**SECTION D 9 – Internal Plumbing Works**

# TECHNICAL SPECIFICATIONS

# INTERNAL DOMESTIC WATER SUPPLY, INTERNAL DRINKING WATER SYPPLY & INTERNAL HOT WATER SYSTEM

|  |  |
| --- | --- |
| **1.0**  | **General**  |
| 1.1**2.0**2.1 | This specification covers design, testing, jointing and water supply line.**Standard**The equipment and pipes covered in this specification shall comply with following latest Indian StandardsIS: 1239-2004 GI PIPEIS:4736 – 1986 Galvanising for GI pipesIS: 554 - 1999 Pipes TheadsIS: 780 – 1984 Full Way ValvesIS: 15778 CPVC Pipes & FittingsIS: 15801 PPR PipesIS: 10500 Drinking WaterSP 35 – Plumbing StandardWHO standard for water qualityStatic & mobile Pressure vessel act / Indian explosives act |

**3.0 General Requirements**

 Work under this Contract shall consist of furnishing all labour, materials, equipment and appliances necessary and required. The Contractor is required to completely furnish all the plumbing and other specialised services as described hereinafter and as specified in the schedule of quantities and/or shown on the plumbing drawings.

 Without restricting to the generality of the foregoing, the sanitary installations shall include the

Plumbing Works

 - Internal Domestic Water System

 - Internal Drinking Water System

 - Internal Hot Water Supply System

 - Internal Sewerage System

 - Internal Drainage System

1.4 Services rendered under this section shall be done without any extra charge.

**4 Specifications**

4.1 Work under this Contract shall be carried out strictly in accordance with specifications attached with the tender.

4.2 Items not covered under these specifications or due to any ambiguity or misprints, or additional works, the work shall be carried out as per codal provisions and specifications of the latest Central Public Works Department with up to date amendments as applicable in the Contract.

4.3 Works not covered above shall be carried out as per relevant Codes & Bureau of Indian Standards and in case of its absence as per British Standard Code of Practice.

**5 Execution of work**

5.1 The Contractor should visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work. No extra charge made in consequence of any misunderstanding, incorrect information on any of these points or on ground of insufficient description will be allowed.

5.2 The work shall be carried out in conformity with the Plumbing drawings and within the requirements of architectural, HVAC, electrical, structural and other specialised services drawings.

5.3 The Contractor shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule. All supports to the civil structure shall be provided with dash fasteners.

On award of the work, Contractor shall submit a schedule of construction in the form of a PERT chart or BAR chart for approval of the Owner/PMC All dates and time schedule agreed upon shall be strictly adhered to within the stipulated time of completion/ commissioning along with the specified phasing, if any.

**6 Drawings**

6.1 The contractor shall submit the detailed drawings of the complete work along with material make & specifications, process flowchart, calculations etc .

6.2 Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.

Contractor shall verify all dimensions at site and bring to the notice of the Owner/PMC all discrepancies or deviations noticed. Decision of the Owner/PMC shall be final.

Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small scale drawings.

6.3 Any drawings issued by the Architects/Consultant for the work are the property of the Architects/ Consultant and shall not be lent, reproduced or used on any works other than intended without the written permission of the Architects/Consultant.

**7 Inspection and testing of materials**

7.1 Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Bureau of Indian Standards.

7.2 For examination and testing of materials and works at the site Contractor shall provide all testing and gauging equipment necessary but not limited to the following:

Steel tapes

Weighing machine

Plumb bobs, sprit levels, hammer

Micrometers

Hydraulic machine

7.3 All such equipment shall be tested for calibration at any approved laboratory, if required by the Owner/PMC. All testing equipment shall be preferably located in special room meant for the purpose.

7.4 Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the Owner/PMC.

**8 Metric conversion**

8.1 All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.

8.2 Any weights, or sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

**9 Reference points**

9.1 Contractor shall provide permanent bench marks, flag tops and other reference points and check that with other agencies to confirm the same reference point for all the proper execution of work and these shall be preserved till the end of the work.

9.2 All such reference points shall be in relation to the levels and locations, given in the architectural and plumbing drawings.

**10 Reference drawings**

10.1 All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings to be submitted by the contractor in fulfilment of the conditions of this contract.

11.3. On award of the work the contractor shall be issued four sets of consultant’s working drawings stamped “good for construction” by the Owner/PMC. The consultant’s drawings shall be the basis of contractor’s shop drawings. In addition, the Owner/PMC shall also issue one copy of the Interior Designer’s; Electrical & HVAC approved shop drawings relevant to his work

11.4 Shop drawings are detailed working drawings which incorporate the contractor's details for execution of the work and incorporate equipment manufacturer's details and dimensions to ensure that the same can be installed in the space provided.

11.5 All shop drawings should detailed pipe routing and levels, showing location of other services at crossings etc., cable runs, route cable trays and all allied works and must be fully co-ordinated with other services and approved by the Owner/PMC before execution of the works. Owner/PMC shall arrange to issue two copies/prints of services drawings from the respective contracting agencies. Additional copies/prints may be provided on payment of actual cost of the copies/ prints. All drawings will valid only when stamped and issued by the Owner/PMC.

11.6 Shop drawings shall also be furnished for detailed layout of all equipment, foundation, bolting and vibration elimination details along with information on dead and dynamic load, vibration etc.

11.7 Six sets of manufacturer's equipment drawings, roughing in and wiring diagrams shall be submitted.

11.8 Contractor shall submit shop drawings furnishing all details of MCC panels, cable routes, wiring diagrams and connection details as required.

11.9 Three copies of each set of shop drawings shall be submitted for initial scrutiny, discussion and approval.

11.10 Each submission shall be accompanied by contractor's certificate stating that the shop drawings meet all the contract requirements and that the piping and equipment can be satisfactorily installed without any obstructions in the space available.

8.11 On approval of the above the contractor shall furnish six sets of the approved shop drawings for execution of the work.

**12 Completion drawings**

12.1 On completion of work, Contractor shall submit one complete set of original tracings and two prints of "as built" drawings to the Project Manager. These drawings shall have the following information.

a) Run of all piping, diameters on all floors, vertical stacks and location of external services.

b) Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall.

c) Run of all water supply lines with diameters, locations of control valves, access panels.

d) Location of all mechanical equipment with layout and piping connections and mechanical equipment.

e) All shop drawings shall be updated from time to time for the purpose of making completion drawings.

No completion certificate shall be issued unless the above drawings are submitted.

12.2 Contractor shall provide four sets of catalogues, service manuals, manufacturer's drawings, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.

12.3 All "warranty cards" given by the manufacturers shall be handed over to the Owner/PMC.

13.1 Scope of work shall be inclusive of cost of materials, labour, supervision, erection, tools, plant, scaffolding, service connections, transport to site, taxes, octroi and levies, breakage, wastage and all such expenses as may be necessary and required to completely do all the items of work and put them in a working condition.

13.3 Scope of work inclusive of all such accessories, fixtures and fixing arrangements, nuts, bolts, hangers as are a standard part of the particular item except where specially mentioned otherwise.

13.4 Scope of work inclusive of cutting holes and chases in walls and floors and making good the same with cement mortar/concrete/water proofing of appropriate mix and strength as directed by the Owner/PMC. Contractor shall provide holes, sleeves, recesses in the concrete and masonry work as the work proceeds. All hot and cold water supply pipes crossing masonry walls shall be provided with G.I. pipe sleeves. The annular space between the pipe and sleeve shall be filled up with fire proof sealant after testing. Contractor shall give the pipe sleeves to the civil contractor well in time so that the same can be fixed along with civil works. Any co-ordination gap shall be of contractor’s responsibility.

13.5 The Contractor shall furnish the Owner/PMC with vouchers & test certificates, on request, to prove that the materials are as specified and to indicate that the rates at which the materials are purchased in order to workout the rate analysis of non tendered items which he may be called upon to carryout.

**14 Testing**

14.1 Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.

14.2 Tests shall be performed in presence of the Owner/PMC and test records for the tests shall be duly signed by Contractor and the Owner/PMC.

14.3 All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.

14.4 Contractor shall perform all such tests as may be necessary and required by the local authorities to meet municipal or other bye-laws in force.

14.5 Contractor shall provide all labour, equipment and materials for the performance of the tests.

**15 Site clearance and clean-up**

15.1 The Contractor shall, from time to time, clear away all debris and excess materials accumulated at the site.

15.2 After the fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints, stains, stickers and other foreign matter or discolouration leaving the same in a ready to use condition.

15.3 On completion of all works, Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done by the Owner/PMC at the Contractor’s risk and cost. Cost of the cleanup shall be deducted from the contractor's bills on pro-rata basis in proportion to his contract value.

**16 Licence permits and authorities**

16.1 Contractor must hold a valid plumbing or any other as required licence by the municipal authority or other competent authority under whose jurisdiction the work falls.

16.2 Contractor must keep constant liaison with the local development, municipal/statutory authority and obtain approval of all drainage, water supply, fire suppression and other works carried out by him.

16.3 Contractor shall obtain, from the municipal and other authorities 'C' & 'D' & other forms as required for approval of drainage and water supply works during execution and the completion certificate with respect to his work as required for occupation of the building. Contractor shall obtain permanent water supply and drainage connections from authorities concerned. CLIENT shall re-imbrues the fees paid to the authorities towards the connection charges on production of receipts for money paid.

16.4 Contractor shall get any materials tested from the appropriate authority if so required with no cost to the CLIENT.

**17 Recovery of cost for materials issued to Contractors free of cost**

If any material issued free of cost by the CLIENT to the contract for use on the work and the same is lost, stolen ,pilfered or broken while in contractor’ possession, the cost of the same shall be recovered from the Contractor on the basis of actual cost to CLIENT. The cost shall include the cost paid, freight, transportation, excise duty, sales tax, octroi, import duty and other levies, plus 100% as penalty. The decision on the actual cost given by the CLIENT shall be final and binding on the Contractor.

17.1 Contractor has to keep full records of material issued by the CLIENT with reference and challans etc. Contractor has to give account of all such materials to the Owner/PMC.

**18 Cutting of Water Proofing Membrane:**

No walls terraces shall be cut for making and opening after water proofing has been done without written approval of Owner/PMC. Cutting of water proofing membrane shall be done very carefully so as other portion of water proofing is not damaged. On completion of work at such place the water proofing membrane shall be made good and ensured that the opening/cutting is made fully water proof as per specifications and details of water proofing approved by Owner/PMCs.

**19 Cutting of structural members**

No structural member shall be chased or cut without the written permission of the Owner/PMC

**21 Materials**

21.1 Unless otherwise specified and expressly approved in writing by the Owner/PMC, only materials of makes and specification as mentioned in the list of approved makes attached with the specifications shall be used.

21.2 If required, the Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the Owner/PMC.

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

a) Distribution system from main supply headers from pump to all fixtures and appliances for cold & hot water.

Cold water supply lines from tube wells and city water connections to Fire and Under Ground Water Tanks.

c) Garden irrigation system

d) Excavation and refilling of pipes trenches.

e) Pipe protection and painting.

f) Control valves, masonry chambers and other appurtenances.

g) Connections to all plumbing fixtures, tanks, appliances and municipal mains

h) Inserts for R.C.C. tanks

**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 Owner/PMC.

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.

2.4 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.

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

2.6 Clamps, hangers and supports on RCC walls, columns & slabs shall be fixed only by means of approved made of expandable metal fasteners inserted by use of power drills.

2.7. All pipe clamps, supports, nuts, bolts, washers shall be galvanised MS steel throughout the building. Painted MS clamps & MS nuts, bolts & washers shall not be accepted.

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

**3 Water Supply System**

3.1 Contractor should study the site plan and the one water supply systems use for domestic water supply.

**Source**

Water supply will be acquired from State Govt sources water mains (as available) to a service connection and collected in water storage tanks located underground.

The system has been connected to a gravity feed system from overhead tanks to all parts of the building.

Dual pipe line system shall be provided to the overhead tanks. The recycled water from STP will be used to meet the flushing water requirements of the project.

It is proposed to provide flushing cistern for all WCs. Infra red NO-TOUCH flush valves shall be provided for Urinals. These will be fed from domestic over head tank by gravity.

Domestic water supply shall be provided with cold water system only. Hot water provisions to kitchen and all toilets connected to a local electric hot water storage geyser /solar..

**4 (CPVC) G.I. pipes, fittings & valves**

4.1 All pipes inside the buildings for domestic hot and cold water supply shall be CPVC conforming to CTs SDR-13.5 at a working pressure of 320 PSI at 23 deg.C. and 80 PSI at 82 deg. C.

4.2 Solvent welded CPVC fittings etc. tees, elbows, couplers, unions, reducers, brushing etc. including transition fittings (connection between CPVC and metal pipes/G.I. ie. Brass adopters conforming to ASTM D-2846) shall be provided.

4.3 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 run above false ceiling with vertical drop in wall chases for all fixtures. No pipes to run inside sunken floor as far as possible. Pipes may run under the ceiling or floors and other areas as shown on drawings.

**4.4 Joining Pipes & Fittings Cutting**

Pipes shall be cut either with a wheel type plastic pipe cutting or hacksaw blade and care shall be taken to make a square cut. All burrs should be removed for proper contact between pipe and fittings during jointing.

Solvent Cement Application

Only CPVC solvent cement conforming to ASTM-F-493 should be used for joining pipe with fittings. An even coat of solvent cement should be applied on the pipe end and a thin coat inside the fitting socket.

Assembly

After applying the solvent cement on both pipe and fitting socket, pipe should be inserted into the fitting socket within 30 seconds, and rotating the pipe ¼ to ½ turn while inserting so as to ensure even distribution of solvent cement with the joint. The assembled system should be held for 10 seconds (approximately) in order to allow the joint to set up.

Testing

The system should be hydrostatically pressure tested at 150 psi (10 Bar) for one hour. During pressure testing, the system should be fitted with water and if a leak is found, the joint should be cut out the replaced with new one.

**4.5 Transition of Flow guard CPVC in metals**

When making a transition connection to metal threads, special brass/plastic transition fitting (Male and female adapters) should be used. Plastic threaded connections should not be over torque.

Threaded sealants

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

Solvent Cement

Only CPVC solvent cement conforming to ASTMF 493 should be used for joining pipe with fittings and valves.

Hangers and supports

For Horizontal runs, support should be given at 3 feet (90 cms) intervals for diameters of one inch and below and at 4 feet (1.2 m) intervals for larger sizes.

Supports should be as per the below mentioned table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Size of pipe | 20ºC | 49ºC | 71ºC | 82ºC |
| Inch | Ft. | Ft. | Ft. | Ft. |
| ½” | 5.5 | 4.5 | 3.0 | 2.5 |
| ¾” | 5.5 | 5.0 | 3.0 | 2.5 |
| 1” | 6.0 | 5.5 | 3.5 | 3.0 |
| 1¼” | 6.5 | 6.0 | 3.5 | 3.5 |
| 1¼” | 7.0 | 6.0 | 3.5 | 3.5 |
| 2” | 7.0 | 6.5 | 4.0 | 3.5 |

**4.7. Anchor Fasteners**

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

**4.8 Unions**

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

**4.9 Flanges**

Flanged connections shall be provided on pipes as required or where shown on the drawings, all equipment connections as necessary and required or as directed by the Owner/PMC. Connections shall be made by correct number and size of GI nuts, bolts & washers with 3 mm thick gasket. Where hot water connections are made insertion gasket shall be of suitable high temperature grade and quality approved by the Owner/PMC. Bolt hole dia for flanges shall conform to match the specification for C.I. sluice valve to I.S. 780. and C.I. butterfly valve to IS: 13095.

**4.10 Trenches**

All water supply pipes below ground shall be laid in trenches with a minimum cover of 60 cms. The width and depth of the trenches shall be as follows:-

 Dia of pipe Width of trench Depth of trench

 ------------- --- --------------- -------------------

 15 mm to 50 mm 30 cms 75 cms

 65 mm to 150 mm 45 cms 100 cms

**4.11 Sand filling**

G.I. pipes in trenches shall be protected with fine sand 15 cms all round before filling in the trenches.

**4.12 Painting (Painting for CPVC pipes not required)**

4.12.1 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 colour code given in this documents or specified by Owner/PMC.

 **4.13 Pipe protection (Protection for CPVC pipes not required)**

 4.13.1 All G.I. pipes in wall chase /below floors or laid underground shall be protected against corrosion by the application of two coats of bitumen paint covered with polythene tape and a final coat of bitumen paint.

4.13.2 G.I. waste pipes buried in ground or sunken slab shall be protected with multilayer bitumen membrane tape 3mm thick with a final coat of hot or cold applied bitumen. Pypkote or equivalent.

**4.14 Valves**

**4.14.1 Ball Valves**

Valves upto 40 mm dia. shall be screwed type Ball Valves with stainless steel balls, spindle, teflon seating and gland packing tested to a hydraulic pressure of 20 kg/cm2, and accompanying couplings and steel handles.(to BS 5351)

**4.15 Butterfly Valves**

4.15.1 Valves 50 mm dia and above shall be cast iron butterfly valve to be used for isolation. The valves shall be bubble tight, resilient seated suitable for flow in either direction and seal in both direction with accompanying flanges and steel handle.

4.15.2 Butterfly valve shall be of best quality conforming to IS: 13095.

**4.16. Non Return Valve (Slim Type)**

Where specified non return valve (swing check type) shall be provided through which flow can occur in one direction only. It shall be single door swing check type of best quality.

4.16.1 Each Butterfly and Slim Type Swing Check (NRV) Valve shall be provided with a pair of flanges screwed or welded to the main line and having the required number of galvanised nuts, bolts and washers of correct length.

4.16.2 Storage tanks Underground & Overhead Tank. (Accessories & Connections)

4.16.6 Storage tanks for water supply shall be in reinforced cement concrete built by the building Contractor.

4.16.4 Each tank shall be provided with lockable type manhole cover fabricated from M.S. sheets. Manhole covers shall be 450-500 mm dia and fully galvanised after fabrication or as approved by the Owner/PMC.

**4.17 Storage Tanks**

**4.17.1 Underground**

Underground storage tanks for water supply shall be reinforced cement concrete built by the building contractor.

Each tank shall be provided with lockable type manhole cover fabricated from M.S. sheet or standard cost iron tank covers. Manhole covers shall be 450-500 mm dia or as approved by local municipal authority.

**4.18 Outlets and overflow**

All nozzles for puddle flanges in RCC tank for inlet, outlet, overflow and scour etc. shall be provided by civil contractor or as given in the Schedule of Quantities. Further connections and accessories shall be provided under this contract.

**4.19 Testing**

4.19.1 All pipes, fittings and valves after fixing at site, shall be tested by hydrostatic pressure of 1.5 times the working pressure or 10 kg/cm2 whichever is more.

Pressure shall be maintained for a period of at least thirty minutes without any drop.

A test register shall be maintained and all entries shall be signed and dated by Contractor (s) and Owner/PMC.

4.19.2 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 by the Contractor during the defects liability period without any cost.

4.19.3 After commissioning 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.

**4.20**

**4.21.2 Valves**

Gunmetal, cast iron, butterfly and non-return valves and puddle flanges shall be measured by numbers and shall include wheels/caps, GI nuts, bolts, washers and insertion gasket.

4.21.3 Painting/pipe protection/insulation

Painting/pipe protection/insulation for pipes shall be measured per linear metre over finished surface and shall include all valves and fittings for which no deduction shall be made. No extra payment shall be made for fittings, valves or flanges.

**Sanitary Fixtures**

**1** Work under this section shall consist of furnishing all materials & labour necessary and required to completely install all sanitary fixtures, chromium plated fittings and accessories as required by the drawings specified hereinafter and given in the Schedule of Quantities.

1.2 Without restricting to the generality of the foregoing the sanitary fixtures shall include the following:-

 a) Sanitary fixtures

 b) Chromium plated fittings

 c) Porcelain or stainless steel sinks

 d) Accessories e.g. towel rods, toilet paper holders, soap dish, towel rails, coat hooks etc.

e) Connections to all kitchens, equipment, pump headers and other equipment requiring water and drainage connections.

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

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

**2 General requirements**

2.1 Sanitary fixtures and C.P. fittings in manufacturer’s packing as specified in the schedule of quantities shall be supplied to the Contractors free of cost at the stores of the CLIENT.

All fixtures and fittings shall be provided with all such accessories. Accessories shall include proper fixing arrangement, brackets, nuts, bolts, screws and required connection pieces, WC flexible connectors etc.

2.3 Fixing screws shall be half round head chromium plated brass screws with C.P. washers where necessary.

2.4 Contractor shall furnish without cost all such accessories and fixing devices that are necessary and required but not supplied along with the Plumbing Fixtures & CP Fittings by the manufacturers as a part of the original and standard supply.

2.5 All fittings and fixtures shall be fixed in a neat workman like manner true to level and heights shown 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 Contractor's cost.

2.6 Contractor shall seal all fixtures fixed near wall, marble and edges with an approved type of poly-sulphide sealant appropriate for its application.

**3 European W.C**

3.1 European W.C. shall be wash down or syphonic type floor or wall mounted set flushed by means of porcelain/ plastic flushing cistern, which will be an integral part of the WC system. Framework, walling and finishing will not form a part of the contractor’s work. Where applicable flush pipe/ bend shall be connected to the W.C. by means of a suitable rubber adapter. Wall hung W.C. shall be supported by C.I. floor mounted chair.

3.2 Each W.C. set shall be provided with a plastic seat shall be with rubber buffers and chromium plated hinges.

3.3 Plastic seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C. Each W.C. shall be suitable for flushing in low volume of water 3-6 litres.

3.4 Flushing cistern when provided shall be provided with all internal flushing mechanism, 15 mm dia ball cock with unbreakable polythene float and overflow pipe. Any frame work required for fixing cistern has to be provided by the contractor.

**4 Indian W.C.**

Indian Water closet (IWC) shall be provided with ‘P’ or ‘S’ trap outlet with a low volume cistern porcelain /plastic flushing cistern with all internal flushing mechanism.

Flush pipe/bend shall be connected to IWC by means of a suitable rubber adaptor.

5 Urinals

5.1 Urinals shall be white glazed vitreous china of size, shape and type specified in the Schedule of Quantities.

5.2 Bowl urinals shall be provided with 15 mm dia C.P. spreader, 32 mm dia stainless steel domical waste and C.P. cast brass bottle trap with pipe and wall flange, and shall be fixed to wall by C.I. brackets and C.I. wall clips as recommended by manufacturers complete as directed by Owner/PMC.

5.3 Urinals shall be fixed with C.P. brass screws and shall be provided with 32 mm dia domical waste leading to urinal's trap.

5.4 Flush pipes shall be G.I. pipes concealed in wall chase but with chromium plated bends at inlet and outlet or as given in Schedule of Quantities.

5.5 Urinals shall be flushed by means of fully automatic no-touch flush valve with solenoid valves.

5.6 Waste pipes for urinals shall be G.I pipes (Medium class) to IS: 1239 or uPVC class III (6 kg/sqcm) conforming to IS: 4985 as given in schedule of quantities.

Waste pipes may be exposed on wall or concealed in chase as directed by the Owner/PMC. Specifications for waste pipes shall be same as given in Section II.

**6. Wash Basins**

6.1 Wash basins shall wall mounted type or Counter top or Counter sunk type as approved by Owner/PMC

6.2 Each basin shall be supported on MS galvanised or CI brackets and clips and the basin securely fixed to wall or on the counter. The design of the brackets shall suit the basin selected and as recommended by the manufacturer.

6.3 Each basin shall be provided with 32 mm dia C.P waste with overflow, pop-up or standard waste with rubber plug and chain, 32 mm dia C.P. brass bottle trap with CP pipe to wall and flange.

6.4 Each basin shall be provided with a Hot & cold CP mixer with pop up waste fittings , 32 mm dia. CP cast brass bottle trap with outlet pipe and wall flange.

6.5 Some of the selected wash basins as identified in the BOQ shall be similar to the one described above but the supply tap shall be a Magic Eye Infrared operated automatic hot and cold mixing fittings.

6.6 Washbasins shall be fixed at proper heights as shown on drawings. If height is not specified, the rim level shall be 79 cms or as directed by Owner/PMCs.

**7 Sinks**

7.1 Sinks shall be stainless steel or any other material as specified in the Schedule of Quantities.

7.2 Each sink shall be provided with brackets of approved and securely fixed. Counter top sinks shall be fixed with suitable brackets or clips as recommended by the manufacturer. Each sink shall be provided with 40 mm dia C.P. waste with chain and plug as given in the Schedule of Quantities. Fixing shall be done as directed by Owner/PMC.

7.3 Supply fittings for sinks shall be mixing fittings or C.P. taps as specified in the Schedule of Quantities.

**8 Hand Drier**

8.1 The hand drier shall be no touch operating type with solid state time delay to allow user to keep hand in any position.

8.2 The hand drier shall be fully hygienic, rated for continuous repeat use.

8.3 The rating of hand drier shall be such that time required to dry a pair of hands upto wrists is approximately 30 seconds.

8.4 The hand drier shall be wall mounting type suitable for 230 volts, single phase, 50 Hz, A.C. power supply.

**9 Toilets for Disabled**

9.1 Where specified in washroom facilities designed to accommodate physically handicapped, accessories should be provided as directed by the Owner/PMC.

9.2 Stainless steel grab bars of required size suitable for concealed or exposed mounting and non-slip gripping surface shall be provided in all washrooms to be used by physically handicapped as directed by the Owner/PMC.

**10 Accessories**

10.1 Contractor shall install all chromium plated and porcelain accessories as shown on the drawings or directed by the Owner/PMC.

10.2 All C.P. accessories shall be fixed with C.P. brass half round head screws and cup washers in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by Owner/PMC.

10.3 Recessed porcelain accessories shall be fixed in walls and set in cement mortar 1:2 (1 cement: 2 coarse sand) and fixed in relation to the tiling work as per Interior Designer’s drawings.

11 Urinal partitions

11.1 Urinal partitions shall be white glazed vitreous china, marble, granite , frosted glass or any other material selected by the Owner/PMC..

Urinal partitions shall be fixed at proper heights with C.P. brass bolts, anchor fasteners and M.S. Clips as recommended by the manufacturer and directed by Owner/PMC..

# C.2 INTERNAL SEWERAGE SYSTEM & INTERNAL DRAINAGE SYSTEM

**1. Soil, Waste, Vent, Rainwater Pipes & Fittings**

1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes and fittings as per approved drawings.

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

Vertical and horizontal soil, waste, vent pipes, and fittings, joints, clamps, connections to fixtures.

Connection of all pipes to sewer lines as shown on the drawings at ground floor levels.

Drainage, channels, gratings & floor drains.

Floor and urinal traps, cleanout plugs, inlet fittings and rainwater heads/Khurras

Testing of all pipe lines

**2 General requirements**

2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of Owner/PMC.

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 intervals specified.

2.5 Access doors for fittings and clean outs shall be so located that they are easily accessible for repair and maintenance. Any access panel required in the civil structure, false ceiling or marble cladding etc. shall be clearly reported to the DPL in the form of shop drawing so that other agencies are instructed to provide the same.

**3 Piping System**

3.1 Schedule of Pipes Use

1. uPVC pipes 75,110 ,160&210 mm dia Vt. stacks for Soil, Waste., Vent & RWP

2. uPVC pipes 40,50 & 63 mm dia pvc pipes Horizontal.

**4 Soil, Waste & Vent Pipes**

4.1 The soil and waste pipe system above ground has been planned as a “Two pipe system” having separate pipes for waste for kitchen sinks, wash basins, AHU’s, condensate drains and floor drains and soil from the WCs and Urinals, and or a “Single stack system” where all waste and soil pipes are connected to the same stack. Necessary venting shall be done by using Air Admittance valves, to be installed based on manufacturers recommendations.

4.2 All waste water from AHU's plant and pump rooms, floor channels will be provided with a deep seal trap before connecting to the main drain or vertical stack.

4.3 Vertical soil & waste stacks shall be connected to a separate horizontal drain at basement ceiling generally as shown on the drawings.

4.4 Toilet layouts have been so arranged that the W.C. outlets shall be with “P” trap above ground.

4.5 All soil/waste from areas in Basement areas will be collected in sumps and after treatment in STP shall be pumped into sewer line.

4.6 Head (Starting point) of drains and sewage / Waste Water Sumps ( as and where applicable) having a length of greater than 4 m up to it connection to the main drain or manhole shall be provided with a 80/ 100 mm vent pipe terminating above roof or as directed by Owner/PMC.

**5 Rainwater Pipes**

All open terraces shall be drained by rain water down takes.

Rainwater down takes are separate and independent of the soil and waste system and will discharge into the open ground Storm water Drainage system of the Complex.

Rain water in open courtyards shall be collected in catch basins and connected to the storm water drain.

Any dry weather flow from waste appliances e.g. AHU’s pump rooms, waste water sumps shall connect to sewers after traps and not in the storm water drainage system.

**6 Balcony/Planter drainage**

Wherever required, all balconies, terraces, planters and other formal landscape areas will be drained by vertical down takes or other type of drainage system shown on the drawings and directed by the Architect/Owner/PMC

**7 Soil Waste and Vent Pipes and Fittings above Ground**

**Noise Insulated Piping System (POLOPLAST – POLO-KAL NG)**

**7.1 SOCKET PIPES**

Three Layer sound insulated Polypropylene piping (PP) system as per ON EN 1451-Part 1-6 & EN 12056 Part 1-5 with 3 layer pipe made of PP-C + PP-MV + PP-C in Blue Ral 5014 (halogen and calcium free) colour, push-fit type, food safe, having high impact and stiffness, offering sound levels of not more than 21 dBA with POLO clip HS/ 22 dBA with Bismat 2000 clamp /equivalent and 16 dBA with Bismat 1000 clamp/equivalent as per DIN 4109 at a flow rate of 4 l/s and having pipe ring stiffness as per 1S0/DIS 9969 and tightness as per EN 1277/B and C and DIN 19560, density = 1.25gms/cm3, elongation = 0.05mm/m0K and tensile strength > 24 N/mm2, with all necessary fittings in blue colour, fitted with factory fitted lip ring, having 3 layers, pipes to be painted with ordinary cement paint for external installation:

**INTERNAL LAYER:**

Of PP-C, hot water resistant to 97 degree C, tested in accordance to ON EN 1451-1 and DIN 19560, good heat and corrosion ageing stability as well as high chemical resistance and a smooth pipe inner-surface.

Color: Blue (halogen and calcium free)

**INTERMEDIATE LAYER:**

Of PP-MV compound reinforced with mineral aggregate, which guarantees greater stiffness and stability.

Color: Grey.

**EXTERNAL LAYER:**

Of PPC. With high impact resistance and good weathering resistance.

Color: Blue (halogen and calcium free).

**7.2 PIPE RING STIFFNESS:**

Pipe ring stiffness would be in accordance with IS0/DIS 9969 and TIGHTNESS as per EN 1277/B and C and DIN 19560.

**7.3 MARKINGS:**

All pipes shall carry the following markings: Batch number; year and week of manufacture; company name; dimension application class; stiffness class, test mark and material details.

**7.4 FITTINGS**

Single- Layered fitting reinforced with mineral aggregate, made of a Halogen free PP-C-KV synthetic material, a reinforced wall and factory fitted lip ring, hot water resistant upto 95 degree c in accordance to ON EN 1451-PART 1-6 EN 12056 PART 1-5.

Color: Blue (halogen and calcium free)

**7.5 INSTALLATION:**

The piping system must be clamped properly as required, pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material internally (between pipe and sleeve) covering the pipe to avoid transfer of body and structural borne sounds (refer manufacturer’s installation guide lines). The piping must not touch any wall, structure, panelling, false ceiling etc.

**Minimum supporting:**

|  |  |
| --- | --- |
| Nominal Outer diameterDN/ODmm | Bracket Distance |
| Horizontal Pipe routing\*)D.max.m (max. 1.5 x dia.) | Vertical Pipe routing\*)D.max.m |
| 32 | 0.50 | 1.50 |
| 40 | 0.60 | 1.50 |
| 50 | 0.75 | 1.50 |
| 75 | 1.10 | 2.00 |
| 90 | 1.35 | 2.00 |
| 110 | 1.65 | 2.00 |
| 125 | 1.85 | 2.00 |
| 150 | 2.40 | 2.00 |
| 200 | 3.00 | 2.00 |
| 250 | 3.00 | 2.00 |

**8 Traps**

**8.1 Floor Traps**

Floor traps where specified shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

**8.2 Urinal Traps**

Urinal traps shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

**8.3 Cleanout Plugs**

 Floor Clean Out and line clean out plugs

Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctions bends, tees, “Y” and on straight runs at such intervals as required as per site conditions. Clean out plugs shall terminate flush with the floor levels. Line clean outs shall be supported with manufacturer provided bracket. They shall be of push fit type of PKNG mane (Poloplast)

**9 Drainage under floor/above floor (service floors, basement ceiling etc.) (POLOPLAST – POL-KAL NG (upto 250mm dia / ECO-PLUS Premium above 250mm dia)**

9.1 All drainage lines passing under building, in exposed position above ground e.g. service floors, basement ceiling etc. shall be Multi-layered as per details given in sub-clause 3.10 above or shall be as per details given below. Position of such pipes shall generally be shown on the drawings.

**10. SOCKET PIPES**

3 layer technology Polo-Eco Plus Premium 10 pipes and fittings for underground/ misc. drainage applications having external layer of PP-Blend + mineral reinforcement, supporting layer of PP + magnesium silicate and internal in PP with chemical resistance between 2-13pH and ring rigidity of =/> 10kN/m2 having OFI certification for longitudinal stability & impermeability of pie connection in line with EN 14741.

**10.1 FITTINGS**

3-layered reinforced polypropylene (PP) sewage pipes, halogen and lead free, with integral push-fit socket and factory-fitted lip ring, tested and monitored according to the Product Standard EN 1852 – 1. Fittings upto dimension DN/OD 200 are manufactured by injection molding (1-layer), above DN/OD 200 (250 and above)

the fittings are butt or extrusion welded by the manufacturer. Fabrication of fittings at site shall not be permitted.

**10.2 Pipe Joints**

Field-proven push-fit connection with improved and modified lip ring of high ageing-resistant shall be provided with the pipes and fittings for easy push-fit installation, installation procedure as given in clause 3.10 above shall be followed.

**11 Air Admittance Valves (AAV) (McAlpine, UK / STUDOR, UK)**

Air admittance valves shall be made in ABS/PVC capable of operating at temperatures between 0 degree c and 60 degree c. The AAV shall be of suitable flow rate and installed in main discharge stacks and / or branches. Design based on air flow capacity required in proportion to the discharge unit capacities. The vendor is to supply data sheet showing relevant calculations and drawings indicating location and type of AAV as required.

AAV’s to have following performance parameter:

Temperature range: -20 degree Celsius to 60 degree Celsius.

Open pressure: -70 pa (-0.010 psi)

Max. Pressure rating tightness: 10,000 pa (1 m/40” h2o) at 0 pa or higher

**12. Maxi Filtra:**

Maxi Filtra shall be in black ABS to be installed at the outlet of the vent pipe discharging gases in the atmosphere. They are fitted with active carbon filters with iodine level being 1050mg/g. The replaceable carbon filters must be changed regularly as per manufacturer’s specification.