixing 300x300 SFRC cover slab and frame, including excavating, refilling .
18. Making connection to the Existing sewage manhole chamber, works including necessary pipes, fittings, and cutting the main road or landscaped area and making good the road after connection.
19. Laying, jointing and testing of socketed and spigotted R.C.C pipes(NP2 class) confirming to IS 458, collars jointed with stiff mixture cement mortaring the proportion of 1:2(1 cement : 2 fine sand) laid to correct levels below ground in trenches up to required depth including excavation in all kinds of soil(hard/ soft), dewatering, refilling, watering, ramming and removing the surplus excavated material and making good the same complete as required.

3.3. Rain water Drain:

1. UPVC SWR "B" class /UPVC-6kg class with same specials, pipes confirming to IS-13592-1992&Pipes for 200/250/315/400 mm dia confirming to IS 4985 – 2000 with fittings such as tee, 45'bend, 90'bend 'y', P-trap, reducer, reducing bush, nipple, coupler, adapter etc; for Rain water from terrace and balconies with necessary specials like bends, shoes, couplers etc and underground storm water drainage systems - pipes in trenches to required positions, buried in ground level. For laying pipes, forming bottom surface to required level, refilling selected excavated earth around the encasing, watering, consolidating and disposing off the surplus earth within the site or as directed by Architects/Consultants within a lead of 300M. etc.
2. Manholes

Necessary cover slab to be laid in R.C.C.1:1.5:3, with manhole cover provision (SFRC cover-600X600, medium duty for landscaped area, Heavy duty SFRC cover 600X600 for Road area, vehicle movement area), PVC insulated footrest to be provided 300 mm c/c as per the drawing. Earth backfilling to be done after completion of all works with selected earth with water consolidation.
3. Granular Materials
 1. Granular "A" crushed rock or crushed gravel
 2. Granular "B" and granular bedding material – composed of clean, hard, durable particles free from lumps of clay, shale or other objectionable materials.
14. Backfill
 1. Earth which is free of roots, organic material, and stones larger than 0.100 meters, and which has natural moisture content suitable for placement and compaction.
15. Site Clearing

1. Protect trees and root structure as well as fences, walls, shrubs, and other vegetation carefully and save from damage during the construction operation.

16. Earth Excavation

1. Trenches

1. Excavate the trench to the alignment and depth requirement, and immediately prior to pipe laying. Where it is found necessary to excavate to greater depths in carrying the mains under present water mains, conduits, sewer pipes or culverts, or passing by, under or around any culverts, manholes, hydro-electric, telephones or other chambers on the line of the pipe, nothing in addition to the price stated in the form of Tender will be allowed.
2. The width of the trench at ground level is not to be less than the width at any depth in the trench. the bottom width of the trench shall not be less than 0.6 metre greater than the internal diameter of the pipe of be laid, but shall not exceed 1.0 metre more than the internal diameter of the pipe. refill over break and slides which have occurred during excavation, with approved materials.
3. where trench excavations are not kept within the maximum limits shown on the drawings, the consultant may order sheathing and shoring and/or a higher class of bedding..
4. The trench shall be so braced and drained that the workmen may work in it safely and efficiently. it is essential that the discharge of the trench dewatering pumps be conducted to natural drainage channels, drains or sewers.
5. Grade and shape te pipe trench and specified bedding, to give uniform and even bedding for the length of pipe. Dig bell holes at each joint. Fill any over excavation below grade with compacted granular material.
6. If the sub-grade in its natural state is inadequate to support the pipe, the consultant may require additional excavation and placement and compaction of granular "B" material, or placement of a heavier class of bedding.
7. Remove foundation material which, in its natural state, has a good bearing strnegh, but which has had its characteristics adversely changed bu the contractor's operations, and replace it with granular "B" material, or placement of heavier class of bedding.
8. Excavate trenches in roadways in a manner to prevent overreach. cut all pavement edges in clean, straight lines before the start of excavation.
9. Where pipes are to be laid in filled ground, construct the fill first, to at least 0.600 metre above the elevation of the top of the pipes before trenching for the pipes. Place fill in 150mm lifts and compact using mechanical vibrating plave compactors or rollers, to 90% of maximum dry density.

17. Sheathing, Shoring and Bracing

1. Remove necessary sheathing, shoring and bracing to maintain stability of banks, excavations and trenches.
2. The neglect, failure or refusal of the Engineers to order the use of sheeting or sheet piling or of a better quality of larger sizes of timber, or to order sheeting, sheet piling, bracing, shores etc; shall not in any

way or to any extent relieve the contractor of any or all of his obligations under the Contract.

3. The Contractor, where necessary in order to prevent injury to workmen, roadways, water pipes, electric conduits or other structures already laid, shall sheet plank and timber the trench. The sheet plank and timber shall be furnished and put in and removed by the Contractor at his own cost and expense. All sheet plank and timber used during the progress of the work to support the sides shall be removed as the filling proceeds.

18. Pipe Bedding

1. Pipe bedding material shall be as per IS. Place bedding material carefully around pipe and compact in 150mm layers. Hand tamp adjacent to pipe. When using powered tamping equipment, care is required to not damage pipe service, should any surface be damaged, remove material and repair or replace pipe.
2. Where cover to pipe is less than 1m then the pipework shall be concrete encased.

19. Backfill and Fill

1. Trenches

1. Backfill trenches from the top of the pipe bedding to the underside of the surface restoration with site selected excavated material. backfill with clean earth free of roots, organic material, and stones larger than 0.100 metre.
2. If the consultant decides that the site selected excavated material is either wholly or partially unsuitable for backfill, then supply and place imported backfill materials.
3. Do not backfill pressure pipe joints until the pipes have passed pressure tests as specified.
4. If there is a deficiency of clean earth, for backfilling, suitable granular fill material shall be supplied by the contractor at his expense. The material shall be approved sandy material. At least as much material shall be replaced as was excavated.
5. No house ashes, refuse or other material of an unsatisfactory character shall be used in refilling, and the contractor shall not permit the trench to be used as dumping ground for refuse.

20. Compaction Tests

Where compaction of sub-grade, backfill or fill is called for, the consultant will require compaction tests. Such tests shall be arranged for and paid for by the contractor.

Where tests show that the compaction does not meet the specified requirement, provide the necessary labour and equipment to recompact the material.

21. Disposal of Surplus Excavation

Surplus excavated materials will be the property of the GE on site. the contractor shall haul and dump the surplus material to an on site location or offsite dump as INSTRUCTED BY THE SITE ENGINEER

22. Surface Restoration

22.1 General

Restore all surfaces to a condition at least equal to the original.
Where road or sidewalk restoration or construction is required, take particular care in compaction of backfill as specified, and assume responsibility for any settlement until the end of the Guarantee period.
Restore trenches as soon as possible after backfilling.

22.2 Restore all culverts and drainage courses intersected by the works to a condition at least equal to the original.

22.3 Where it is necessary and permitted to remove trees, shrubs, etc; , from the line of the water mains, such works shall be done by the contractor.

22.4 Ornamental shrubs, hedges and trees shall be preserved from damage, shrubs and small trees on or close to the line of the work shall be removed and carefully replaced after the backfilling is completed. Excavation close to large trees shall be carried out in such a way as to protect the roots from damage. Hedges crossing the line of the main shall be removed and replaced unless the main is laid in tunnel below the hedge. No extra payment will be allowed for removing, replacing or protecting trees, shrubs, hedges, etc;

The cost of clearing shall be included in the price and no extra payment will be allowed.

22.5 All culverts, private sidewalks and driveways which are broken, damaged or disturbed in the execution of this contract are to be restored to their original condition

22.6 Where mains are laid under boulevards or other places where there is a finished surface of grass, the same shall, in all cases, be carefully cut, preserved and replaced by the contractor. Any sod which does not resume normal growth shall be replaced with field or nursery sod, scrubs and trees. Watering and caring for the sod is the Contractor's responsibility till normal growth is resumed
Sewerage

22.7 Pipe work

Pipes are to be laid in straight lines and at uniform gradient in accordance with normal code of practice requirements. The gradients may be reduced if so directed by the consultant or as shown on the drawings.

22.8 Pipe Installation

Install all piping in the best workmanlike manner in accordance with the best practices of the trade.

The piping shown on the drawings is diagrammatic for clearness in indicating the general run and connections and may or may not be, in all instances, shown in its true position. Take responsibility for the proper erection of systems of piping in every respect suitable for the work intended and as described in the specifications.

Keep plugged or capped all openings in pipe or fittings during installation.

23 Inspection and Testing

1. The contractor shall notify the CONCERN SITE ENGINEER of the time at which all tests are to be held and shall provide all the materials, labour and equipment required for testing. Upon completion of the tests, copies of the complete records shall be given to the consultant for his retention in accordance with division one submittals.

2. The contractor shall ensure the safety of the pipe work under test and he shall be responsible for the pipe work and ancillary works during the test and shall replace or repair as directed by the consultant, any pipe or fitting which in the opinion of the consultant has failed to withstand the test.

24 Gravity Sewers

1. Test Procedure
1. Pipelines shall be tested in lengths between manholes by potable water with a minimum head of 3m.

This test shall be carried out prior to backfilling with bedding up to pipe soffit and with pipe joints clear of bedding. No pipeline shall be accepted if leakage is detected at pipe joints or through the pipe barrel within one hour of the commencement of the test.

3.4. POTABLE WATER SUPPLY

3.4.1. Internal water supply

Chlorinated Polyvinyl Chloride (CPVC) Pipes

Pipe	CPVC	SDR-11 & Schedule 80
Fittings	CPVC	Schedule – 80
Joints		Solvent Welded

CPVC

pipe - SDR 11 grade-pipes and CPVC Fittings confirming to ASTM D 2846 for Domestic water supply, flushing water supply within the toilets areas and kitchen, pantry breakout & AHU area - Concealing in walls & ledge walls, running in ceiling level with necessary fittings such as tee, elbow, union, nipple. Including brass molded fittings, brass male/female adapters etc; Works including cutting and jointing using CPVC solvent cement weld on 724-CPVC and use primer weld on P-70 primer for dia above 2". chasing the wall and fixing the pipe with proper rigid support with hot dipped galvanized "c" channels supports, redoing the same, and fixed properly, running in ceiling level and running in sunken floor level with proper pipe supports, pressure testing.

Making of water supply pipes connected with the fittings by CPVC solvent cement (IPS USA) as per the drawing routing, pipes chasing in the wall, running in high level floors with in the toilets, kitchen and service areas. Works are including cutting in the wall, floors and necessary areas and refilling the same.

3.4.2. PUMPING MAIN TO OHTS:

CPVC pipe – SH-80 grade-pipes and CPVC Fittings confirming to ASTM D 2846 for Domestic water supply, flushing water supply within the toilets areas and kitchen, pantry breakout & AHU area - Concealing in walls & ledge walls, running in ceiling level with necessary fittings such as tee, elbow, union, nipple. Including brass molded fittings, brass male/female adapters etc; Works including cutting and jointing using CPVC solvent cement and use primer for dia above 2". chasing the wall and fixing the pipe with proper rigid support with hot dipped galvanized "c" channels supports, redoing the same, and fixed properly, running in ceiling level and running in sunken floor level with proper pipe supports, pressure testing.

3.4.3. HOT WATER SUPPLY:

CPVC-SH 80 pipe with specials such as elbow, tee, coupler, reducing tee, reducing elbow, adopter, nipple with CPVC solvent cement and use primer for dia above 2". etc as per IS standards. The installed pipes are tested to withstand the necessary test pressure as per the recommended practices. Identification marks, flow marks to be done on the all pipes which are exposed with suitable paint mark/stickers.

3.4.4. INSULATION FOR ALL THE HOT WATER PIPES:

wrapping of Vido flex/k-flex insulation 10mm thickness with proper glue as per the manufacturers recommendation and confirming to Indian standards for hot water supply and return line in inside toilet, kitchen .

Cutting

In order to make a proper and neat joint, measure the pipe length accurately and make a visible marking using a felt tip pen. Ensure that the pipe & fittings are size compatible. You can easily cut with plywood cutting saw/ratchet cutter or a wheel cutter. Cutting the pipe as squarely as possible (at 90°) provides optimal bonding area within a joint. Inspect pipe ends thoroughly prior to making a joint. If a crack or splintering is noticed, cut-off min. 100 mm beyond the visible crack before proceeding.

Deburring / Beveling

Burrs in & on pipe end can obstruct flow/proper contact between the pipe & socket of the fitting during assembly & should be removed from both in & outside of the pipe. A 15 mm dia half round file/a pen knife or deburring tools are suitable for this purpose. A slight bevel on the end of the pipe will ease entry of the pipe into the socket of the fitting socket.

Fitting Preparation

Using a clean dry rag wipe the dirt and moisture from the fitting sockets and pipe end. Dry fit the pipe to ensure total entry into the bottom of the fittings socket & make a visible marking using a felt tip pen.

Solvent cement application

Use only CPVC solvent cement and use primer for dia above 2". to ensure a perfect solvent weld joint. When making a joint, apply an even coat of cement on the pipe en and also inside the fitting socket. Do not use thickened or lumpy solvent cement. It should have a flow consistency like that of syrup or honey.

Assembly

Immediately insert the pipe into the fitting socket, rotate the pipe $\frac{1}{4}$ to $\frac{1}{2}$ turn while inserting. This motion ensures an even distribution of cement within the joint. Hold the assembly for approx. 10 seconds to allow the joint to set-up.

Cure time for operating/test pressure up to 12 kg/cm²

Ambient Temp	Up to 1 ¼"	1 ½" to 2"
17° to 48° C	1 hr	2 hr
5° to 17° C	3 hr	4 hr
-20° to 5° C	8 hr	16 hr

Cure time for operating/test pressure above 12 kg/cm²

Ambient Temp	Up to 1 ¼"	1 ½" to 2"
17° to 48° C	6 hr	6 hr
5° to 17° C	12 hr	24 hr
-20° to 5° C	48 hr	96 hr

3.4.5. **External water supply Works:**

CPVC pipe –SDR-11/ SH-80 grade-pipes and CPVC Fittings confirming to Pipe : CPVC - SDR 11 conforming to IS.15778.2007 For Domestic water supply, flushing water supply within the toilets areas and kitchen, pantry breakout & AHU area - Concealing in walls & ledge walls, running in ceiling level with necessary fittings such as tee, elbow, union, nipple. Including brass molded fittings, brass male/female adapters etc; Works including cutting and jointing using CPVC solvent cement and use primer for dia above 2". chasing the wall and fixing the pipe with proper rigid support with hot dipped galvanized "c" channels supports, redoing the same, and fixed properly, running in ceiling level and running in sunken floor level with proper pipe supports, pressure testing.

The pipes and fittings shall be laid in trenches. The widths and depths of the trenches for different diameters of the pipes shall be given as in the table below, and shall be enough to have a clear cover of at least 400 mm above the top of pipes.

Dia of pipe	Width of trench	Depth of Trench
15 mm to 50 mm	300 mm	600 mm
65 mm to 100 mm	450 mm	750 mm

The pipes shall be laid on a sand cushion layer of 75 mm. river sand and filled with excavated earth. The surplus earth shall be disposed off as directed. The filling shall be done after testing & rectifying leakages and after final passing of work by Engineer In charge / Owners Representative at site.

When the excavation is done in rocks the bottom shall be cut deep enough to permit the pipes to be laid on a sand cushion of minimum 75 mm. for all diameter pipes if it is pressure pipe thrust blocks of cement concrete 1:2:4 (1 Cement: 2 coarse sand: 4 graded stone aggregate of 20 nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground and spreading it over a sufficient area, as directed by the Engineer-in-charge / Owners Representative at Site.

3.5. **DRAINAGE & WATER SUPPLY INSTALLATION AND ACCESABILITY PROVISIONS:**

3.5.1. **Water supply installation:**

1. Pipes Concealing in walls & ledge walls, running in ceiling level with necessary fittings by cutting the pipe square and removing the burs and clean the pipe with pipe cleaners and jointing using CPVC solvent cement and use primer for dia above 2". chasing the wall and fixing the pipe with proper supports and the pipes running in the high level shall be jointed in the same procedure mentioned above and provide rigid support with hot dipped galvanized "c"channels supports in every .8 mtr for pipes less than 40mm 1 mtr distance above 40 mm, and pipes laying in vertical risers with proper

pipe supports and rigid support with “c” channel and “U “ bolts of 8/10mm thick, after completion pressure testing has to be conducted before plastering in concealed pipe lines and before false ceiling in high level piping’s and before shaft closing in risers.

Making of water supply pipes connected with the fittings by CPVC solvent cement as per the drawing routing, pipes chasing in the wall, running in high level floors within the toilets, kitchen and service areas. cutting in the wall, floors and necessary areas and refilling the same. All the horizontal pipes running at ground floor and above up to the terrace floor where ever crossing the wall of any type. pipe sleeves has to be provided where ever required in slabs and beams up on approval of structural consultant for all the pipes and after pipe installation the gap between the pipe and the sleeve shall be filled up properly.

2. SUPPORT AND FIXING

The contractor shall lay out all pipes and fittings and check alignment, internal matching of joints, and verticals before jointing and securing in position. The minimum clearance between any pipe and the structure shall be 32mm after insulation has been applied.

All the riser pipes has to be fixed with G.I “u” bolts with G.I nut and washer on both the side top and bottom, supported with hot dipped galvanized “C” channel all vertical support should be with the intervals of 1.5 mtr and no split clamp should be used for vertical pipe supports.

All horizontal support shall be of 0.8 mtr for dia up to 40 mm and 1 mtr for the 50 dia and above.

Inside the toilet pipes shall be fixed with rubber lined G.I Split clamp of approved make with **G.I threaded rods** with anchor fasteners of approved make, **G.I bolts, G.I .nuts and G.I washers**, apart from rubber lined split clam provision the pipes has be supported inside the toilet with rigid support for every change of direction, fixed with rigid support made with hot dipped galvanized “C” channel and **G.I “U” bolts** with nut and washer on both the side top and bottom. Above 2” water supply should be laid with G.I “U” bolts with rubber packing & “C” channel rigid supports with **hot dipped galvanized** only. **No split clamps should be used for the water supply pipe above 2” it should be supported by only with G.I “U” bolts.**

3.5.2. Drainage installation:

Pipe work

1. Run pipes in straight lines and at uniform gradients. The minimum gradient shall be in accordance with normal code of practice requirements except that where such gradient on overhead pipes would reduce the headroom materially, the gradient may be reduced if so directed by the Engineer or as referenced in the Contract documents.
2. In accordance with the latest codes of practice there shall be no minimum gradient for soil and waste water pipe work. No branch drains shall have a lesser grade than that for the main drain to which it is connected.

Make all branch connections on horizontal Sanitary and storm water drainage system with 135 degree branch fittings. Do not use 90 degree branches on horizontal drainage & on vertical drainage pipe work .All bends to be long radius except where space conditions preclude their use, submit details for review by the Engineer prior to installation. Circuit vent shall be provided for each and every floor toilets and where ever the drainage pipes taken from the fixtures, vent tapping should be taken after the first

fixture and also the additional tapping should be taken after the last fixture of that circuit and finally connected to the vent stack, proper cutouts in beams and slabs and walls has to be provided to run the vent pipe in the up ward direction no vent should be taken down while running horizontally in order to avoid the trap in line.

3. All the horizontal pipes running at ground floor and above up to the terrace level where ever crossing the wall of any type. Pipe sleeves has to be provided for all the drainage and vent pipes where ever necessary up on approval of structural consultant and after the pipe installation the gap between the pipe and the sleeve shall be filled with ROCK WOLL and Fire sealant of approved make and the thickness of the fire sealant has to be as per the manufacturers recommendations. And all the pipes crossing the slab has to be provided with fire wrap of approved make as per manufacturers recommendations. At all the place of building expansion joint ,expansion pipe coupling has to be provided with rigid support.
4. Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets
5. Where pipe sizes differ from connections sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
6. Sanitary and storm drainage: Run piping to main sewers with uniform grade. Trap with deep seal traps, and vent fixtures as required by code.
7. Jointing or pipe: Compatible with type of pipe used.
8. Access to interior of pipe work.
9. Sufficient and suitable access shall be provided to enable all pipe work to be tested and maintained effectively. The access covers, plugs or caps shall be sited so as to facilitate the insertion of testing apparatus and the use of equipment for cleaning and/or for the removal of blockages. Their use shall not be impeded by the structure of other services.
10. Vertical rain water pipe work shall be provided with means of access at or near the foot of the stack.
11. Vertical sanitary pipe work shall be provided with means of access near to, but above, the spill-over level of the pipe work likely to be affected by a blockage, where no sanitary fittings are connected on a floor to a stack, the means of access shall be provided at or near floor level.
12. Branch discharge pipes serving multiple sanitary fittings shall be provided with means of access at the head of the branch and at the connection to the stack.
13. SUPPORT AND FIXING
 1. The contractor shall lay out all pipes and fittings and check alignment, internal matching of joints, gradients and verticals before jointing and securing in position. The minimum clearance between any pipe and the structure shall be 32mm after insulation has been applied.

All the riser pipes has to be fixed with G.I “u” clamp with rubber packing ,G.I nut and washer on both the side top and bottom, supported with hot dipped galvanized “c” channel all vertical support should be with the intervals of 1.5 mtr and all horizontal support shall be of 1.2 mtr

2. Inside the toilet pipes shall be fixed with rubber lined Split clamp of approved make with G.I threaded

rods with anchor fasteners of approved make, bolts, nuts and washers, apart from split clamp provision the pipes has be supported inside the toilet with rigid support for every change of direction, fixed with rigid support made with hot dipped galvanized “c” channel and G.I “u” bolts with nut and washer on both the side top and bottom. Outside the toilet area pipes above 4” should be supported with G.I. “U” Bolts with rubber packing only with rigid supports with “C” channel. No split clamps should be used above 4”.For all the pipes in the risers only G.I. “U” bolt with rubber lined has to be used ,split clamps should not be used for all the down take pipes.

3. All reducers shall be eccentric with the taper at Invert on horizontal pipes to give constant soffit level and to avoid air pocket.

3.6 VENT SYSTEM

In addition to the independent venting system the soil and waste ventilating stacks shall be extended above the roof level to provide a system of ventilation which will permit the admission of air so that under normal and intended use, the seal of any trap shall not be subjected to a pressure differential of more than 25mm of water.

1. Ventilating pipes shall project through roofs, to vent into open air at the points shown on the Drawings.

The ventilating pipes terminating through the roof shall be fitted with a proprietary vent cowl at the top, terminating at least 1000mm above the roof or as shown the drawings, and / or as required by authorities having jurisdiction.

proper cutouts in beams and slabs and walls where ever necessary up on approval of structural consultant has to be provided to run the vent pipe in the up ward direction no vent should be taken down while running horizontally in order to avoid the trap in line.

2. All vent and branch vent pipes shall be so graded and connected as to drip back to the soil or waste pipe by gravity.
3. Where vent pipes connect to horizontal soil or waste pipes, the vent pipe shall be taken off above the centre line of the pipe. The vent pipe shall rise vertically or at an angle not more than 45 degrees from the vertical, to a point of at least 150mm above the spill over level of the fixture vented before off-setting horizontally or before connecting to the branch vent.

A connection between a vent pipe and a vent stack or stack vent shall be made above the spill-over level of the highest fixtures served by the vent. Horizontal vent pipes forming branch vents, relief vents or loop vent shall be above the spill-over level of the highest fixture served.

3.7. PROTECTION OF PLUMBING FIXTURES AND PIPE LINES:

During course of construction:

1. **Cover exposed fittings with poly ethylene sheets**
2. **Cover fixtures with protective housings.**
3. Uncover and thoroughly clean fixtures and fittings and pipes when directed. at the time of handing over all the pipes and fittings and fixtures shall be cleaned properly. And the shall get the final approval from the plumbing consultant.
4. Install fixtures in perfect condition, at completion of job if fixtures are not in perfect condition they shall

be replaced by contractor without additional cost.

1. Install all fixtures; drains cleanouts, etc; as per manufacturer's requirements.
2. Connect fixtures: complete with supplies and drains, separately trapped with deep seal traps, supported level and square, provide chrome plated piping for all exposed water supply, waste and vent connections complete with C.P. escutcheons.
3. Provide supports, required to set fixtures square and level.
4. Fixtures mounted on glazed tile surfaces: provide ground faces to finished surfaces.
5. Pipe both hot and cold water connections of lavatories and sinks to the cold water supply except where hot water provisions is required to conform with the contract documents.
6. Install water hammer arresters for each fixture or group of fixtures.
7. Provide washrooms groups and branch takeoffs from main with isolating gate valves. Install stop valve in each fixture supply.

PART 4: TESTING & COMMISSIONING:

4.1. WATER SUPPLY INSPECTION AND TESTING COMMISSIONING:

General:

- After installation and prior to testing, insulating or painting, inspect each run of each system for completion of joints, supports and accessory items.
- During the progress of work, pressure test the various piping system including mains, risers, branches and fixtures as directed or as required to permit insulation, general construction and built in rough work to proceed.
- Provide all apparatus and temporary work for tests. Take all due precautions to prevent damage to the building or its contents as a result of such tests. Pay for all such damage to the building or work of other trades caused by such tests. After testing remove all water.

Testing the Joints

After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 12 kg/cm². (Double the designed working pressure whichever is more). The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off takes and stop cocks shall be then closed and specified hydraulic pressure shall be applied gradually. Pressure gauges at least 2 hrs. The pipes and fittings should be tested in section as the work of laying proceeds, keeping the joints exposed for inspection during the testing.

1. Piping

Free of traps.

Slope and valve for complete control and draining of system with drain cocks at low points and base of valved riser.

Provide check valves, to code requirements.

2. Connections to Equipment

Flanges or unions.

3. Disinfections

Disinfect, in the presence of the Employer and the engineer, underground water mains after installation and test in accordance with the Requirements of state Water Department/Municipality.

Disinfect interior and exterior potable water distribution system in accordance with requirements of Authorities having jurisdiction. Where no prescribed method exists, provide the following procedure:

After system is flushed, fill with either 50ppm chlorine water solution and let stand for 24 hours, or 20ppm chlorine water solution and let stand for 3 hours.

Flush system with clean potable water until no excess chlorine remains in system

Repeat procedure if contamination still persists after further test.

Disinfect water storage tanks for potable water in accordance with indian standard or the requirements of local Authorities. Where no prescribed method exists, provide the following procedure:

Spray walls, floor, stanchions, underside of top with a 200ppm chlorine solution

Fill tank with a 1ppm chlorine water solution and let stand for two hours.

Drain tank completely before refilling with clean potable water.

4. Tests

1. Booster pump, transfer pumps should have control valves at both suction and deliver side..
2. And also pressure regulating valves, electromagnetic flow meter pressure gages at deliver side.
3. Strainer at suction side .

The tests shall be carried out on the chemical composition of the raw material to verify organoleptic behavior (smell, taste, emission of. Oxidizable carbon compounds and toxicity).

4.2. INSPECTION AND TESTING OF GRAVITY LINES:

1. The contractor shall notify the Engineer of the time at which all tests are to be held and shall provide all the materials, labour and equipment required for testing. Upon completion of the test, copies of the complete records shall be given to the Engineer for his retention in accordance with applicable divisions of the specifications.

2. The contractor shall ensure the safety of the pipe work under test and he shall be responsible for the pipe work and ancillary works during the test and shall replace or repair as directed by the Engineer, any pipe or fitting which in the opinion of the Engineer has failed to withstand the test.

4.3. **GRAVITY DRAINAGE**

1. Air Test

1. This test, to detect if all pipes and fittings are air tight, shall be completed in one operation.
2. For large multi storey systems, the contractor shall, with the Engineer's prior written approval, test the system in sections.
2. Preparation: The water seals of all sanitary appliances shall be fully charged and test plugs or bags inserted into the open ends of the pipe work to be tested. To ensure that there is a satisfactory air seal, or at the lowest plug or bag in the stack, a small quantity of water sufficient. To cover the plug or bag can be allowed to enter the system. One of the remaining testing plugs shall be fitted with a tee piece, with a cock on each branch, one branch being connected by means of a flexible tube to a manometer.
3. Application: system shall be charged with air until a pressure equal to 35 kPa (5 psi) is obtained. The air inlet cock shall then be closed and pressure in the system shall remain constant for a period of not less than fifteen (15) minutes.
4. Leak Detection: Defects by the air test may be located with the pipe work subjected to an internal pressure; a soap solution can be applied to the pipes and joints. Leakage can be detected by the formation of bubbles.

2. Water Test:

1. The part of the system below the lowest sanitary appliance shall be tested by inserting a test plug in the lower end of the pipe and filling the pipe with water up to the flood level of the lowest sanitary fixture, provided that the static head does not exceed 6m.
2. Long runs of above ground pipe work in the horizontal plane shall be subjected to the same water test. This shall be applied by inserting a test plug downstream of the section to be tested and fill in the pipe with water up to the spill over level of the lowest sanitary fixture, upstream of the section under test, provided that the static head does not exceed 6m.
3. Clean water shall be used and promptly removed upon completion of the test.

4.4. **GRAVITY DRAINAGE – PERFORMANCE TESTS**

1. Every trap shall retain not less than 25mm of seal when subjected to the appropriate tests given below.

Each test shall be repeated three times; the trap being recharged before each test and the maximum loss of seal in any one test measured by a dip stick, shall be taken as the significant result.
2. To test for the effect of self-syphonage, the waste appliance shall be filled to overflowing level of discharge in the normal way. WC pans shall be flushed. The seal remaining in the trap shall be measured when the discharge has finished.

3. For multiple fixtures (combinations of fixtures), it shall be discharged after being filled to overflow level, and the seal remaining in each trap of the multiple fixtures measured when the discharge has ended. The worst conditions are likely to occur when the fixtures at the top of the building are discharged.
4. To test the stability of trap seals when water flows down the stack, the appropriate combinations of fixtures shall be discharged simultaneously with the traps fully charged. The seal remaining in the traps shall be measured when the discharge has ended.

4.5. PUMPED DRAINAGE PIPEWORK TESTING

1. Pumped drainage pipe work shall be pressure tested in accordance with IS for a period of two (2) hours.
2. The pipe work shall be tested to 150% of operating pressure or 175 kPa whichever is the greater.
3. At the end of the test period the section of pipe work shall be inspected for leakage and if leaks are observed or pressure drop exceeds 5% of test pressure then the test is considered to have failed.
4. Repair sections of failed pipe work by disassembly and reinstallation using new material to the extent required to overcome leakage. The use of chemicals, stop-leak compound, mastics or other temporary repair methods is not acceptable.
5. Drain test water from piping system after testing and repair work has been completed.

4.6. TESTING OF EQUIPMENT AND FIXTURES:

1. Faucets

Contractor shall test operate each faucet for water pressure, flow, and leakage.

If pressure is excessive pressure regulating valve to be adjusted accordingly.

2. Booster pump

Run booster pump to ascertain available pressure at highest point in the building with maximum flow from all pumps operating.

Check STAND BY PUMP with the same procedure.

3. Sump pumps

Check each sump pump for lift and flow

Check level switches for correct pump operation.

Check alternator on duplex units

Check reservoir level controls for correct switching at high medium and low level settings.

4. Hot water Heater

Check hot water heater operations.

Drain water from tank and verify recovery time for full supply or cold water.

5. Water Closets

Flush each water closet to ensure correct and complete flushing action

Check tank fill level.

Check for leaks at tank and floor plate of water closet.

6. Water Reservoirs

Check level controls and ball float valve for correct operation.

7. Electrical

Test in accordance with the requirement.

4.7. CLEAN-UP

1. Leave systems operating with work areas clean to satisfaction of Engineer.

4.8. DOMESTIC WATER SUPPLY METERS

1. Coordinate with the Employer and campus operator and install as detailed on drawings.
2. The domestic water supply meter shall comply with the following:
 1. Housing protection degree and material: IP 67 – Aluminum alloy housing / Stainless steel cable glands.
 2. Display: Alphanumerical – 2 lines 16 digits – backlit: instant flow rate and totalization.
 3. It shall have bi directional flow
 4. Serial communication: IS standard.
 5. Self diagnostic functions: Erroneous settings – empty pipe detection.
 6. Working temperature range: -15°C +60°C

And the measuring tube shall comply with the following:

4.9. MATERIALS:

1. Materials shall be of the best approved quality obtainable and unless otherwise specified they shall conform to the respective Indian Standard Specification.

Sample of all materials shall be got approved before placing order and the approved samples shall be deposited with Info park or Engineer.

In case of non-availability of materials in metric sizes, the nearest size in FPS units shall not be provided with prior approval of the Engineer for which neither extra will be paid nor shall any rebate be recovered.

If directed, materials shall be tested in any approved Testing Laboratory and the Contractor shall produce the test certificate in original to the Engineer and entire charges for original as well as repeated tests shall be borne by the Contractor. If required by the Engineer, the Contractor shall arrange to test portions of the work at his own cost in order to prove their soundness and efficiency. If after any such test the work or portion of works is found, in the opinion of the Engineer, to be defective or unsound, the Contractor shall pull down and redo the same at his own cost. Defective materials shall be removed from the site.

It shall be obligatory for the Contractor to furnish certificate, if demanded by Engineer, from manufacturer or the material supplier that the work has been carried out by using their material and installed/fixed as per their recommendations.

2 Cement

Cement shall comply in every respect with the requirements of the latest publication of IS: 8112-1989 and unless otherwise specified, Ordinary Portland cement Grade 43 shall be used.

Cement shall be stored in weather proof shed with raised wooden plank flooring to prevent deterioration by dampness or intrusion by foreign matter.

3 Sand

Sand shall be clean, free from salt, clay, loam, shells, vegetable matter and fit for use in the opinion of Engineer and shall conform to IS : 383 and IS : 2116. if directed, the sand shall be washed.

4 Coarse aggregate

Coarse aggregate shall conform to IS:383. It shall be angular, tough, sharp and well graded stone metal from approved source. It shall be clean and free from any foreign material. If directed, the metal shall be washed.

5 Bricks

Brick shall conform to IS: 1077. Bricks shall be with a minimum compressive strength of 50Kg/sqcm. Bricks shall be of chamber burnt best quality locally obtainable and shall be well burnt, but not over burnt and shall be free from cracks, chips, flaws and stones. It shall not absorb water more than 20% of its own weight when dry.

6 Cement mortar

Cement mortar shall be in proportion specified in the particular item in the Schedule of Quantities. Sand shall be measured in suitable measuring boxes and correct quantity of cement shall be added. The materials are mixed dry on a clean platform. Clean water is then added and mixed thoroughly. It shall be prepared in such quantity as can be readily used up. Mortar which has partially set shall under no circumstances be re-tempered by mixing with additional material or water.

4.9. LIST OF IS COADS:

Latest editions shall always be consulted.

IS:458	Precast concrete pipes (with and without reinforcement).
IS:771	Glazed fire clay sanitary appliances.
IS:774	Flushing cistern of water closets/urinals (Valve less Symphonic type).
IS:778	Copper alloy gate, globe and check valves for water works purposes.
IS:783	Code of practice for laying of concrete pipes.
IS:781	Cast copper alloy screw down bib taps & stop valves for water services.
IS:784	Pre-stressed concrete pipes.
IS:1172	Code of basic requirements for water supply drainage and sanitation.
IS:1200	Methods of measurement of building and civil engineering works.
IS:1703	Copper alloy float valves for water supply fittings.
IS:1726	CI manhole covers and frames intended for use in drainage works.
IS:1742	Code of practice for building drainage.
IS:2064	Code of Practice for selection, installation and maintenance of sanitary appliances.
IS:2065	Code of practice for water supply in building.
IS:2470	Code of practice for installation for septic tank.
IS:2527	Code of practice for fixing rain water gutters and down pipes for roof drainage.
IS:2548	Plastic seats and covers for water-closet.
IS:3076	Low density polyethylene pipes for potable water supplies.
IS:4111	Code of practice for ancillary structures in sewerage system.
IS:4984	Specification for high density polyethylene pipes for potable water supplies, Sewage and industrial effluents.
IS:5329	Code of practice for sanitary pipe work above ground for buildings.
IS:1795-1982	Pillar taps for water supply purposes (second revision).
IS:2548-1980	Plastic water-closet seats and covers (third revision).

IS:2556	Vitreous sanitary appliance (vitreous china)
Part XI-1979	Specific requirements for shower rose (first revision).
Part XII-1973	Specific requirements for floor traps.
Part XV-1974	Specific requirements of universal water – closets.
IS:3311-1979	Waste plug and its accessories for sinks and wash basins (first revision).
IS:5961-1970	Cast iron gratings for drainage purposes.
IS:7231-1974	Plastic flushing cisterns (valve less Symphonic type) for water-closets and urinals.
IS:4985-1981	In-plasticized PVC Pipes for potable water supplies (first revision).
IS:1742-1983	Code of practice for Building drainage.
IS:4111 (Part	Code of practice for Manholes.1)-1986
IS:4985-1987	Specification for PVC Pipe line
IS:7834-1987	Specification for PVC Fittings.
IS:2379-1990	Pipe lines-identification colour code
SP 27-1987	Mode of measurement for water supply, plumbing, drains water and sewer lines.

LIST OF APPROVED MATERIALS		
SL NO	DESCRIPTION	MAKE
1	SANITARYWARE	HINDWARE /PARRYWARE/KHOLER
2	SS KITCHEN SINK	PARRYWARE/DIAMOND
3	CP FITTINGS & RELATED ACCESSORIES	HINDWARE /PARRYWARE/JAQUAR
4	URINAL SENSOR	ASKON/JAQUAR/PARRYWARE
5	10kg PVC PIPES	AJAY / FINOLEX / ASTRAL
6	PVC SWR 'B' CLASS/ 'A' CLASS PIPES & FITTINGS	AJAY / FINOLEX / ASTRAL
7	POLY PROPYLENE PIPES -PP	HULIOT/ASTRAL/REHAU
8	CP & SS GRATINGS/ANTI COCKROACH GRATINGS	NEER/ELIGNA/CHILLY
9	C.I GRATINGS	NECO/NEER/PLASMA
10	CPVC SDR-11 AND SCH 40 & 80 PIPES	AJAY / FINOLEX / ASTRAL
11	uPVC SCH-40,SCH-80 PIPES & FITTINGS	AJAY / FINOLEX / ASTRAL
12	BALL VALVES	ZOLOTO/SANT/LEHRY
13	BUTTER FLY VALVE	ZOLOTO/SANT/LEHRY
14	'Y' STRAINERS	ZOLOTO/SANT/LEHRY
15	CHECK VALVE/NON RETURN VALVE	ZOLOTO/SANT/LEHRY/RUMAX
16	AIR RELEASE VALVES	LEHRY/SANT/ZOLOTO
17	CI / DI/ PFRC MANHOLE COVER	NECO /PLASMA
18	OPEN WELL SUBMERSIBLE TRANSFER PUMP	GRUNDFOS / KIRLOSKER/ ITT-LOWARA
19	G.I RUBBER LINED SPLIT CLAMPS/'U' BOLTS	HILTI/MUPRO/ASTRAL
20	WATER METERS	ZENNER AQUAMET / TOSHNIWAL/RLT
21	WATER LEVEL CONTROLLERS	JKN ENTERPRISES /LEHARY
22	ELASTOMERIC RUBBER INSULATION	K-FLEX/VIDOFLEX
23	FASTNERS	HILTI/FISHER/MUPRO
24	RAIN WATER OUTLETS	NEER/SGE/NECO
25	PRESSURE REDUCING VALVE	ZOLOTO / LEHARY/SANT
26	BALL FLOAT VALVE	SINGER / LEHARY/LEADER
27	WATER HAMMER ARRESTORS	LEHRY/MIFAB
28	PRESSURE GAUGE	WEIKA/VEKSLER(FLUITECH)/H-GURU
29	BOREWELL SUBMERSIBLE PUMPS	GRUNDFOS / KIRLOSKER /CRI
30	HYDROPNEUMATIC SYSTEM PUMPS	ITT / GRUNDFOS /EBARA
31	SEWAGE CUTTER VERSION PUMPS	ITT / GRUNDFOS /KIRLOSKER
32	DEWATERING PUMPS	ITT / GRUNDFOS /KIRLOSKER
33	ELECTRO MAGNETIC FLOW METER	TOSHNIWAL/RLT/ZENNER AQUAMATE
34	HUME PIPES	P.K.RCC HUME PIPES/VIJAYAVASA HUME PIPES

LIST OF APPROVED MATERIALS		
SL NO	DESCRIPTION	MAKE
35	ELECTRICAL WATER HEATER	A.O SMITH / JAQUAR
36	PRESSURE GAUGE	WEIKA
37	FOOT VALVE	NORMAX/LEHARY
38	SOLAR PANEL	V-GUARD
39	HDPE WATER TANKS	SINTEX/AQUA TECH/GANGA
40	BOREWELL SUBMERSIBLE PUMPS	CG / KIRLOSKER /EBARA
41	BOOSTER PUMPS	ITT / GRUNDFOS / C.R.I / KIRLOSKER / EBARA
42	SEWAGE CUTTER VERSION PUMPS	ITT / GRUNDFOS /KIRLOSKER / EBARA
43	STP& FILTRATION UNIT	ECO CARE ENGINEERING/EYAR SYSTEMS/BIG BLUE WATER TECH
44	HAND DRIER	ASKON/EORONICS
45	MINI RO UNITS	EUREKA FORBES AQUA GUARD/KENT
46	ELECTRO MAGNETIC FLOW METER	FORBES MARSHEL/E+H
47	HAND TOWEL DISPENSER CUM WASTE CONTAINER	ASKON/BORBICK
48	TOILET PAPER HOLDER	BORBICK
49	TOILET CLEANING BRUSH	KHOLER
50	SANITARY NAPKIN/WSATE RECEPTABLE	BORBICK

END OF PLUMBING TECHNICAL SPECIFICATION