### TECHNICAL SPECIFICATIONS FOR SANITARY & PLUMBING WORKS

**THIS NOTE IS TO BE CONSIDERED IN CONJUNCTION WITH THE SCHEDULE OF QUANTITIES.**

**NOTE:**

**A.** Quantities given in the schedule are tentative and may vary as per site / drawing requirements. The Contractor will have to collect materials from the Employer's store after proper requisition (if material supplied by client). Contractor must check the quality of items before taking delivery of the same. Once the materials are taken to the site under the custody of the Contractor, no complaint will be entertained about any defect/fault and the Contractor shall ensure Safety / Security till it is handed over to the Employer in good condition.

### SPECIAL NOTES ON INTERNAL SANITARY INSTALLATION INCLUDING WATER DISTRIBUTION, SEWERAGE & DRAINAGE CONNECTION.

1. The Schedule of Quantities shall be read in conjunction with the Technical Specification and Drawings supplied by the Consultant. In case of any discrepancy between Schedule of Quantities, Technical Specification and Drawings, during execution period, the decision of the Employer / Project Manager will be final and the Contractor has to do the works as per the instruction of Project Manager without any extra cost.

2. The quantities given in the Schedule of Quantities are estimated and are given to provide a common basis for bidding. The quoted rates shall not vary if the actual quantities arrived as per working drawings differ from that of the tender quantities. The basis of payment will be the actual quantities of work carried out as per the final specifications and drawings issued for execution and as measured by the Contractor and Project Manager jointly. The method of measurement of completed work for payment shall, unless said otherwise, be in accordance with the joint measurement carried out by the Contractor and Project Manager and the decision of Project Manager will be final and the Contractor will be liable to accept the decision.

3. Unless otherwise mentioned, the Contractor shall consider all work items on supply, installation, balancing, testing and commissioning of equipment & accessories.

4. All civil works such as groove cutting in wall and floor and finishing of all grooves, making opening in wall /floor and making good etc. shall form part of item rates quoted against each particular items in the Schedule of Quantities and shall not be measured separately. Only Sanitary & Plumbing works which have been specifically indicated in the Bill of Quantities shall be paid for at an agreed cost.
### LIST OF APPROVED MAKES FOR PLUMBING WORKS

<table>
<thead>
<tr>
<th>Item</th>
<th>Make</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Ground uPVC pipe for Sewerage &amp; Drainage</td>
<td>FOAMCORE / SUPREME Stiffness Value SN-4N/sqmm.</td>
</tr>
<tr>
<td>Paint &amp; Primer</td>
<td>Berger / ICI / J&amp;N / Shalimar</td>
</tr>
<tr>
<td>M.S flat / Clamp (Hot dip galvanized)</td>
<td>To be approved by client</td>
</tr>
<tr>
<td>Anchor Fastener</td>
<td>Fisher, Hilti or equivalent</td>
</tr>
<tr>
<td>SWR Pipe</td>
<td>SUPREME / ASTRAL as per IS : 13592 (Type-B)</td>
</tr>
<tr>
<td>Sanitary ware</td>
<td>Hindware / Parryware / Eq.</td>
</tr>
<tr>
<td>C.P Fittings</td>
<td>JAQUAR / Equivalent.</td>
</tr>
<tr>
<td>G.M Ball Valve as per IS:778</td>
<td>ITAP / KITZ</td>
</tr>
<tr>
<td>C.I Butterfly Valve</td>
<td>ITAP / KITZ / Audco/Crawley &amp; Ray</td>
</tr>
<tr>
<td>Pressure Reducing Valve</td>
<td>ITAP / Leader</td>
</tr>
<tr>
<td>CPVC Pipe and Fittings</td>
<td>ASTRAL / ASHIRBAD / AJAY</td>
</tr>
<tr>
<td>Galvanized Steel Pipe</td>
<td>Tata (medium class) as per IS: 1239</td>
</tr>
<tr>
<td>G.I Fittings</td>
<td>HB or Equivalent</td>
</tr>
<tr>
<td>Manhole cover and Grating</td>
<td>MUNICAST / NECO / EQ.</td>
</tr>
<tr>
<td>Submersible Pump</td>
<td>GRUNDFOS / WILO / EQ</td>
</tr>
<tr>
<td>Hydro-pneumatic Pump set</td>
<td>GRUNDFOS / WILO / EQ</td>
</tr>
<tr>
<td>uPVC SWR Pipe for Soil, Waste, Rain Water.</td>
<td>ASTRAL/ ASHIRBAD/SUPREME</td>
</tr>
<tr>
<td>uPVC Pipe as per ASTM D-1785 for potable water (lead Free)</td>
<td>Astral/ Ashirbad / Supreme</td>
</tr>
</tbody>
</table>
1. **GENERAL REQUIREMENTS:**

The installation shall be carried out in conformity with the requirements of relevant bye-laws of Municipal and other Authorities in whose jurisdiction; the work is being carried out and also with specification laid down by Indian Standards in this codes and National Building Code of Practice - No. SP: 7 - 1983 (Part IX) plumbing services. & SP: – 35: 1987

1.1 **RULES & REGULATIONS:**

All materials, supply, erection, testing and commissioning shall comply with the requirements of the relevant Indian Standards & Codes of Practice as given below:

- **I.S. : 2556**  
  Vitreous china sanitary fixture.

- **I.S. : 2065 – 1988**  
  Code of Practice for water supply in Building.

- **I.S. : 5329 (Latest Edition.)**  
  Code of Practice for sanitary pipe work above ground.

- **I.S. : 1742 - 1983.**  
  Building drainage.

- **I.S. : 13592-1992**  
  uPVC Pipes (Type-B) Rain water Pipe

- **I.S. : 14735-99**  
  uPVC fittings (Type-B)

- **I.S. : 4984**  
  High Density Poly Ethylene pipes for potable work.

- **IS : 3989**  
  CCI Pipe & Fittings.

- **DIN : 8077 : 1999 - 07**  
  Polypropylene Random Copolymer Pipe.

- **I.S. : 2379 - 1963.**  
  Colour code for identification of pipelines.

2. **GENERAL:**

- **i**  
  All water supply, drainage and sanitary work shall be executed by a Licensed Plumbing Contractor and shall be in accordance with the requirement of relevant bye-laws of Municipal or other Authorities in whose jurisdiction the work is being carried out.

- **ii**  
  The diameter of pipes and fittings wherever mentioned shall mean the internal diameter, unless otherwise specified.

- **iii**  
  The job shall include the cost of making necessary chases, holes etc. in walls, floors and in other places and also making good on completion of the work. The contractor shall make good, to the satisfaction of Project Manager/Employer in case of any damage caused to floors during sanitary and plumbing works.

- **iv**  
  Careful Handling, fitting and fixing the sanitary fixtures, as per drawings/specifications and instructions of authorities concerned and complete testing of necessary pipe connections, etc.

- **v**  
  Fitting and fixing including jointing of uPVC Soil, waste pipes and fittings to be completed. Prior to fixing, all pipes and fittings are to be properly checked. After fixing of pipelines, the same are to be tested by water test to ensure the system is leak proof.

- **vii**  
  Fitting & fixing of CPVC Pipe as per ASTM D 2846, SDR-11 for hot & cold water supply (concealed work) with various fittings such as tee, elbow, reducer, union, valves, cocks, float valve etc. with Solvent Cement Joint as per ASTM D-2564 for cold fusion. On
viii) Fitting & fixing of PVC pipe (lead free) as per ASTM D-1785, schedule 40 for ring main, vertical distribution & fittings such as tee, elbow, reducer, union, coupling, male/female adapter, end cap, valves, cocks, float valve etc. with solvent cement solution as per ASTM D-2564. On completion the pipelines are to be tested by Hydraulic Pressure Testing Machine to ensure that the system is absolutely leak proof.

ix) Fitting, fixing & jointing of rain water pipe shall be laid over the M.S clamp (if required) with plastic clamps of suitable designs. Provision shall be made for movement in the suspended pipe caused due to thermal differences such that it does not grip or disturb the pipe at supports between the nut-bolts. The supports shall allow the repeated movements to take place without abrasion. Jointing of uPVC pipes shall be made by means of solvent cement for horizontal lines & “O” rubber ring for vertical line.

xi) Provide all tools and equipments including testing machines required for testing and supporting & fixing devices so as to install the sanitary fittings, pipe lines etc. securely in position.

3. **METHOD OF MEASUREMENT:**

The following methods of measurement will be followed unless otherwise settled:

a) **Sanitary fixtures, Water Heater etc.:**

These shall be measured as per actual number of units fixed.

b) **uPVC Soil, Waste and Antisyphonage Pipes & Fittings:**

The measurement of pipes shall be taken along the centerline of the pipelines inclusive of fittings and joints.

c) **Underground Water Supply Pipes & Fittings:**

The measurement shall be taken along the centerline of pipelines inclusive of CPVC / uPVC Specials. Number of CPVC / uPVC fittings will not be measured separately. No extra payment is admissible for testing of pipeline. Numbers of valves, cocks, pumps etc. are to be measured separately.

d) **Underground Sewerage & Storm Water Lines:**

For sewer/storm lines, measurement shall be recorded for the finished length of the pipeline including joints i.e. overall length of sewer/storm line excluding the internal length of manholes.

For yard gully connections, measurement shall be recorded between the joint of Y.G. and the inside face of the manhole.

Number of manholes, gully pit and yard gullies etc. are to be measured separately.
No extra payment is admissible for testing of sewer lines, storm line & water supply line.

4. **INDIAN STANDARD SPECIFICATIONS:**

All work under this contract shall be carried out in accordance with the technical specification and the latest issue of the Indian Standard Specification applicable to the particular class of work. If Indian Standards are not formulated for any particular materials of work, the relevant British Standard Specification shall apply. Relevant issues of I.S. Specifications applicable to the particular work have been described along with the specification for the respective works. In case of any confusion or dispute regarding the meaning and interpretation of any specification for the respective works, the decision of the Project Manager/Architects shall be final and binding on the contractor.
5. **EXCAVATION OF TRENCHES (FOR U.G. WATER, STORM & SEWERAGE LINES)**:

Excavation shall form a part of the item under the schedule and shall not be paid separately unless otherwise specified in the schedule of quantities. It includes excavation in all kinds of soil including shoring and bailing out water wherever necessary and refilling the excavated trenches in layers of 15cms, properly rammed and watered and neatly dressed at the top. If the excavation is done to dimensions greater than those shown on the drawings or as directed by the Project Manager/Architect, the excess depth shall be made good at the own cost of the Contractor. The excavation work should be done in a manner which does not in any way endanger the stability of the adjacent buildings or other structures or services. Cuttings in road pavements or crossing shall be restored to their original conditions at no extra cost to the Owner. Moreover, after completion of the work, the Contractor shall have to dress the site including disposal of the surplus earth at his own cost as directed by the Project Manager/Architect.

The bed width of the trenches shall be of the exact width as shown in the drawings or as specified.

In firm soil, the sides of trenches shall be widened by allowing steps of 45 Cm. on either side after every 1.82 M. depth from the bottom so as to give side slopes of 6mm. to 25mm. Wherever the soil is soft, loose or slushy, the width of steps shall be suitably increased as directed by the Project Manager/Architect. It shall be the responsibility of the Contractor to take complete instructions in writing from the Project Manager/Architect regarding the stepping, sloping or shoring which has to be done for excavation in trenches deeper that 1.82 M.

The bed of the trenches shall be firmly leveled by watering and ramming. Any soft or defective spots that are found shall be filled with concrete in the proportion as specified or as may be directed by the Project Manager/Architect.

6. **INSTALLATION OF SANITARY FIXTURES AND FITTINGS:**

6.1.0 **General Requirement**:

The fixtures and fittings shall be provided with all such accessories which are required to complete the item in satisfactory working conditions, whether specifically mentioned or not in the schedule of quantities, specifications and drawings.

The sanitary fixtures and fittings shall be installed at the correct assigned position as shown on the drawings and as directed by the Architect, and shall fully meet the aesthetic and symmetrical requirements as demanded by the Architect.

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tile or interior finish as per the requirements of the Architect. Wherever necessary, the fittings shall be centered to dimensions and pattern as called for.

Skilled workmen shall install fixtures with appropriate tools according to the best trade practice. Manufacturer’s instructions shall be followed for the installation of fixtures. Fixtures in all toilets shall be of standard height mounting as specified in the drawings. Fixtures shall be mounted rigid, plumb, and true to alignment.

6.1.1 **Sanitary fixtures & Appurtenances**:

**A) European WC with Integrated Cistern**

A.1 WC shall be fixed on the leveled and finished floor with brass screws and PVC holdfasts. (No timber spacers or leveling chips shall be used). Leveling chips (if required) shall be PVC / HDPE or similar type. The edging between floor and EWC base shall be finished with silicone compound available in tubes manufactured by PIDILITE industries. After application of the compound it must be wiped clean so that smears are not left on floor or EWC surface. The WC must be fixed at the correct level and position. The connector pipe
must be u-PVC from supreme industries. No other connector pipe will be acceptable.

A.2 The Cistern behind the EWC bowl shall be fixed to the wall with brass screws and PVC holdfasts. Aluminum L-type concealed brackets may be fixed at the bottom of the cistern for added support (if required) the brackets shall be screwed to wall with galvanized screws and PVC holdfasts. The flush pipe (if required) should be heavy quality white in colour.

A.3 EWC seat and lid shall be fixed on the WC bowl with brass CP hinges or with the hinges manufactured and supplied by the manufacturer.

B. Angle valve with wall flange shall be fixed in line of the cistern inlet ball cock and the connector pipe will be a short one connected in the same straight line with the cistern inlet as indicated in the drawing.

C. The EWC set shall be so installed that no gap is perceptible between the wall & rear of the cistern.

C. Indian WC with Cistern

C.1 The Orissa type IWC shall be embedded in the floor with PCC (1:2:4) and Sika grout admixture so that the footrest portion remains flushed with finished floor level.

C.2 Fixing of the flushing cistern with angle valve shall be the same as mentioned above for EWC.

D. Wash Hand Basin Set

D.1 The WHB will be fixed to the wall in the following manner.

D.2 If WHB is without a pedestal then Anchor Bolt embedded support brackets will be used. Leveling shall be checked by good quality spirit levels and not by the conventional tube type water levels.

D.3 The WHB shall be placed on the anchor bolt at the correct level. The edge of wall and basin shall be finished neatly with colourless silicon compound.

D.4 After placing the WHB on the anchor bolt, the 32mm CP waste shall be fixed. The outlet will be sealed with a rubber bung or suitable sealant and covered with a flange.

E. CP angle valves with flanges shall be fixed to the PPR pipe fittings with Teflon tape. Connector pipes and coupling nuts shall be fixed with proper bending to the inlet points of pillar cock.

F. Shower Set

This will be installed as concealed units. There will be Diverter / 2 in 1 wall mixture with C.P bend pipe with two stop cocks for (1h & 1c) controls. Over Head shower will have one angular shower arm with wall flange and ball bearing shower rose. Bottom spouts will have wall flanges. All fixtures shall be screwed on type and shall be fitted with Teflon tape and holdtite pipe thread solution. No jute and zinc oxide will be used for sealing the threaded joints.

The shower set long screws will be made from “PPR” PN 16 Grade pipes. The cap of bend pipe shall be so fitted that the wall flanges are flush mounted on the wall cladding without any gap between wall face and flange face. The centre line of shower arm and the spout should be in the same line.
G. **Towel Rails / Racks**

These shall be fixed on to walls with brass CP / galvanized screws (IS 1365 & 1366) – 40mm long and PVC holdfasts. All holes will be drilled with a portable electric drill. Installation heights and other dimensions will be as per the drawing.

H. **Ablution Tap**

This tap (bib cock) shall be screwed on type with wall flange. The tap shall be screwed on with Teflon tape and holdtite joint sealant. Installation heights and other dimensions will be as per the drawing.

I. **Kitchen Sinks.**

i. The kitchen sink shall be installed on the kitchen table where an aperture will be provided as per the sink dimensions. Wall mounted swivel type sink spout (cold water only) with wall flange shall be fixed at the centre of sink bowl with height and dimensions as shown in drawing. The accessory will be screwed on type and is to be installed with Teflon tape and holdtite joint sealing solution.

ii. Above the swivel spout, one angle valve is to be fitted in plumb in a similar manner for water filter connection.

iii. The sink will have a 40mm dia waste outlet fitted with coupling nut, & a small flange.

J. **Grating.**

Grating with hinged cover is to be placed on the floor traps flushed with the floor, the edge sealing is to be done with colourless silicon compound.

7.0 **Supporting and Fixing Devices:**

The contractor shall provide all the necessary supporting and fixing devices to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not present an unsightly appearance in the final assembly. Where the location demands, the Architect may instruct the contractor to provide chromium plated or other similarly finished fixing devices. In such circumstances the contractor shall arrange to supply the fixing devices and shall be installed completely with appropriate vibration isolating pads, washers and gaskets.

All pipes shall be securely supported. The maximum distance between hanger & supports for horizontally mounted & vertically mounted pipes shall be as indicated below.

**Details of Pipe Support:-**

<table>
<thead>
<tr>
<th>Nominal size of Pipe (mm)</th>
<th>M.S Flat in (mm)</th>
<th>“U” Bolt in (mm)</th>
<th>Expansion Bolt in (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 25</td>
<td>75 x 6</td>
<td>6 mm</td>
<td>6</td>
</tr>
<tr>
<td>32 to 40</td>
<td>75 x 6</td>
<td>6 mm</td>
<td>9</td>
</tr>
<tr>
<td>50 to 80</td>
<td>75 x 6</td>
<td>9 mm</td>
<td>9</td>
</tr>
<tr>
<td>100</td>
<td>75 x 6</td>
<td>12 mm</td>
<td>12</td>
</tr>
<tr>
<td>150</td>
<td>75 x 6</td>
<td>15 mm</td>
<td>15</td>
</tr>
</tbody>
</table>
### Schedule of Pipe Supports:

<table>
<thead>
<tr>
<th>Nominal pipe size in (mm)</th>
<th>Hanger rod or clamp in (mm)</th>
<th>M.S hook thk in (mm)</th>
<th>Maximum Interval in (m) Steel pipe</th>
<th>CPVC/uPVC pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50</td>
<td>9</td>
<td>5</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>65 to 80</td>
<td>12</td>
<td>6</td>
<td>3.3</td>
<td>4.5</td>
</tr>
<tr>
<td>100</td>
<td>15</td>
<td>6</td>
<td>4.4</td>
<td>4.5</td>
</tr>
<tr>
<td>150</td>
<td>22</td>
<td>9</td>
<td>4.8</td>
<td>4.5</td>
</tr>
</tbody>
</table>

**SPECIAL NOTE:**

Any types of M.S flat’s Clamp, hook, etc. shall be Hot dip Galvanized.

Nut Bolt, Washer & Band Strap etc. shall be made of Hot Dip Galvanized.

### 7.1 Final Installation:

The contractor shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with the other exposed fittings.

Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, washbasins, sinks and other appliances.

### 8. PROTECTION AGAINST DAMAGES:

The contractor shall take every precaution to protect all sanitary fixtures against damage, misuse, cracking, staining, breakage and pilferage by providing proper wrapping and locking arrangement till the completion of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all the fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

### 9. uPVC SOIL and WASTE PIPES & FITTINGS:

9.1 Pipes / fittings and accessories shall be installed as detailed below (for soil/waste water).

9.2 Pipes and fittings laid under floors will be suspended by galvanized brackets and hangers as shown in drawing.

9.3 Pipes and fittings fixed to walls of ducts or other walls. In case the pipes have no ears a separate "U" – type galvanized bracket will be made with 35mm X 5mm Flat and fixed over the barrel of pipe and under the socket with galvanized nail. The brackets shall be fabricated and then galvanized and then painted with one coat of coal tar epoxy paint before fixing.
### 9.4 Joints in the pipes shall be solvent as well as rubber push fit joint.

**uPVC SOIL, WASTE, VENT & RAIN WATER PIPES & FITTINGS:**

#### 9.5 Fixing:

The inner surface of the pipes and fittings shall be clean with cleanout solution and an application of the solvent cement joint as supplied by the contractor shall be done for outer surfaces of the pipe. The pipes and fittings shall be fixed to walls by using proper clamps. The pipes shall be fixed perfectly vertical or in a line as directed. All soil pipes shall be carried up above the roof and shall have uPVC cowl on top.

Where pipes are laid along walls, the uPVC pipes are to be fixed 25mm away from the wall surface. Anchor fasteners and clamps etc. to be used for this purpose.

The access door fittings shall be of proper design so as not to form any cavities in which filth may accumulate. Doors shall be provided with brass bolts.

Using branches shall make connections between main pipe and the branch pipes and bends invariably with access doors for cleaning.

#### 9.2 Jointing:

The outer space between the sockets and spigot will be well cleaned by cleanout solution. After applying of cleanout solution the socket and spigot will be tight by solvent cement.

#### 9.3 Solvent Cement for joints:

uPVC 'O' ring pipes and fittings (Grooves for rubber rings and plain for solvent joints.) Rubber ring sockets and T-shaped rubber ring joints are firm joints which will be 15 chamfered ends.

#### 9.4 Testing:

Before the appliances are connected all openings of pipes shall be inspected and tested. All openings of pipes bend shall be sealed with plugs and water test in small section of pipes shall be carried out to a static head of 4.5 meter.

All uPVC pipes and fittings including joints will be tested by water test and left in working order after completion.

### 10. LAYING OF WATER SUPPLY PIPES:

#### 10.1 The CPVC / uPVC pipes and fittings shall run in the wall chase or ceiling or as specified.

The fixing shall be done by means of standard pattern holder bat clamps keeping the pipes about 1.5 cm clear from the wall where it is to be laid on surface or specified as earlier. Where it is specified to conceal the pipes, chasing may be adopted. For pipes fixed in the shafts, ducts etc., sufficient space is to be provided to work on the pipes with the usual tools. As far as possible, pipes may be buried for short distances provided adequate protection is given against damage and special care is to be taken at joints. Pipe sleeves shall be fixed (as directed by the Construction Manager/Architect) where the pipe is passing through a wall or floor for reception of the pipe allowing freedom for expansion, contraction and other movements. In case of pipes embedded within the walls or floors, the pipe should be painted with anticorrosive bitumenastic paints of approved quality.

The CPVC pipes shall be jointed with cold Fusion as per the manufacturer’s specification. Special Care shall be taken to remove any burn from the end of the pipes. Pipes and joints for water supply shall be tested to a pressure of 7.0 kg. Per sq.cm for not less than 30 minutes.

#### 10.2 All cutting holes, chases, trenches etc. at any place necessary in connection with the works and subsequent mending of damages are to be included in the rates unless
otherwise specified.

10.3 **Internal Works:**

Internal CPVC pipe as per ASTM D 1785, (SDR-11) and fittings inside the Toilet and Kitchen shall be fixed by means of standard pattern holder bat clamps keeping the pipe 20mm clear of the wall everywhere or concealed as directed. Where it is imperative to fix the pipe in front of a house or in any conspicuous position, where it looks ungainly, chasing may be adopted. Concealed pipes are to be secured to the walls by hooks. The valves should be fitted with a male / female threaded adopter.

All pipes and fittings shall be fixed truly vertical and horizontal or as directed by the Project Manager/Architect.

10.4 **Disinfecting of Piping System and Storage Tank**

Before commissioning the water supply system, the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph.

The water storage tanks and pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine should be added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is used, the proportions will be 150 gm. of powder to 1000 liters of water. The powder shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, makers shall specify the proportions. When the storage tank is full, the supply shall be stopped and all the taps on the distributing pipes are to be opened successively working progressively away from the storage tank. Each tap shall be closed when the water discharged begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose.

10.5 **Testing:**

All CPVC (SDR-11), uPVC (schedule-40) Pipes and fittings should be tested (flat wise) by hydraulic pressure testing machine to a pressure of 5.0 Kg. per sq.cm for not less than 30 minutes, inorder to ensure that pipes have proper threads and that proper materials (such as white lead and hamp) have been used in jointing of G.I pipe & socket cold fusion welded for CPVC & solvent cement joint for uPVC (schedule-40). All leaky joints must be made leak proof by tightening or re-doing it at the contractor's expenses.

10.6 **Flexible PVC drainage pipes**

Flexible PVC drainage pipes (if required) during the execution stage will be dealt with individually from case to case.

12.6 **Testing:**

All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least two-meter head of water at the highest point of the section under test. The pipes shall be plugged preferably with standard drain plugs (with rubber strings) on both
### 12.7 Sewer/Storm lines shall be tested for straightness by:

i) Inserting a smooth ball of diameter 15 mm less than the bore of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end.

ii) By means of a mirror at one end and a lamp at the other end. If the pipelines are straight the full circle of light will be seen otherwise obstruction or deviation will be apparent.

iii) The contractor shall be giving a smoke test to the drain & sewer at his own expense & charges if directed by the Project Manager.

All manholes shall be tested for water tightness by filling them with water and observing any subsidence of water level. The down-stream pipeline too shall be filled with water to avoid outgo from the manhole. This applied to specifications for manholes.

A test register shall be maintained which shall be signed & dated by contractor & Project Manager.

### B. RCC Hume Pipes as per IS :458-2003

#### B.1 Laying and Jointing of Pipes

Tarred Gasket shall first be wrapped round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe which has been previously laid; the pipe shall then be adjusted and fixed in its correct position and the gasket caulked tightly home so as to fill not more than one quarter of the total depth of the socket.

The end grooves of the R.C.C pipe shall be filled with necessary bitumastic compound.

The remainder of the socket shall be filled with a stiff mix of cement mortar (1:1) one part of cement to one part of clean sharp washed sand. When the socket is filled, a fillet should be formed round the join with a trowel forming angle 45 degrees with the barrel of the pipe.

The mortar shall be mixed as needed for immediate use and no mortar shall be beaten up and used after it has begun to set.

After the joint has been made, any extraneous materials shall be removed from inside of the joint with a suitable scraper or 'badger'. The newly made joints shall be protected from the sun, drying winds, rain or dust until they are set. Sacking or other suitable materials, which can be kept damp, shall be used. The joints shall be exposed and space should be left around the pipes for inspection by the Project Manager/Architects. The inside of the sewer must be left absolutely clear in bore and free from cement mortar or other obstructions throughout its entire length. The joints shall be cured for at least seven days.

#### 11.6 Testing:

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

The leakage or quantity of water to be supplied to maintain the test pressure during the period of 10 minutes shall not exceed 0.2 liters/mm dia. of pipes per kilometer length per day. For non pressure pipes it is better to observe the leakage for a period of 24 hours if feasible.
### Sewer/Storm lines shall be tested for straightness by:

<table>
<thead>
<tr>
<th>i)</th>
<th>Inserting a smooth ball of diameter 15 mm less than the bore of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii)</td>
<td>By means of a mirror at one end and a lamp at the other end. If the pipelines are straight the full circle of light will be seen otherwise obstruction or deviation will be apparent.</td>
</tr>
<tr>
<td>iii)</td>
<td>The contractor shall do a smoke test for the drain &amp; sewer at his own expense if directed by the Project Manager.</td>
</tr>
</tbody>
</table>

All manholes shall be tested for water tightness by filling them with water and observing any subsidence of water level. The down-stream pipeline too shall be filled with water to avoid outgo from the manhole. This is also applicable for manholes.

A test register shall be maintained which shall be signed & dated by the contractor & Project Manager.

### MANHOLE:

a) Manholes of different types and sizes shall be constructed in the sewer line as per the levels & dimensions shown in the drawings or as directed by the Project Manager/Architects. The size specified shall indicate the inside dimensions of the manholes. The work shall be done strictly as per the drawings and specifications.

b) The manhole shall be excavated true to its dimensions and levels shown on the plan or as directed by the Project Manager/Architects. The excavation shall be done as directed in item 5 under "excavation of Trench".

c) **Bed Concrete:**

The manholes shall be built on a bed of cement concrete (1:3:6) (1 cement: 3 fine sand: 6 stone ballast) with 20mm down stone chips. The thickness of the bed shall be (15 cms) up to a depth of 2.0 mtr, unless otherwise specified or directed by the Project Manager/Architects.

d) **Brick Work:**

The brickwork shall be with 1st class bricks in cement mortar 1:6 (1 cement: 6 fine sand).

e) **Plastering:**

The walls of the manholes shall be plastered inside with 18mm thick cement plaster 1:4 (1 cement: 4 coarse sand) finished smooth, with a floating coat of cement slurry. In case of arched type manholes, the walls shall be plastered inside all around only up to crown level and flush pointed with cement mortar 1:2 (1 cement : 2 find sand).

All external surface of brick masonry shall be plastered with 12mm cement plaster 1:4 (1 cement: 4 coarse sand). The plastered area shall be water proofed with addition of approved water proofing compound as per the manufacturer's recommendation.
f) **Benching**:

The channels and benching shall be done in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone ballast) with 20mm gauge and rendered smooth with neat cement.

g) **R.C.C. Work**:

R.C.C. Work for slabs and lintels shall be in cement concrete 1:1.5:3 (1 cement: 1.5 coarse sand: 3 stone ballast with 20mm down stone chips). The thickness of the slab and reinforcement shall be as per the drawing.

h) **Foot Rests**:

All manholes deeper than 1.0 Meter shall be provided with polycoated C.I. footrests as per IS: 5455. They shall be embedded in cement concrete blocks (225 x 225 x 80 mm.) of 1:2:4 mix.

Footrests shall be fixed apart 30 cms vertically and staggered laterally and shall project 10 cms beyond the surface of the wall.

i) **Manhole Cover with frame as per IS:12592**:

DI manhole cover with frame should be heavy duty (20 MT capacities) at road and medium duty (10 ton capacity) for inside & foot path area.