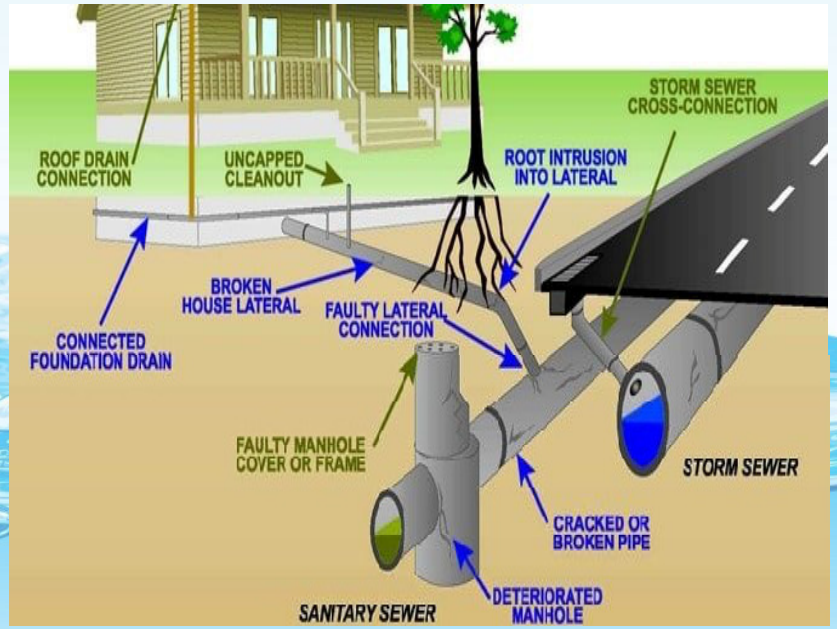
# Chapter 6

# Sanitary Drainage



# Overview

- A Sanitary drainage system provides a means of conveying sewage and liquid waste from plumbing fixtures to a public sewer or private sewage disposal system.
- Provisions in the code regulates the design, construction, installation and quality of materials for drainage systems in order to protect public health.
- In general the contents of this chapter refer to

Uniform Illustrated Plumbing Code-India(UIPC-I) and NBC- 2016

. One pipe fully vented system has been covered in detail in UIPC-I. Two pipe system with venting which is extensively followed in India is well covered in NBC-2016.

# OPTIONS

Multiple options are available in building sanitary drainage systems such as :

- One pipe - partially vented system
- One pipe fully vented system
- Two pipe system
- Single stack system

# ONE PIPE - PARTIALLY VENTILATED SYSTEM

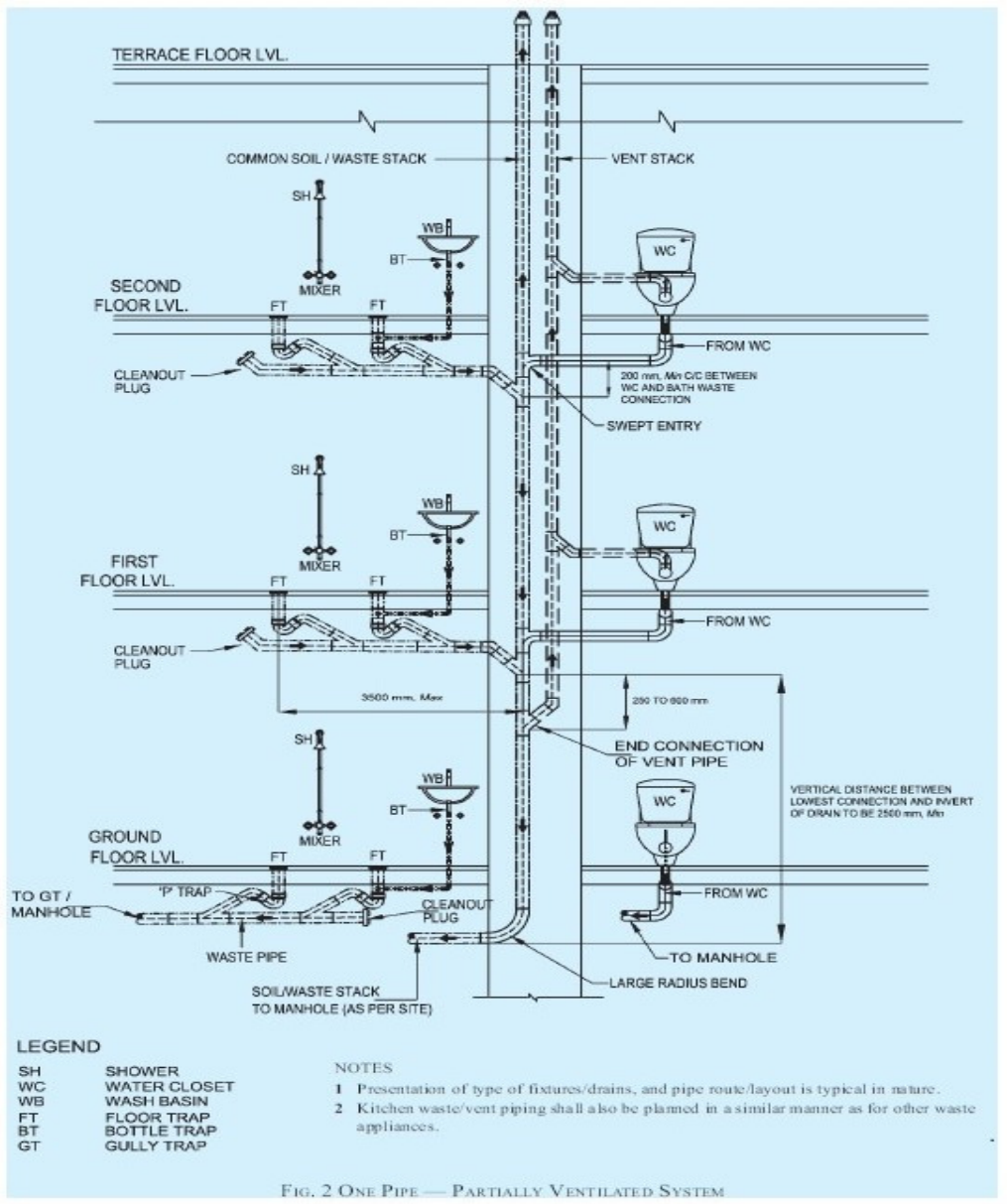



FIG. 2 ONE PIPE — PARTIALLY VENTILATED SYSTEM

In one pipe – partially vented system the soil and waste pipes from within the toilet are connected to a single vertical stack with additional vent pipe for ventilation of traps of Water Closets

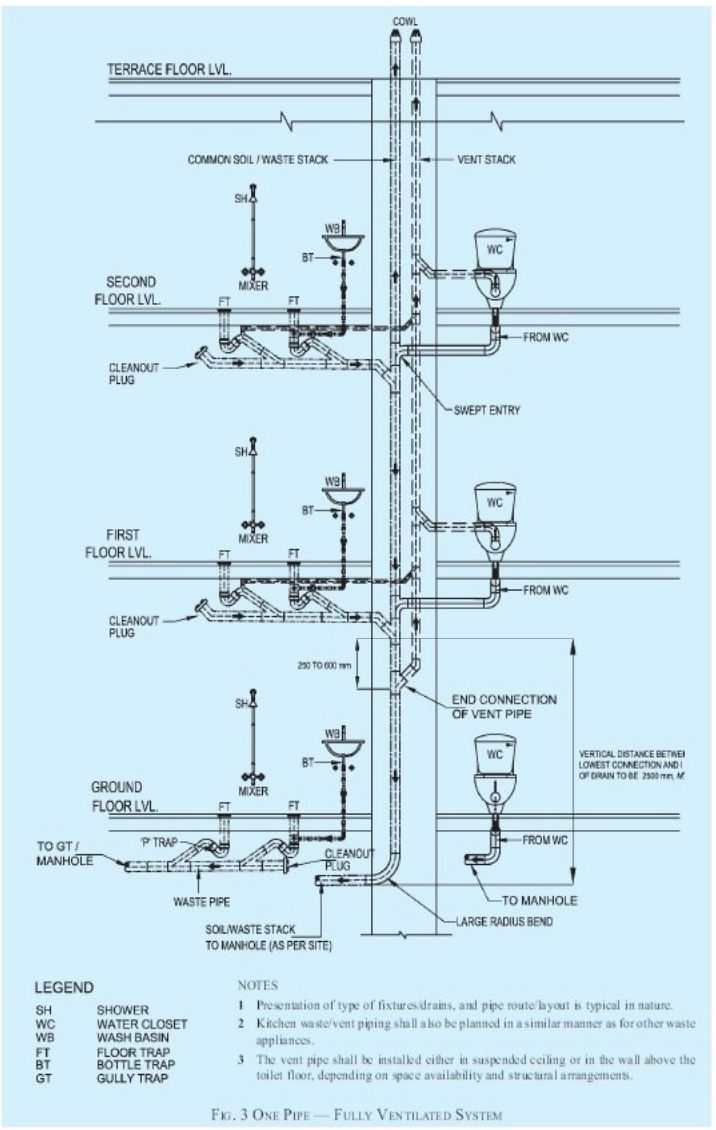
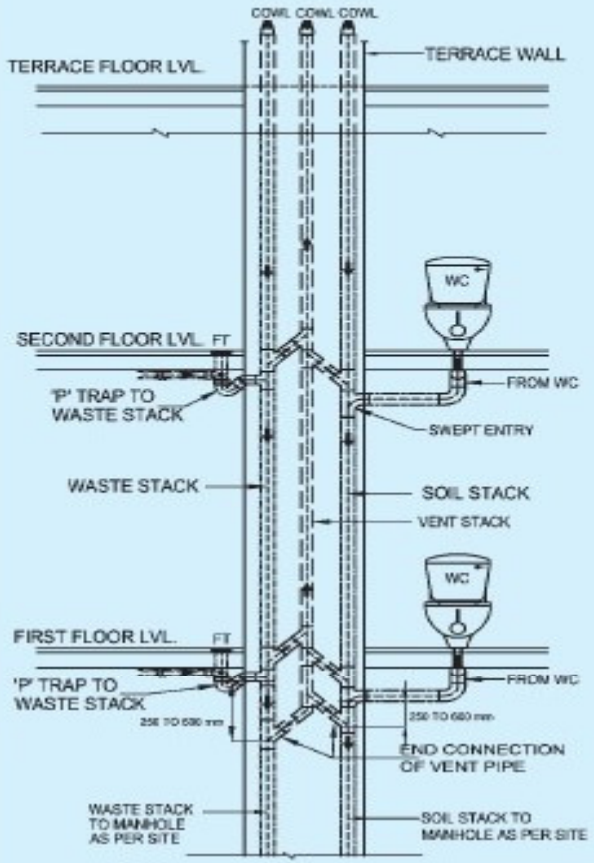



FIG. 3 ONE PIPE — FULLY VENTILATED SYSTEM

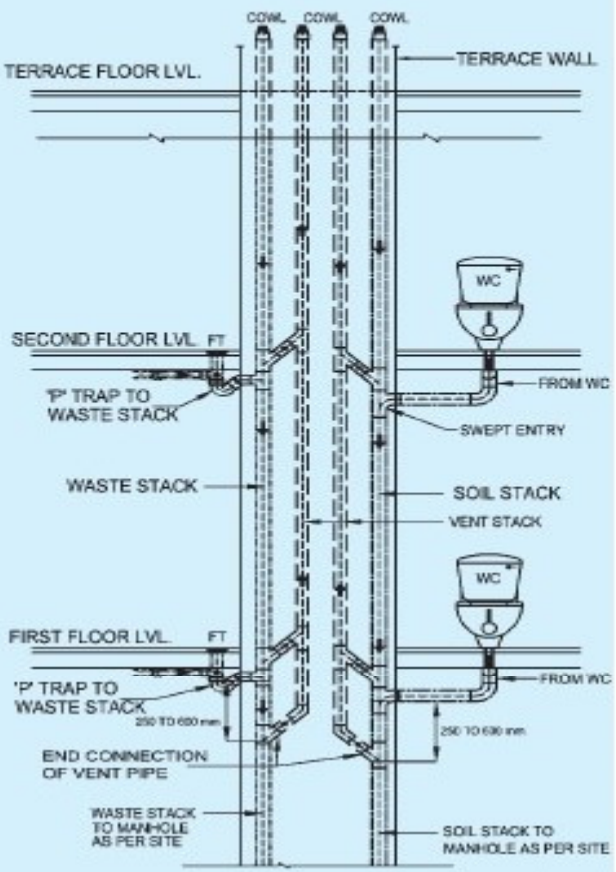
# ONE PIPE – FULLY VENTILATED SYSTEM

In One pipe – fully ventilated system the waste pipe from the sink, wash basin and bath and the soil pipe from the water closets are connected to a single stack. The traps of the waste appliances and the water closets are individually connected to a separate vent stack

# TWO PIPE SYSTEM




4A TWO PIPE SYSTEM WITH COMMON VENT PIPE




4B TWO PIPE SYSTEM WITH INDEPENDENT VENT PIPES

LEGEND

| | |
|---|---|
| SH | SHOWER |
| WC | WATER CLOSET |
| WB | WASH BASIN |
| FT | FLOOR TRAP |
| BT | BOTTLE TRAP |
| GT | GULLY TRAP |

NOTES

1 Presentation of type of fixtures/drains, and pipe route/layout is typical in nature.

2 Kitchen waste/vent piping shall also be planned in a similar manner as for other waste appliances.

FIG. 4 TWO PIPE SYSTEM

## Two pipe system with common vent pipe:

In this system all soil appliances such as W.C's and bidet are connected to a vertical soil stack and all waste appliances such as wash basins and bath are connected to a waste stack through a deep seal trap. In addition a common vent stack is provided for ventilation of soil and waste stacks.

## Two pipe system with independent vent pipes:

The system is similar to the one above with the exception that the soil and waste pipes are ventilated with independent vent stacks.

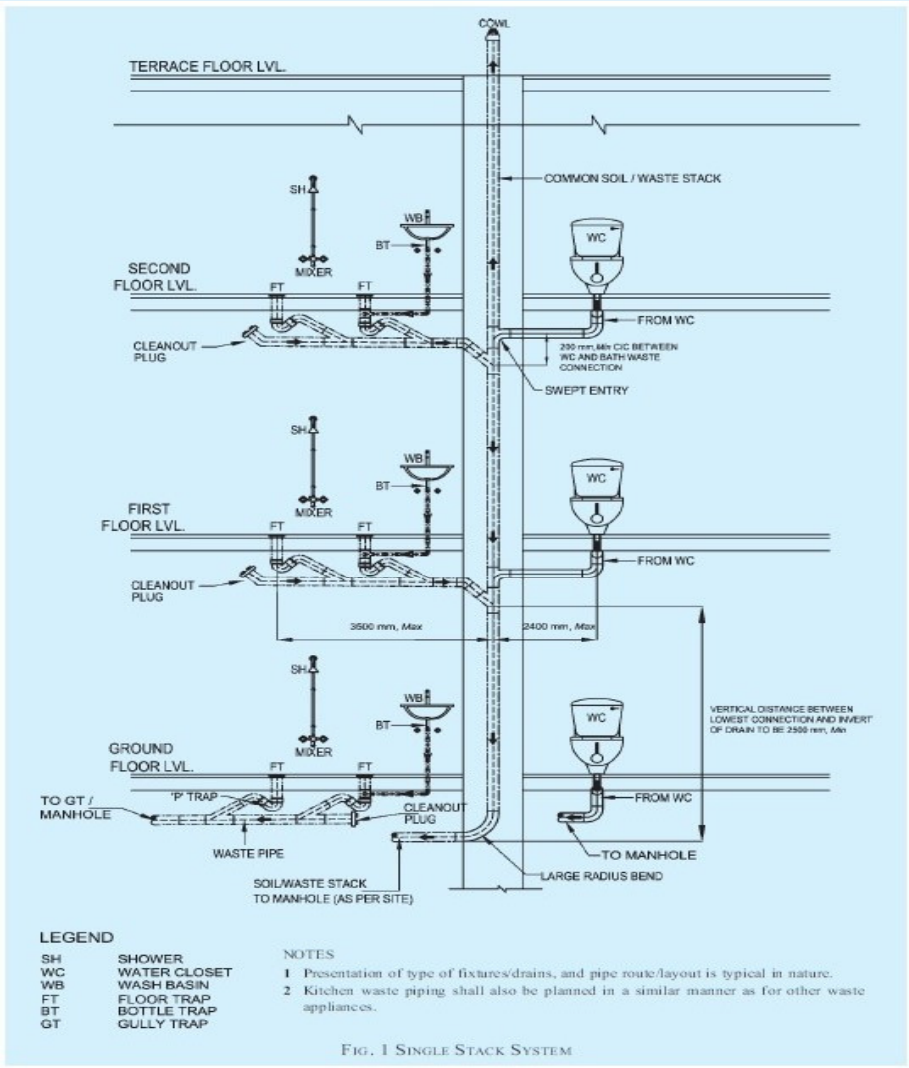


FIG. 1 SINGLE STACK SYSTEM

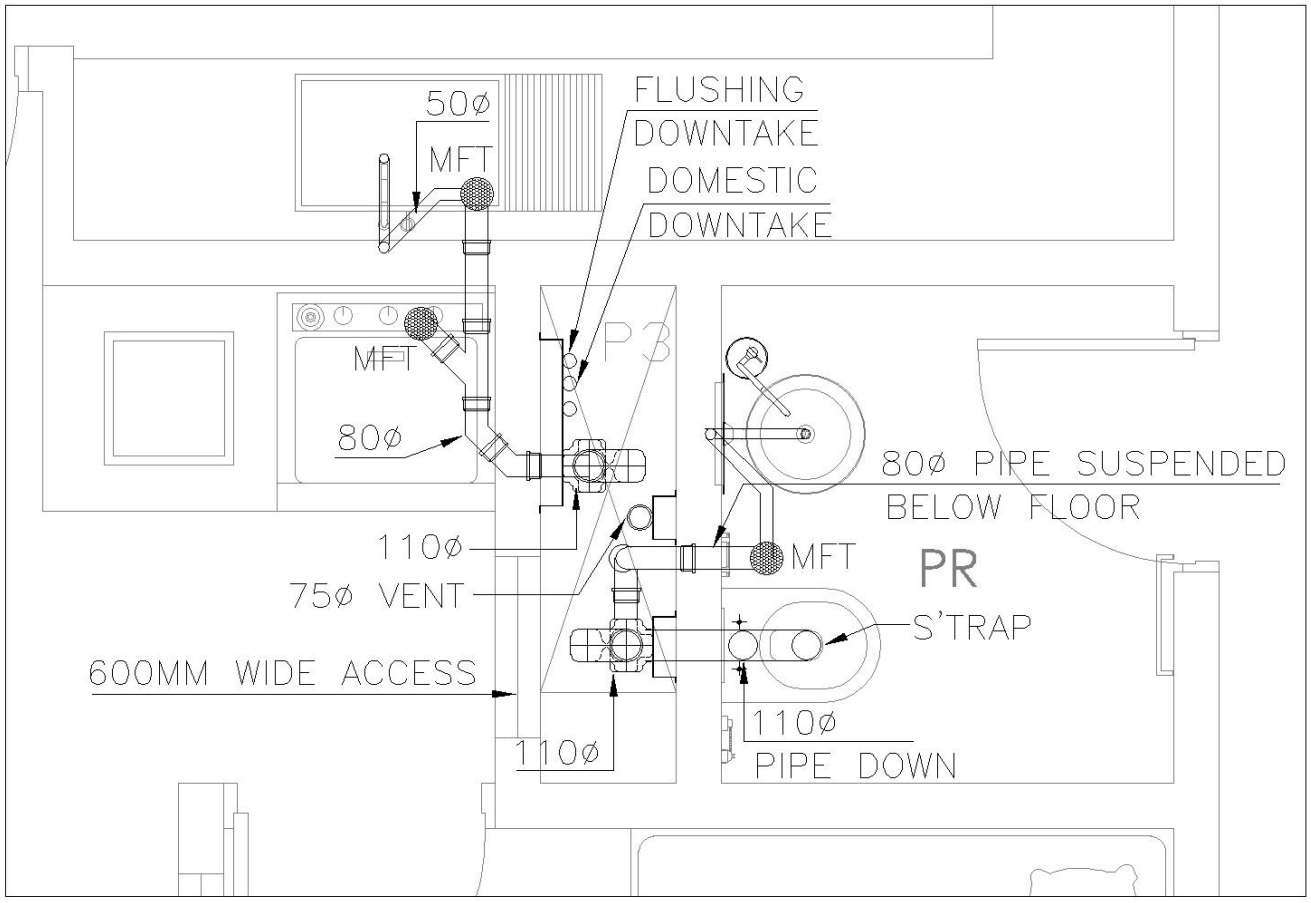
# SINGLE STACK SYSTEM

- In single stack system there is no trap ventilation and the stack itself acts as vent
- Care shall be taken for proper sizing of pipes and the trap arm distance
- The horizontal distance of the sanitary fixtures from the drainage stack and vertical distance between connection of branches is very important

# SINGLE STACK WITH SOVENT

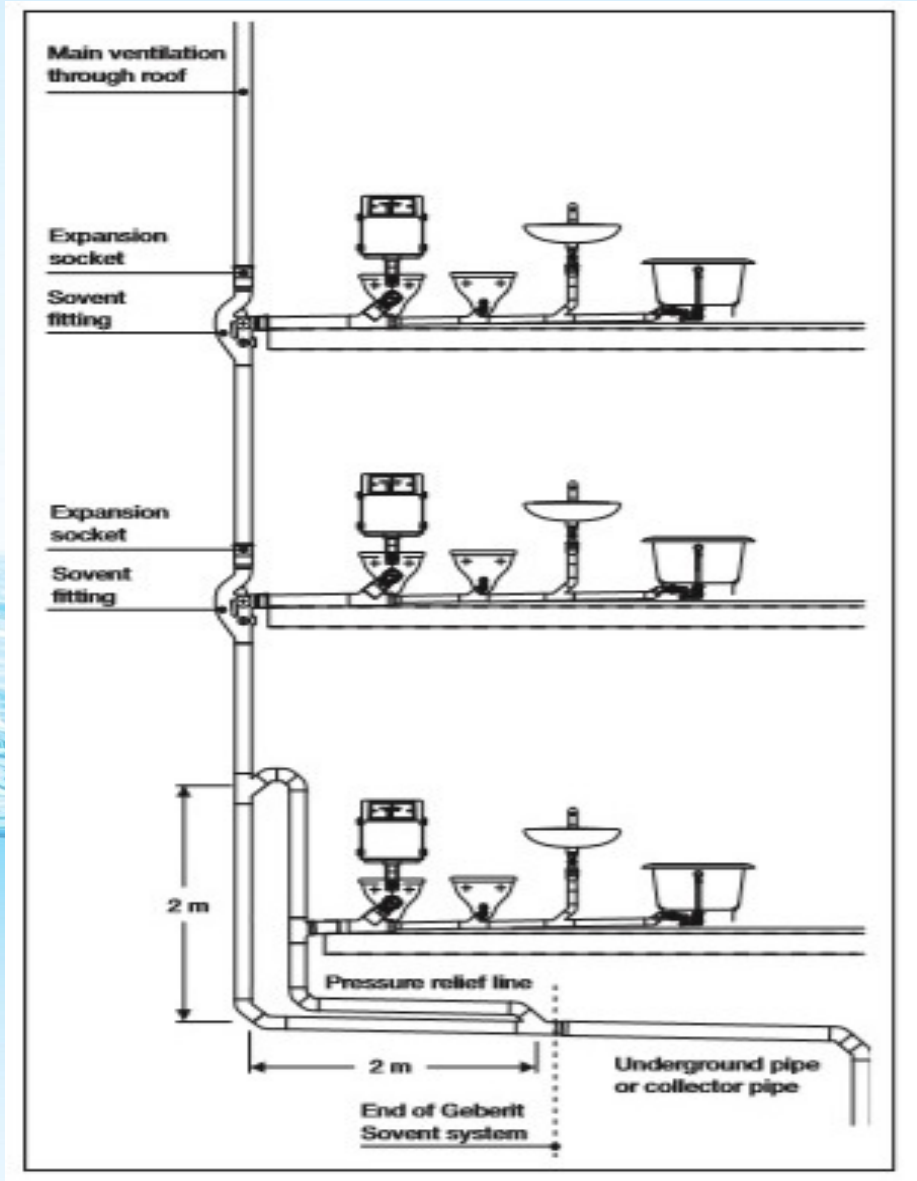
- Sovent is a fitting at the branch of a stack to facilitate connection of soil and waste pipe from the toilets at different levels.
- Soil and waste pipe are individually connected to the sovent stack.

# DRAWING OF TYPICAL TOILET WITH SINGLE STACK DRAINAGE SYSTEM




Indian Plumbing Association

# Typical Sovent Section




Sovent Section

Indian Plumbing Association

# Materials

- Materials for drainage piping shall be in accordance with the applicable standards referenced in Table 701.1.
- RCC pipe (using sulphate resistant cement) and uPVC (unplasticized polyvinyl-chloride) shall be permitted for underground installations when listed in accordance with the applicable BIS codes.

| TABLE 701.1<br>Materials for Drain, Waste, Vent Pipe and Fittings | | | |
|---|---|---|---|
| **Material** | **Underground Drain, Waste, Vent Pipe and Fittings** | **Above ground Drain, Waste, Vent Pipe and Fittings** | **Building Sewer Pipe and Fittings** |
| ABS (Schedule 40) | X | X | X |
| Brass | | X | |
| Cast-Iron | X | X | X |
| Co-Extruded ABS (Schedule 40) | X | X | X |
| Co-Extruded PVC (Schedule 40) | X | X | X |
| Copper (Type DWV) | X | X | X |
| Galvanized Malleable Iron Fittings | | X | |
| Galvanized Steel | | X | |
| PE Pipe and Fittings | X | X | X |
| uPVC | X | X | X |
| Stainless Steel 304 | | X | |
| Stainless Steel 316L | X | X | X |
| Vitrified Clay (Extra strength) | | | X |

**No galvanized wrought-iron or galvanized steel pipe shall be used in drainage applications**

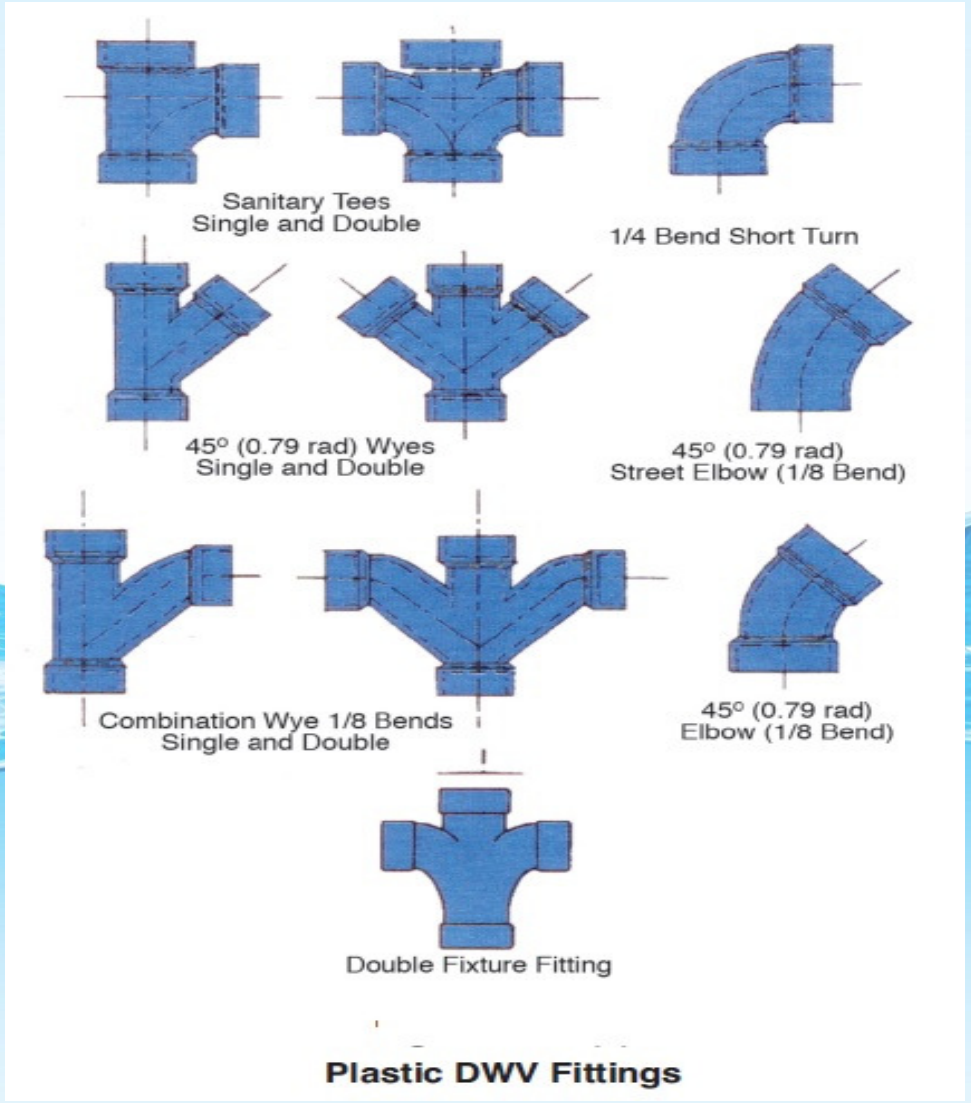
Due to the possibility of wrought iron or steel piping rusting, whether galvanized or not, it is not permitted for use in DWV (Drainage, Waste, Vent) applications.

# ABS and uPVC DWV

- Used above and below ground

- Use depends on building type

# Plastic DWV Fittings




Swept Tee

# Clay Pipe

No vitrified clay pipe or fittings shall be used above ground or where pressurized by a pump or ejector.

When laid underground they shall be laid not less than 300 mm below ground.

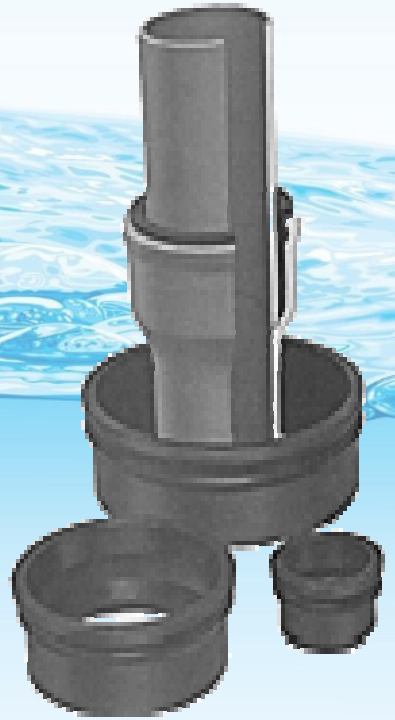
# Stainless steel pipe and fittings

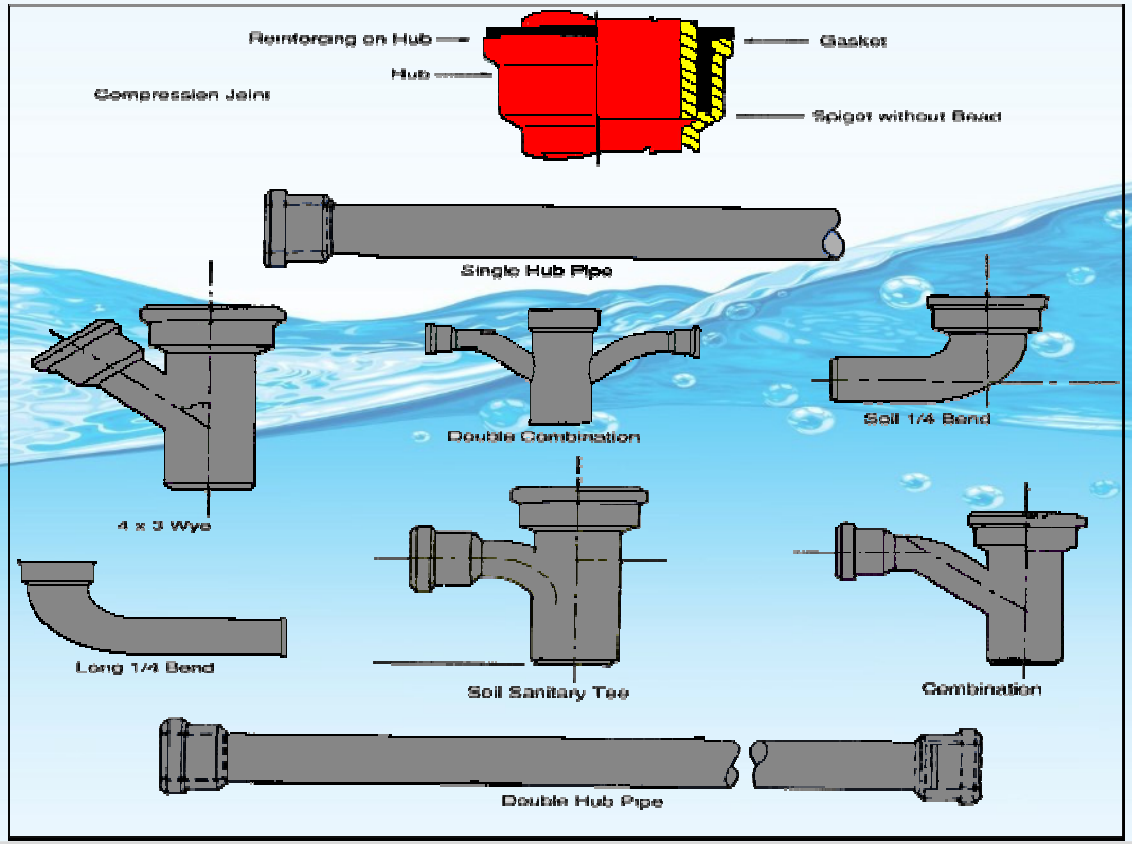
- Stainless steel 304 grade pipe and fittings shall not be installed underground. They shall be kept at 150 mm aboveground.

- Type 316L is approved for above- or below-ground applications.

# Cast-iron pipe and fittings

## Cast Iron Hub With Plain End
## for Use With Approved EPDM Gaskets





# Cast Iron Joining Methods

- Cast Iron Hubless Pipe for Use
- With Shielded or Unshielded Couplings

# Materials

- Drainage fittings shall be of cast iron, malleable iron, RCC, brass, copper, ABS, uPVC, PE, vitrified clay, stainless steel 304 and 316L etc.

- Or other approved materials having a smooth interior waterway of the same diameter as the piping served, and all such fittings shall be compatible with the type of pipe used.

# Fixture Unit Equivalents.

**Drainage Fixture units (DFU)** to be referred for drain pipe design.

The unit equivalent of plumbing fixtures shown in Table 702.2a shall be based on the size of the trap required

Maximum drainage fixture units for a fixture trap and trap arm loadings for sizes up to 100 mm are as follows:

| Size of Trap and Trap Arm | Drainage Fixture Unit Values (DFU) |
|---|---|
| 32 mm | 1 unit |
| 40 mm | 3 units |
| 50 mm | 4 units |
| 80 mm | 6 units |
| 100 mm | 8 units |

**TABLE 702.1**
**Drainage Fixture Unit Values (DFU)**

| Plumbing Appliance, Appurtenance, or Fixture | Min. Size Trap and Trap Arm (mm)[7,11] | Private | Public | Assembly[8] |
|---|---|---|---|---|
| Bathtub or Combination Bath/Shower | 40 | 2.0 | - | - |
| Bidet | 32 | 1.0 | - | - |
| Bidet | 40 | 2.0 | - | - |
| Clothes Washer, domestic, standpipe[5] | 50 | 3.0 | - | - |
| Dental Unit, cuspidor | 32 | - | 1.0 | 1.0 |
| Dishwasher, domestic, with independent drain[2] | 40 | 2.0 | - | - |
| Drinking Fountain or Water Cooler | 32 | 0.5 | 0.5 | 1.0 |
| Food-Waste-Grinder, commercial | 50 | - | 3.0 | 3.0 |
| Floor Drain, emergency | 50 | - | 0.0 | 0.0 |
| Floor Drain (for additional sizes see Section 702.0) | 50 | 2.0 | 2.0 | 2.0 |
| Shower, single-head trap | 50 | 2.0 | 2.0 | 2.0 |
| Multi-head, each additional | 50 | 1.0 | 1.0 | 1.0 |
| Lavatory, single | 32 | 1.0 | 1.0 | 1.0 |
| Lavatory, in sets of two or three | 40 | 1.0 | 2.0 | 2.0 |
| Washfountain | 40 | - | 2.0 | 2.0 |
| Washfountain | 50 | - | 3.0 | 3.0 |
| Mobile Home, trap | 80 | 12.0 | - | - |
| Receptor, indirect waste[1,3] | 40 | - | See footnote[1,3] | |
| Receptor, indirect waste[1,4] | 50 | - | See footnote[1,4] | |
| Receptor, indirect waste[1] | 80 | - | See footnote[1] | |

| | | | | |
|---|---|---|---|---|
| ***Sinks*** | | | | |
| Bar | 40 | 1.0 | | |
| Bar[2] | 40 | | 2.0 | 2.0 |
| Clinical | 80 | | 6.0 | 6.0 |
| Commercial with food waste[2] | 40 | | 3.0 | 3.0 |
| Special Purpose[2] | 40 | 2.0 | 3.0 | 3.0 |
| Special Purpose | 50 | 3.0 | 4.0 | 4.0 |
| Special Purpose[9] | 80 | | 6.0 | 6.0 |
| Kitchen, domestic[2] (with or without food-waste grinder and/or dishwasher) | 40 | | 2.0 | 2.0 |
| Laundry[2] (with or without discharge from a clothes washer) | 40 | 2.0 | 2.0 | 2.0 |
| Service or Mop Basin[10] | 50 | | 3.0 | 3.0 |
| Service or Mop Basin [10] | 80 | | 3.0 | 3.0 |
| Service, flushing rim | 80 | | 6.0 | 6.0 |
| Wash, each set of faucets (includes Wash Trough) | | | 2.0 | 2.0 |
| Urinal, integral trap 3.8 LPF[2] | 50 | 2.0 | 2.0 | 5.0 |
| Urinal, exposed trap 3.8 LPF | 40 | 2.0 | 2.0 | 5.0 |
| Water Closet, 6.0 LPF Gravity Tank[6] | 80 | 3.0 | 4.0 | 6.0 |
| Water Closet, 6.0 LPF Flushometer Tank[6] | 80 | 3.0 | 4.0 | 6.0 |
| Water Closet, 6.0 LPF Flushometer Valve[6] | 80 | 3.0 | 4.0 | 6.0 |
| Water Closet, greater than 6.0 LPF Gravity Tank[6] | 80 | 4.0 | 6.0 | 8.0 |
| Water Closet, greater than 6.0 LPF Flushometer Valve[6] | 80 | 4.0 | 6.0 | 8.0 |

[1] Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with Table 7-4.

[2] Provide a 50 mm minimum drain.

[3] For refrigerators, coffee urns, water stations, and similar low demands.

[4] For commercial sinks, dishwashers, and similar moderate or heavy demands.

[5] Buildings having a clothes-washing area with clothes washers in a battery of three or more clothes washers shall be rated at six fixture units each for purposes of sizing common horizontal and vertical drainage piping.

[6] Water closets shall be computed as six fixture units when determining septic tank sizes based on Appendix K of this code.

[7] Trap sizes shall not be increased to the point where the fixture discharge may be inadequate to maintain their self-scouring properties.

[8] Assembly [Public Use (See Table 4-1)].

[9] For sinks in commercial kitchens (such as hotels, foodcourts, canteens etc) DFU value of 3.0 shall be considered.

[10] DFU values provided in the Table for mop basins shall also be applicable for janitor sinks.

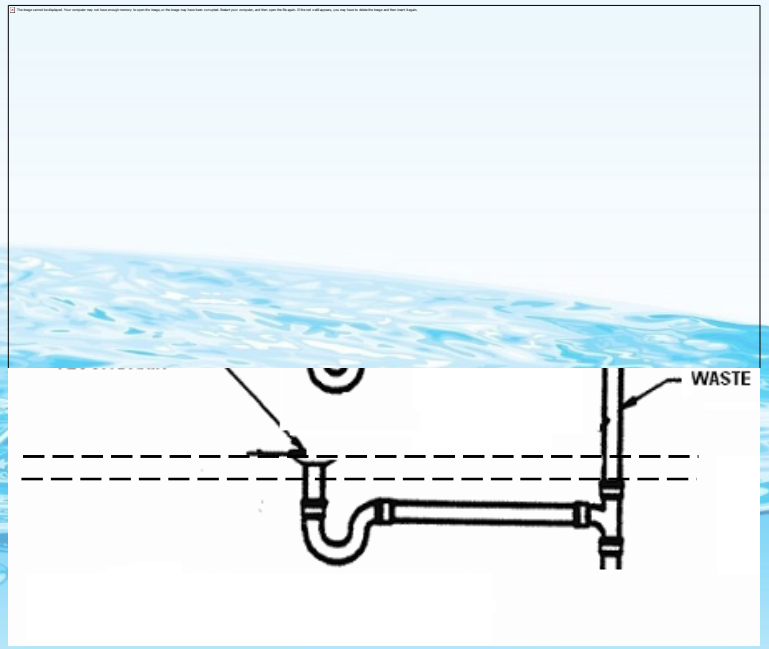
Drainage fixture units for intermittent flow into the drainage system shall be computed on the rated discharge capacity in liters per second in accordance with Table 702.2b.

**TABLE 702.2b**
**Discharge Capacity in Liters per Second**
**For Intermittent Flow Only**

| L/sec | |
|---|---|
| 0.47 to 0.95 | Equals 2 Fixture Units |
| 0.95 to 1.89 | Equals 4 Fixture Units |
| 1.89 to 3.15 | Equals 6 Fixture Units |

**Note:** Discharge capacity exceeding 3.15L/sec. shall be determined by the Authority Having Jurisdiction.

# Emergency Use Floor Drain




The emergency use floor drain is not assigned a fixture unit value because it does not add a drainage load on the drainage system. This floor drain is installed to capture water or waste overflow that is produced by another fixture or fixtures that are plugged and draining onto the floor. These other fixtures are assigned fixture units and the system is sized for their loads, so there is no need to add more fixture units and possibly increase pipe sizes for a fixture that adds no load of its own.

**Emergency-use Floor Drain**

# Receptor (Floor Sink)

Receptor (Floor Sink)

- This note refers to the "receptor, indirect waste," which is most often a floor sink (see **Figure)**. The size of the receptor and the trap size and fixture unit rating of the receptor will be based on the flow rate of the equipment, fixtures or devices draining into them. Refer Table 7-4 to find the proper trap size and the receptor size for the installation.

# Kitchen Sink Rough In

## 40 mm Trap Arm to 50 mm Drain

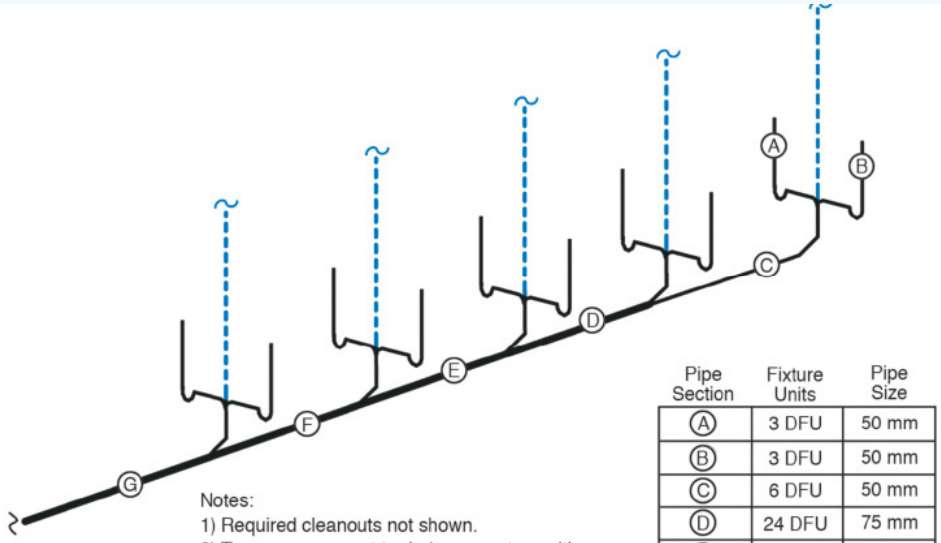
- Kitchen sinks to have minimum 40mm trap and shall drain into a 50mm drain. They require a 50 mm drain because of the nature of the waste draining into them.

- Similarly requirement of 50mm drain for the urinal is because of the possibility of frequent clogging.

**Kitchen Sink Rough In – 40 mm Trap Arm to 50 mm Drain**

# Note 5(**Table 702.1**) – Sizing Example

Clothes washers in groups of 3 or more shall be rated at 6 units each for the purpose of sizing common horizontal and vertical waste piping




| Pipe Section | Fixture Units | Pipe Size |
|---|---|---|
| A | 3 DFU | 50 mm |
| B | 3 DFU | 50 mm |
| C | 6 DFU | 50 mm |
| D | 24 DFU | 75 mm |
| E | 36 DFU | 100 mm |
| F | 48 DFU | 100 mm |
| G | 60 DFU | 100 mm |

Notes:
1) Required cleanouts not shown.
2) Trap arms connect to drainage system with an approved double fixture fitting in accordance with Sec. 704.2
3) Each clotheswasher is individually rated at 3 dfu.
4) Where a draibage line serves a battery of 3 or more clotheswashers, each clotheswasher is rated at 6 dfu.

**Figure 702.1d**
**Illustration of Clothes Washer Sizing Per Note 5 of Table 702.1**

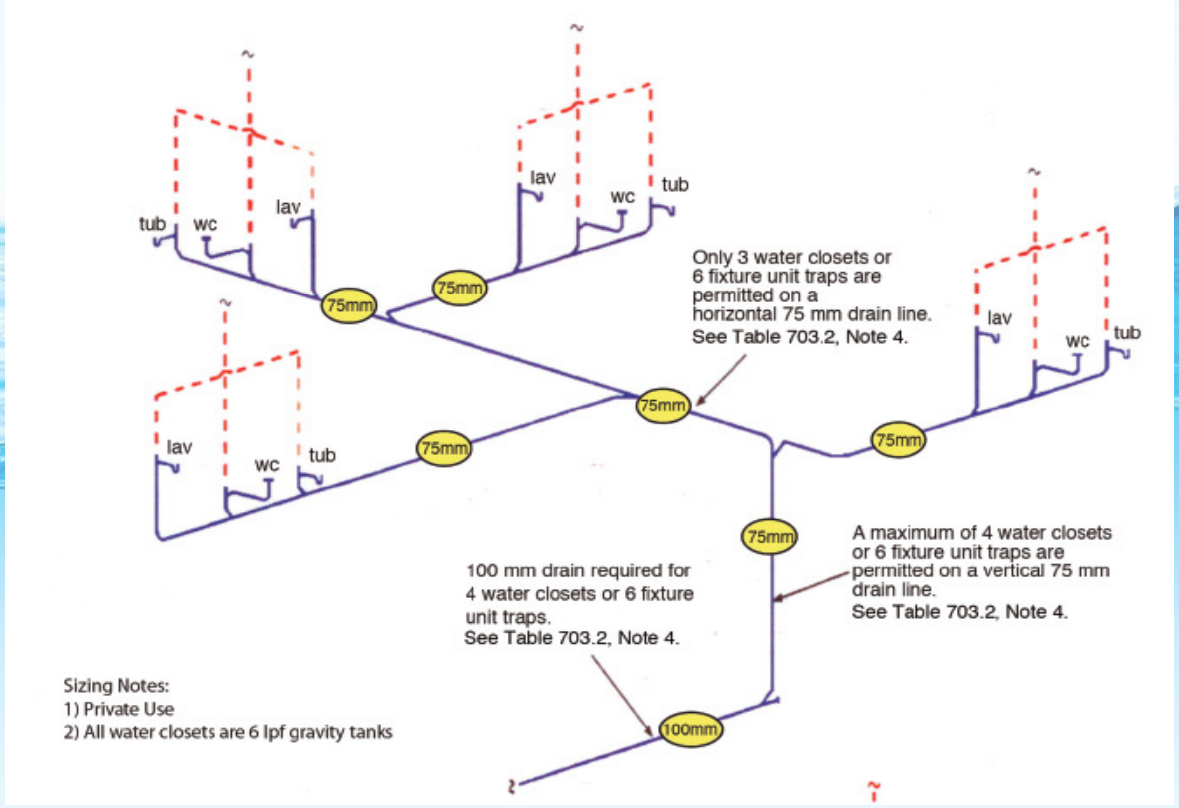
**TABLE 703.2**
**Maximum Unit Loading and Maximum Length of Drainage and Vent Piping**

| Size of Pipe, mm | 32 | 40 | 50 | 65 | 80 | 100 | 125 | 150 | 200 | 250 | 300 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Maximum Units** | | | | | | | | | | | |
| Drainage Piping[1] | | | | | | | | | | | |
| Vertical | 1 | 2[2] | 16[3] | 32[3] | 48[4] | 256 | 600 | 1,380 | 3,600 | 5,600 | 8,400 |
| Horizontal | 1 | 1 | 8[3] | 14[3] | 35[4] | 216[5] | 428[5] | 720[5] | 2,640[5] | 4,680[5] | 8,200[5] |
| **Maximum Length** | | | | | | | | | | | |
| Drainage Piping | | | | | | | | | | | |
| Vertical, feet m | 14 | 20 | 26 | 45 | 65 | 91 | 119 | 155 | 229 | | |
| Horizontal (unlimited) | | | | | | | | | | | |
| **Vent Piping** (See note) | | | | | | | | | | | |
| Horizontal and Vertical | | | | | | | | | | | |
| Maximum Units | 1 | 8[3] | 24 | 48 | 84 | 256 | 600 | 1380 | 3,600 | | |
| Maximum Lengths, m | 14 | 18 | 37 | 55 | 65 | 91 | 119 | 155 | 229 | | |

1 Excluding trap arm.
2 Except sinks, urinals, and dishwashers – exceeding 1 fixture unit.
3 Except six-unit traps or water closets.
4 Only four water closets or six-unit traps allowed on any vertical pipe or stack; and not to exceed three water closets or six-unit traps on a horizontal branch or drain.
5 Based on 1:50 (2 %) slope. For 1:100 (1 %) slope, multiply horizontal fixture units by a factor of 0.8.
6 The diameter of an individual vent shall be not less than 32 mm nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2(b). Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.2.

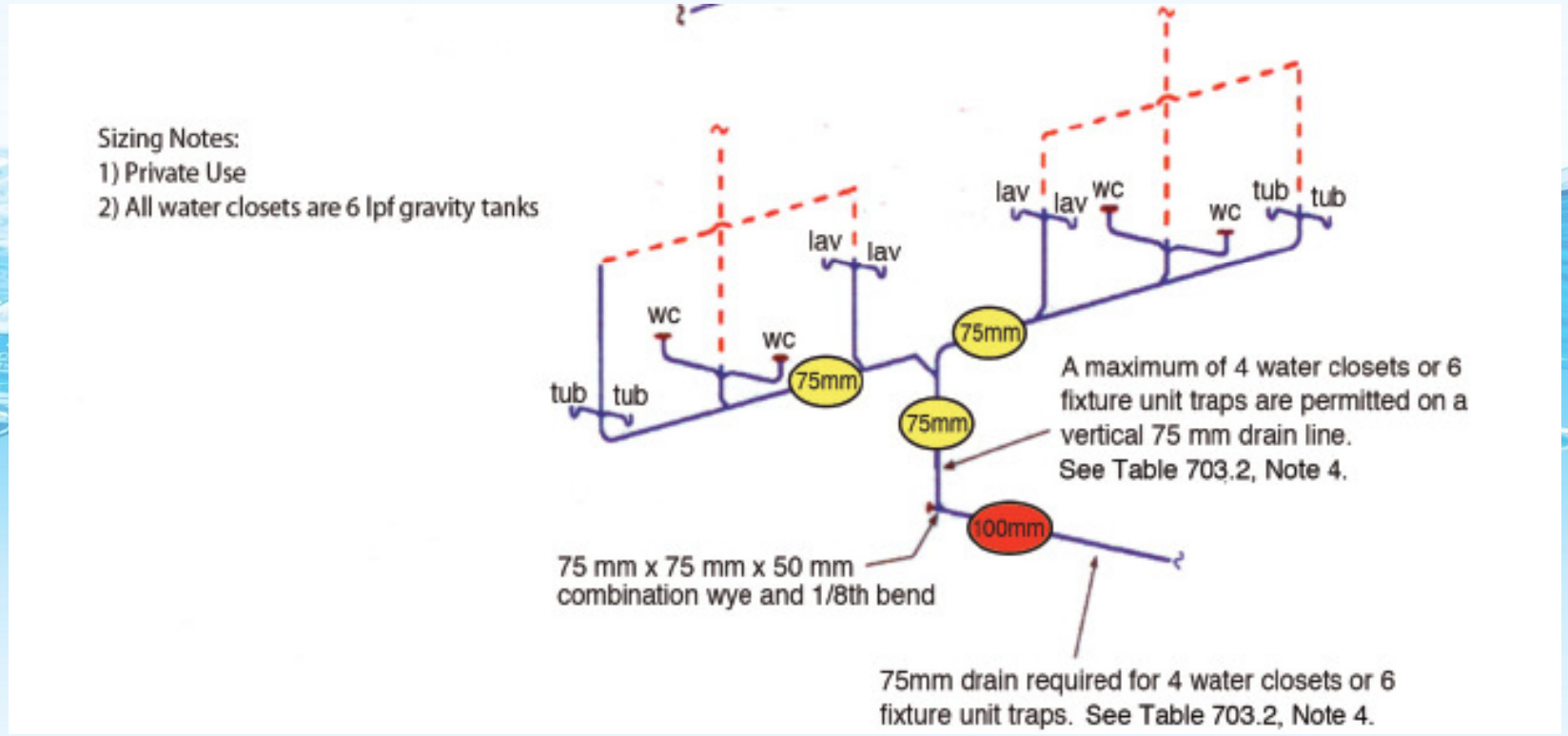
# Explanation of Note 4 of Table 703.2

- Only 4 WCs or 6 unit traps on 75 mm vertical pipe



# Note 4 ……Continued

- Only 3 WCs or 6 unit traps on 75 mm horizontal pipe



# Explanation of Note 5 of Table 703.2

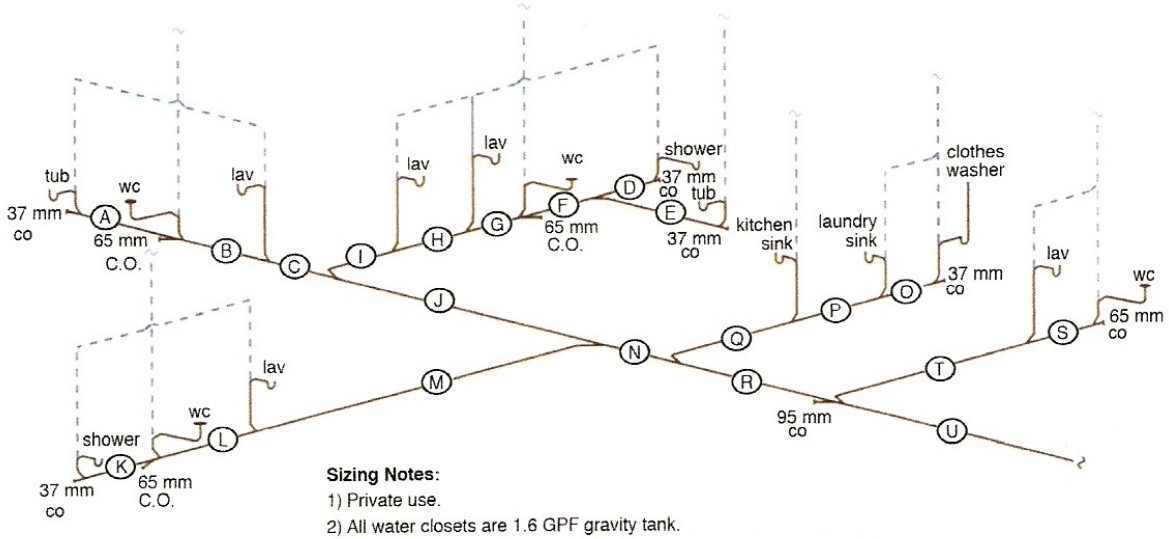
- Based on 1:100 grade
- When 1:200 grade is used, the FU amount of the appropriate column is multiplied by .8
- Example:

  100 mm = 216 fu at 1:100 grade

  If 1:200 grade is used, 216 fu x .8 = 173

  At 1:200 grade a 100 mm pipe can only carry a maximum of 173 fu

In India most AHJs require the min. size of soil pipe as 100 Φ and waste pipe as 75 Φ, while referring to the next slide




**Sizing Notes:**

1) Private use.
2) All water closets are 1.6 GPF gravity tank.
3) Horizontal drainage piping is below the floor level of the lowest floor.
4) All horizontal drainage pipe sections exceed 5 feet in length.
5) Cleanouts are sized in accordance with Table 7-6.
6) Section (U) serves 4 water closets and a total load of 32 drainage fixture units. Note 4 at the bottom of Table 7-5 limits a 75 mm horizontal drain to a maximum of 3 water closets or 6 fixture unit traps.

| Pipe Section | Drainage Fixture Units | Pipe Size | Pipe Section | Drainage Fixture Units | Pipe Size |
|---|---|---|---|---|---|
| (A) | 2.0 | 50 mm | (L) | 5.0 | 75 mm |
| (B) | 5.0 | 75 mm | (M) | 6.0 | 75 mm |
| (C) | 6.0 | 75 mm | (N) | 21.0 | 75 mm |
| (D) | 2.0 | 50 mm | (O) | 3.0 | 50 mm |
| (E) | 2.0 | 50 mm | (P) | 5.0 | 50 mm |
| (F) | 4.0 | 50 mm | (Q) | 7.0 | 50 mm |
| (G) | 7.0 | 75 mm | (R) | 28.0 | 75 mm |
| (H) | 8.0 | 75 mm | (S) | 3.0 | 75 mm |
| (I) | 9.0 | 75 mm | (T) | 4.0 | 75 mm |
| (J) | 15.0 | 75 mm | (U) | 32.0 | 100 mm |
| (K) | 2.0 | 50 mm | | | |

**From Table 7-3...**

| | |
|---|---|
| Water Closet | = 3.0 dfu |
| Lavatory | = 1.0 dfu |
| Shower | = 2.0 dfu |
| Bathtub | = 2.0 dfu |
| Kitchen Sink | = 2.0 dfu |
| Laundry Sink | = 2.0 dfu |
| Clothes Washer | = 3.0 dfu |

**Vertical Drainage Pipe Sizing**
(not shown on drawing)

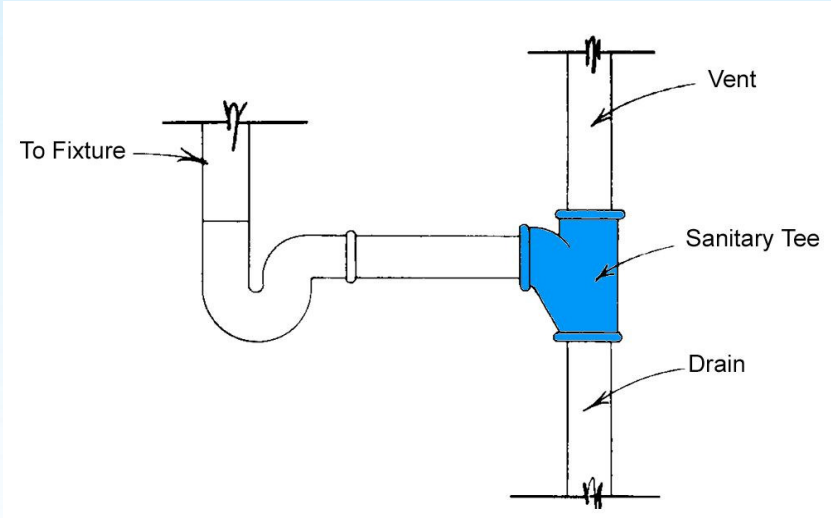
| | |
|---|---|
| Water Closet | = 75 mm |
| Lavatory | = 32 mm |
| Shower | = 50 mm |
| Bathtub | = 37 mm |
| Kitchen Sink | = 50 mm |
| Laundry Sink | = 37 mm |
| Clothes Washer | = 50 mm |

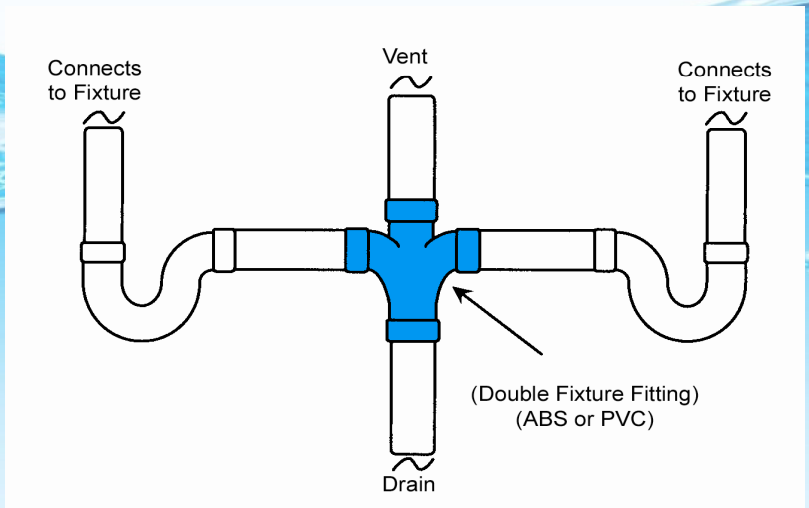
**Figure 7-9**
**Sizing the Drainage System**

# Fixture Connections

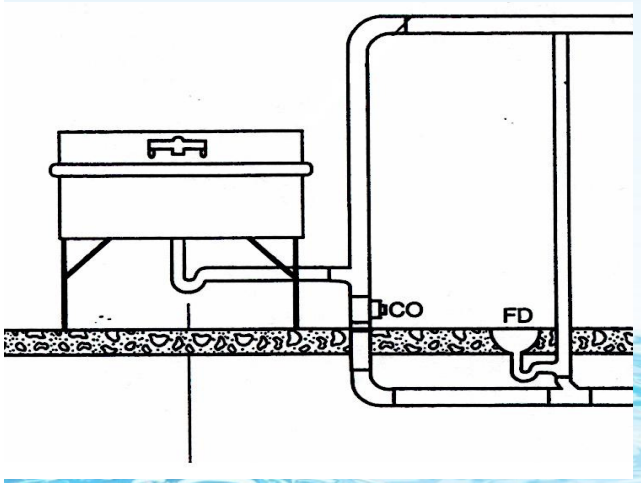
- For single fixture, use sanitary (Swept) Tee
- Two fixtures set back to back may be served by a single drainage pipe if approved double fixture fitting is used

# Sanitary Tee (Swept Tee) and Double Fixture Fitting



# Fixture Connections



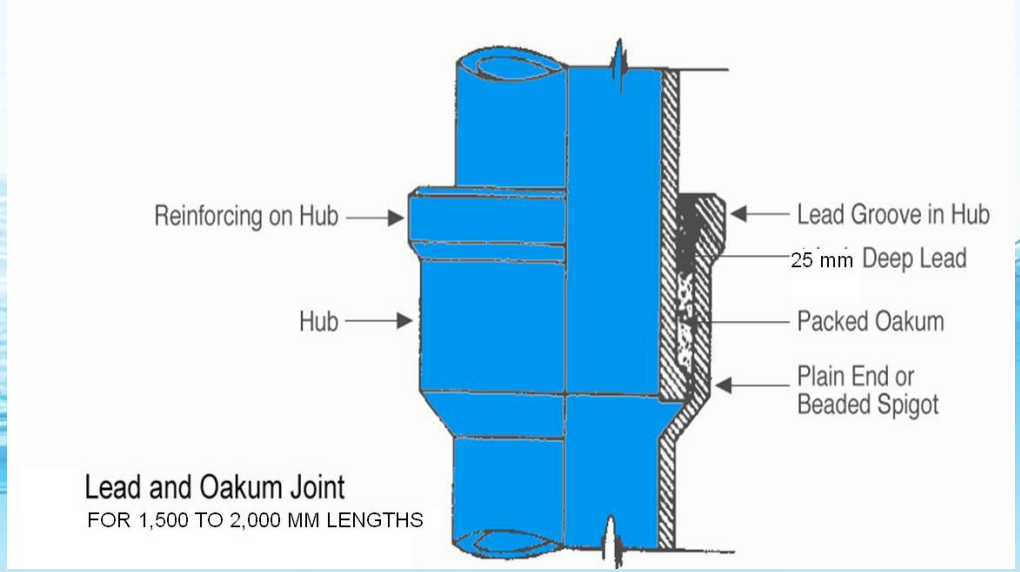

Pot sinks, scullery sinks, dishwashing sinks, silverware sinks, commercial dishwashing machines and other similar fixtures shall be connected directly to the drainage system

- A floor drain shall be placed adjacent to the fixture

**Typical Commercial Kitchen**

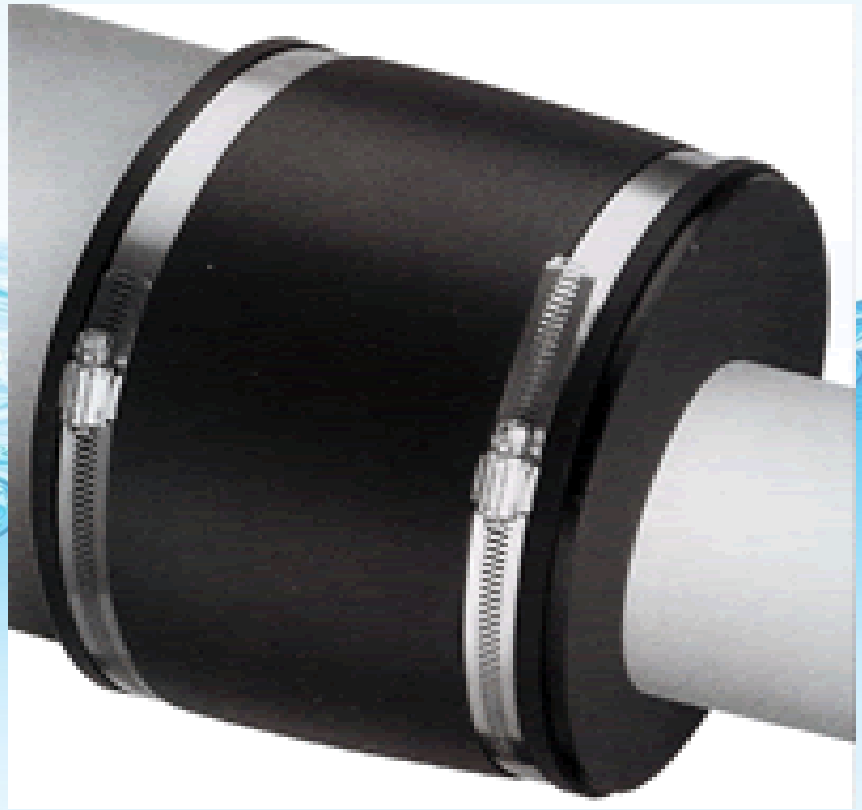
# Joints and Connections.

## Caulked Lead Joint




The Epoxy or other chemical sealants such as "Drip seal are fast replacing the lead joints in India. The depth of sealant to be filled shall be as per recommendations of the manufacturer.

# Molded Rubber Transition Coupling



# Changes in Direction of Flow.

1. Flow from vertical pipe into horizontal pipe.
2. Flow from horizontal pipe into vertical pipe.
3. Flow from horizontal pipe into another horizontal pipe.

In the case of buried external gravity sewers, changes in direction may also be achieved using inspection chambers/manholes.

# Cleanouts

- Each cleanout fitting for cast iron pipe shall consist of a cast iron or brass body and a approved plug.

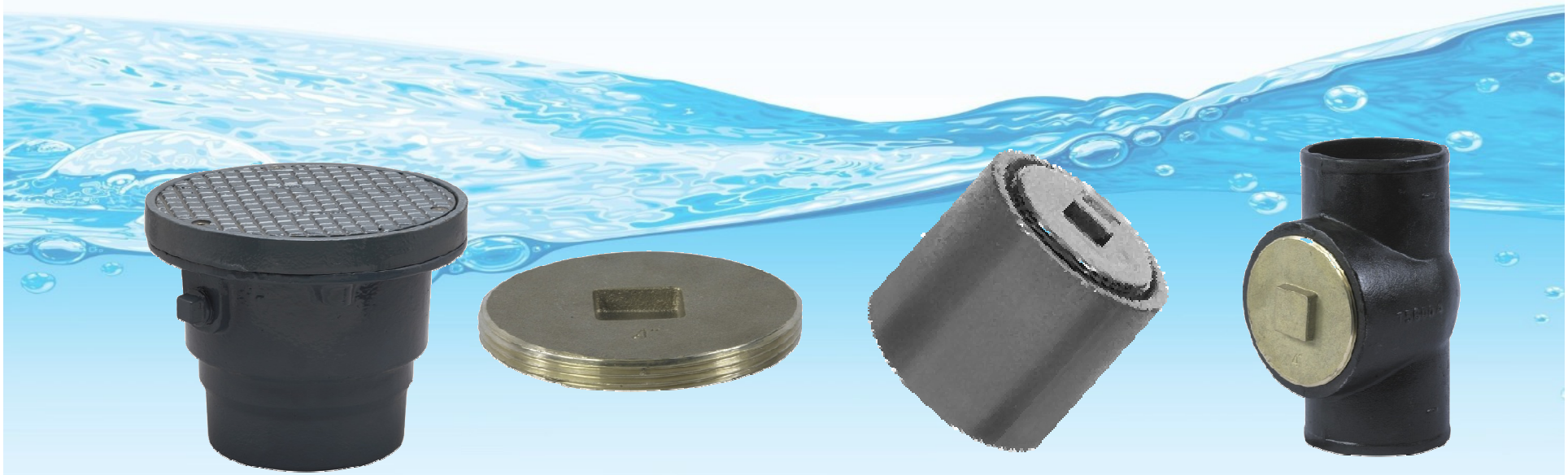
- Each cleanout for galvanized wrought iron, galvanized steel, copper, or brass pipe shall consist of a brass plug as specified in Table 707.1, or a standard weight brass cap, or an approved ABS or PVC plastic plug, or an approved stainless steel cleanout or plug.

- Plugs shall have raised square heads or approved countersunk rectangular slots.

# Minimum Size Cleanout –90mm

# Cleanouts

- Each cleanout fitting and each cleanout plug or cap shall be of an approved type.



# Cleanout Installations

# Cleanout Requirements

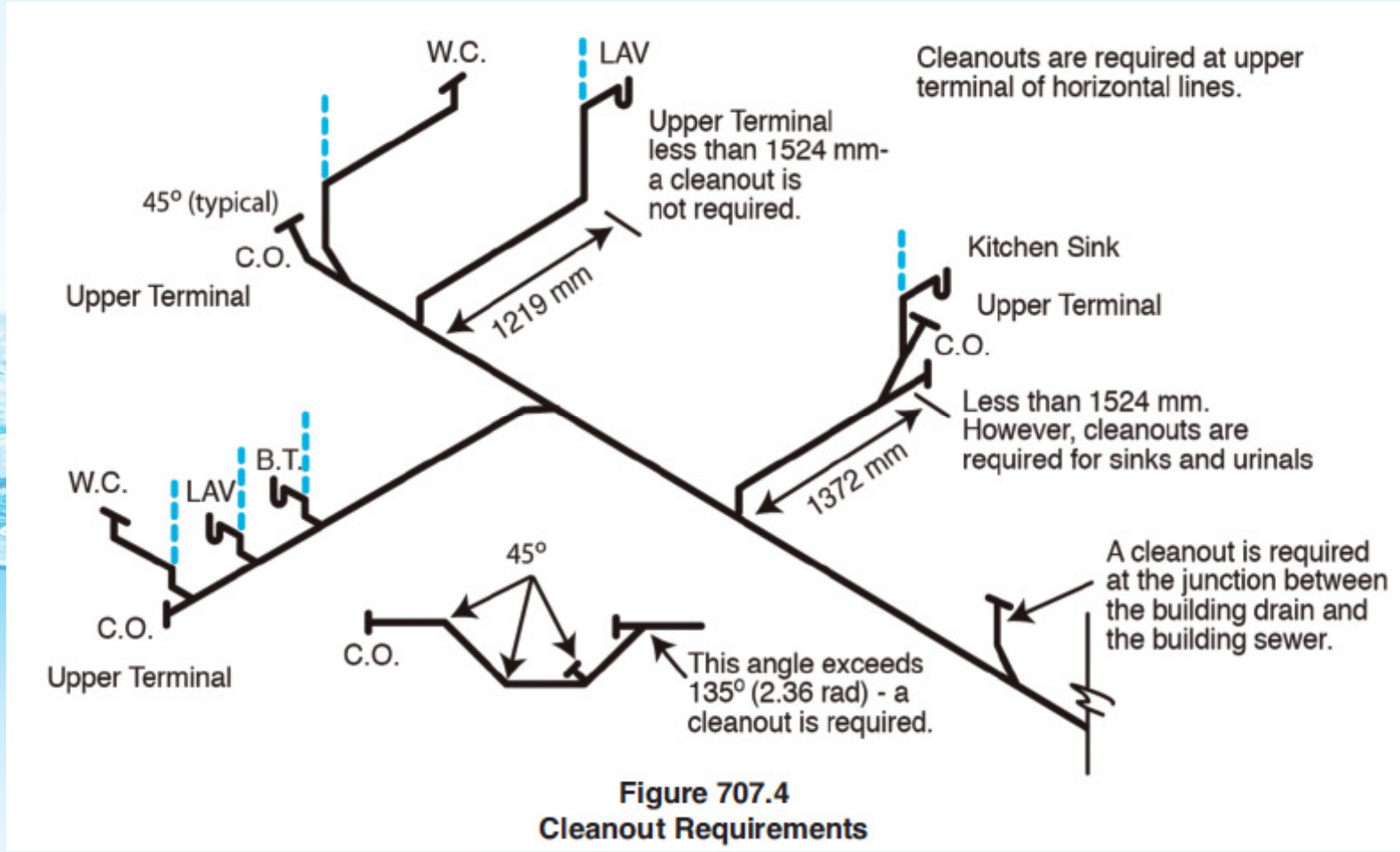
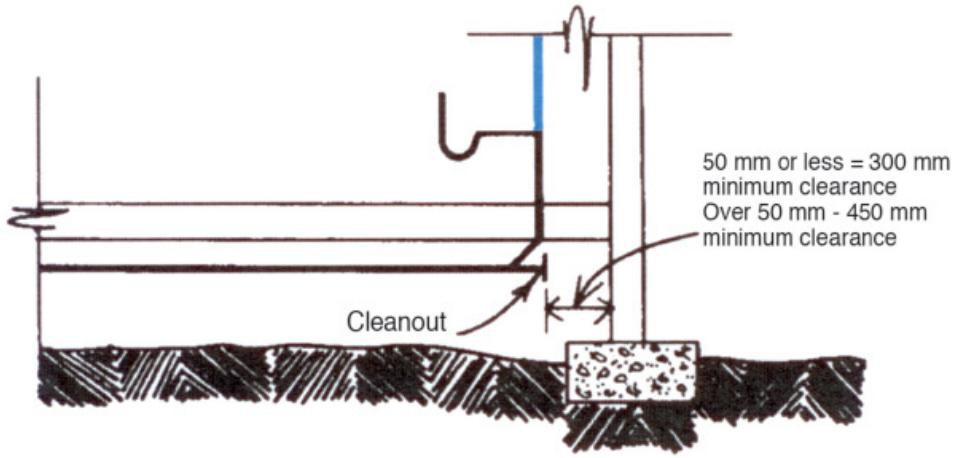



**Figure 707.4**
**Cleanout Requirements**



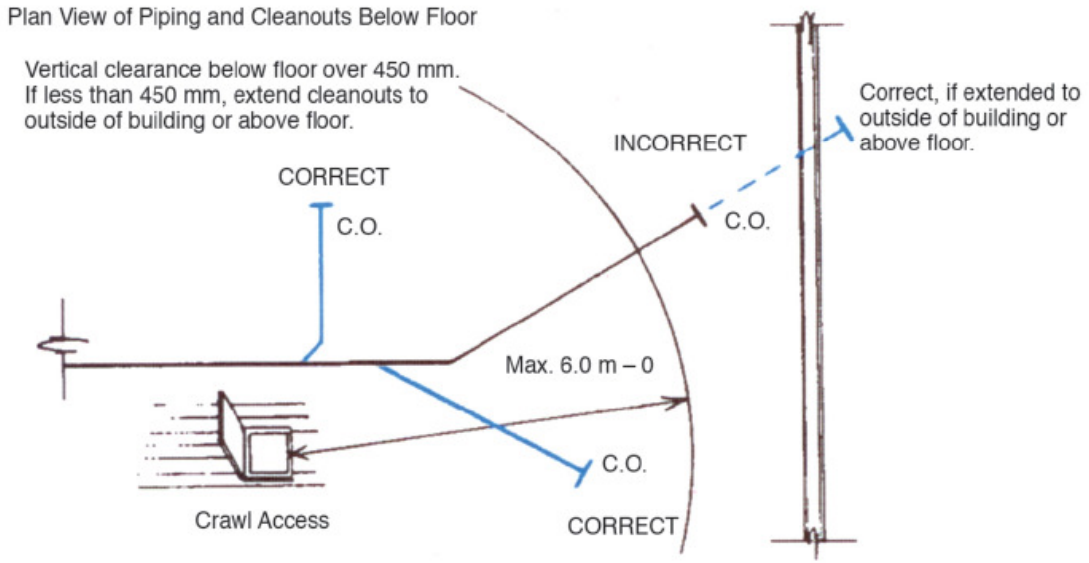




**Figure 707.9**
**Cleanout Access**

# Grade of Horizontal Drainage Piping

- Horizontal drainage piping of 100 mm diameter and smaller shall be installed in practical alignment and a uniform slope of not less than 1:50.
- Where it is impractical, to maintain a slope of 1:50, pipe of 100 mm or larger in diameter may have a slope of not less than 1:100.
- 150 mm diameter pipe shall be sloped at 1:100.
- For pipes above 150 mm diameter, flatter slopes shall be permitted.

# Gravity Drainage Required

- Where practicable and as far as possible, all fixtures shall drain by gravity to sewer.
- In unavoidable circumstances and when contours/ levels don't permit, forced system through pumping may be permitted.

# Gravity Flow To Sewer

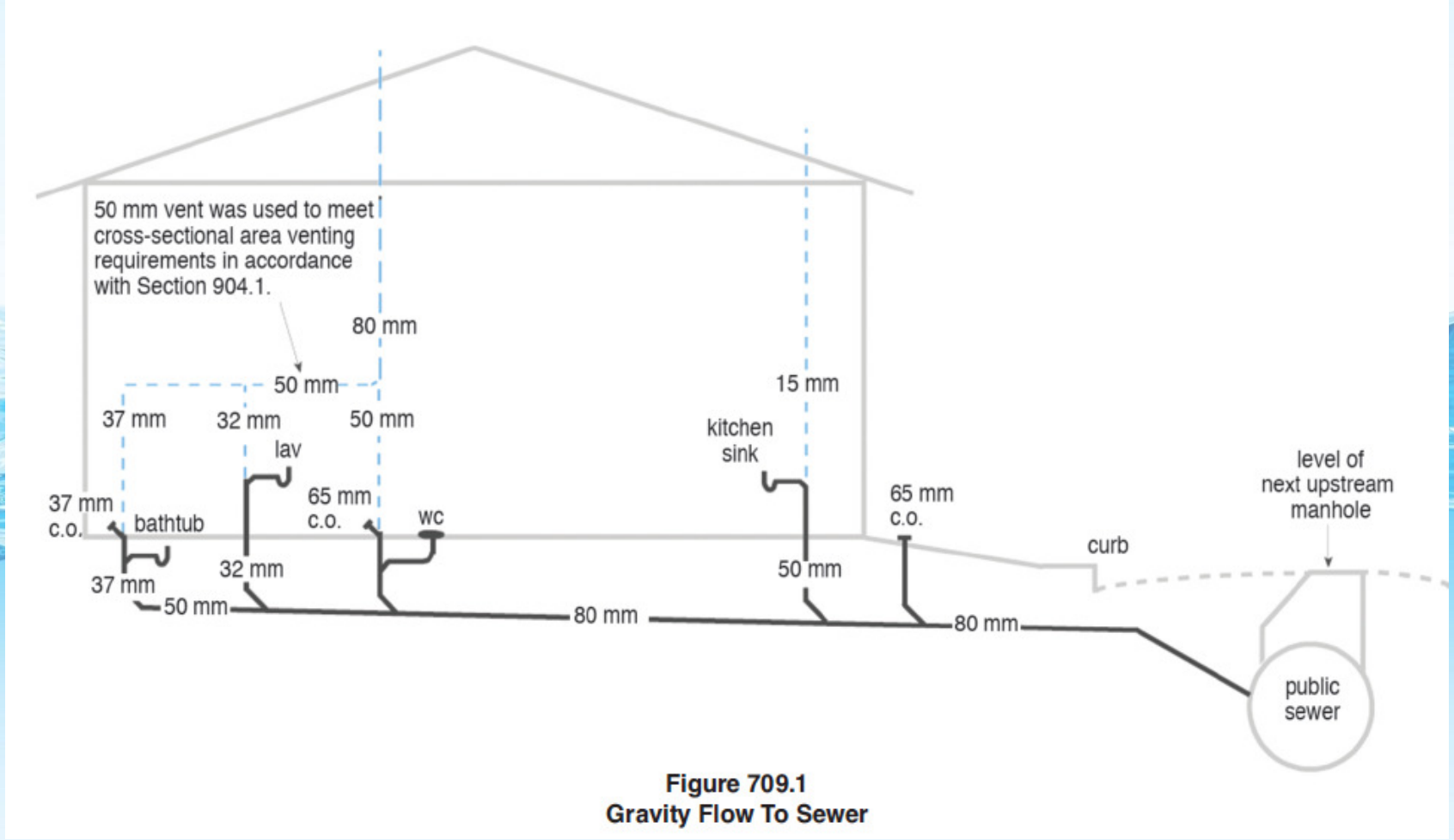



**Figure 709.1**
**Gravity Flow To Sewer**

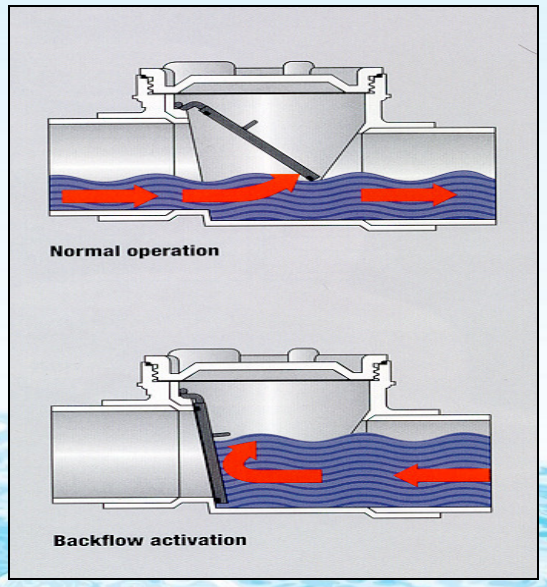
# Drainage of Fixtures With Flood Level Rim Located Below Upstream Manhole

- Shall be protected from backflow by a backwater valve

- Fixtures located above shall not discharge through backwater valve

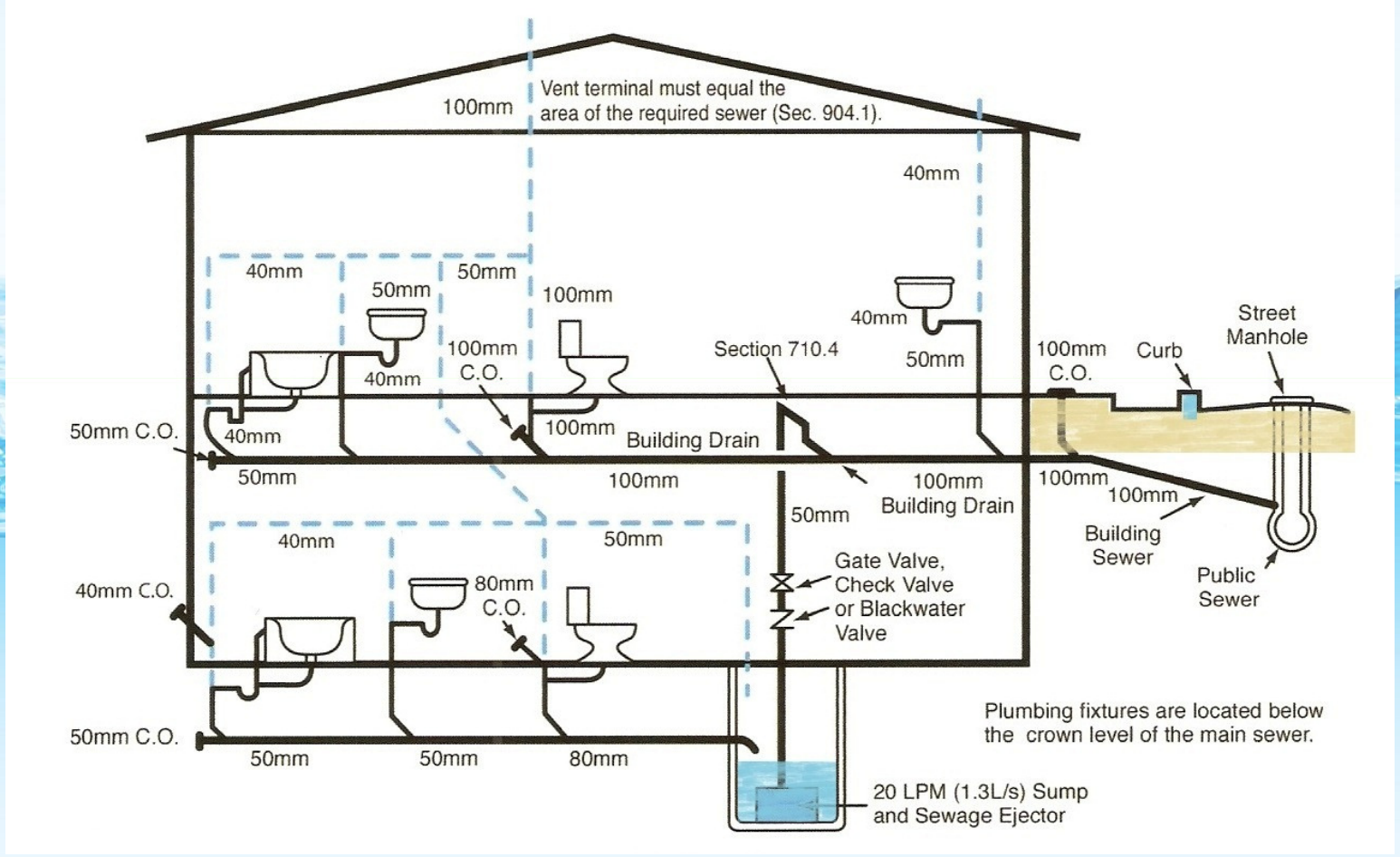
# Flooding - No Back water Valve

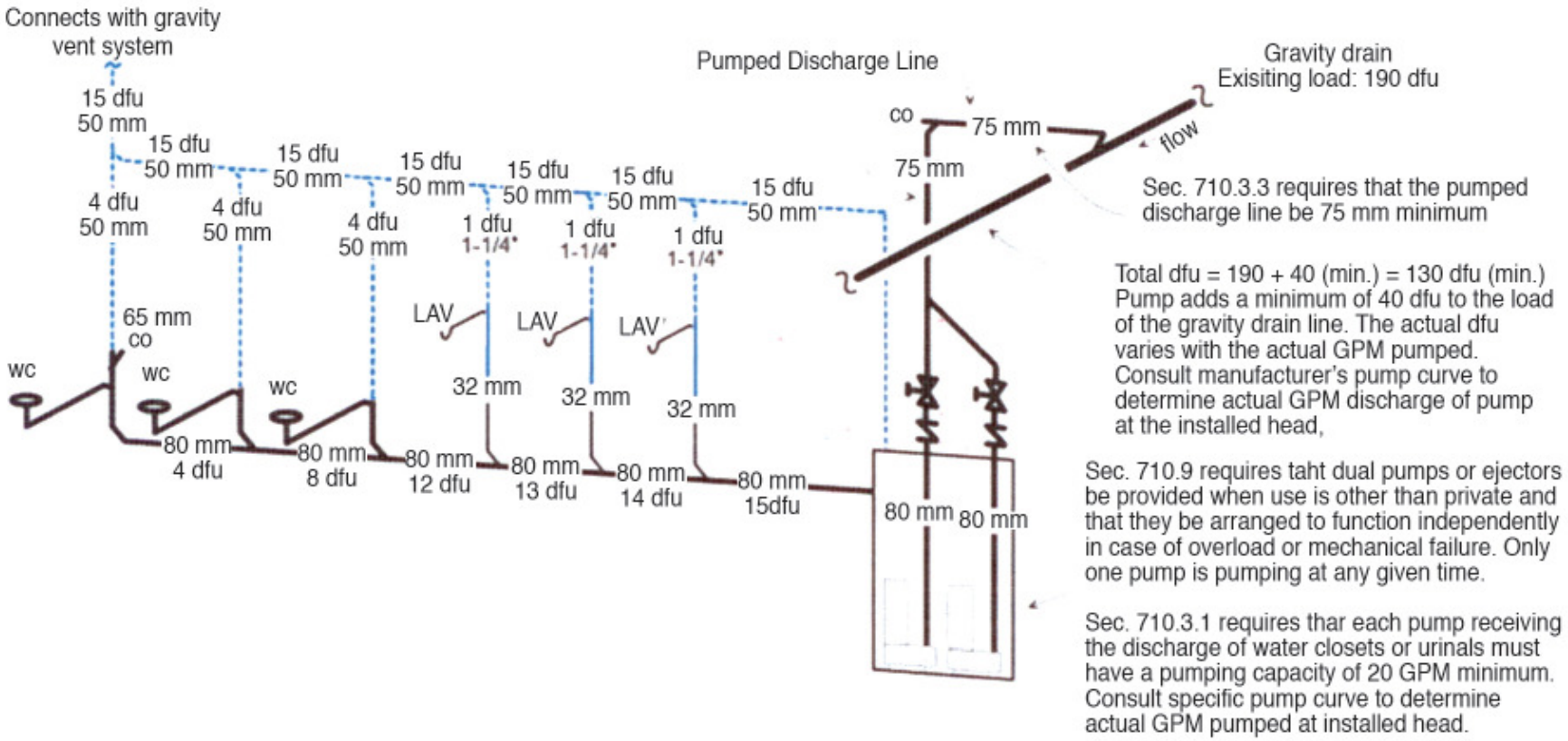
# Back Water Valve




- Accessible
- Bodies of cast iron plastic or brass
- Non corrosive bearings and seats
- Self aligning disc
- Positive seal
- Valve covers bolted with gasket

# Fixtures Located Below the Sewer Level and Dual Sump Pump Installation






Sec. 710.3.3 requires that the pumped discharge line be 75 mm minimum

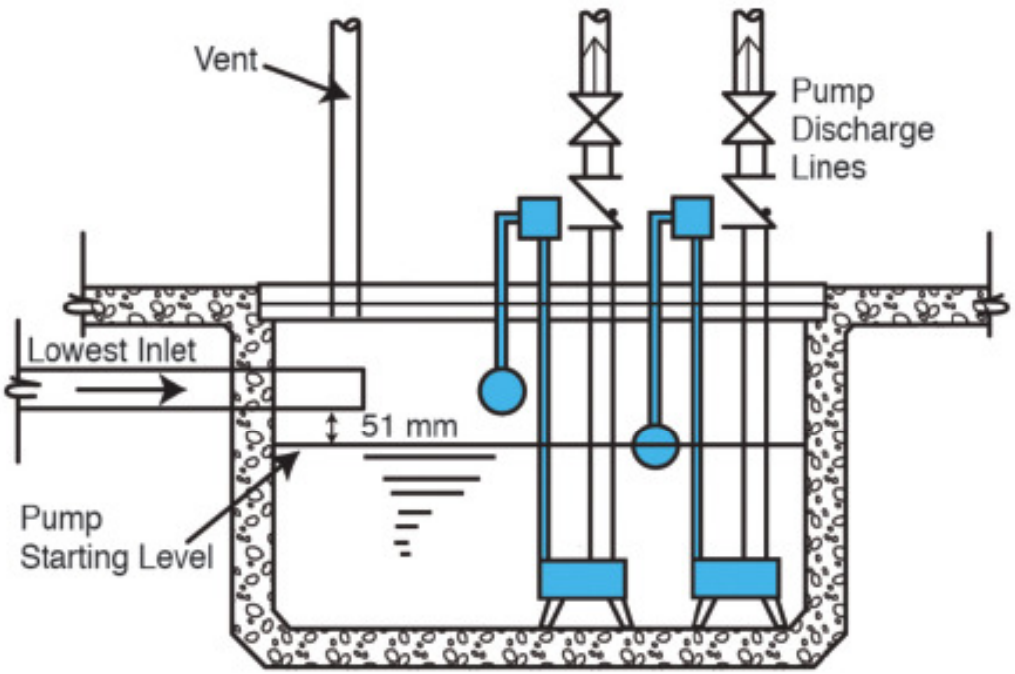
Total dfu = 190 + 40 (min.) = 130 dfu (min.)
Pump adds a minimum of 40 dfu to the load of the gravity drain line. The actual dfu varies with the actual GPM pumped. Consult manufacturer's pump curve to determine actual GPM discharge of pump at the installed head,

Sec. 710.9 requires taht dual pumps or ejectors be provided when use is other than private and that they be arranged to function independently in case of overload or mechanical failure. Only one pump is pumping at any given time.

Sec. 710.3.1 requires thar each pump receiving the discharge of water closets or urinals must have a pumping capacity of 20 GPM minimum. Consult specific pump curve to determine actual GPM pumped at installed head.

**Figure 710.3**
**Fixtures Located Below the Sewer Level and Dual Sump Pump Installation**

# Sump Pump Installation
# ( 1 duty + 1 standby)




Arranged to Function Independently in Case of Overload or Mechanical Failure

**Figure 710.9**
**Dual Sump Pump Installation**

# Suds Relief

- Drainage connections shall not be made within 2,400 mm of any vertical to horizontal change when suds producing fixtures are present
- Bathtub, laundry sink, washing machine, kitchen sink, dishwashers are suds producing
- Parallel vent stacks shall connect

  2,400 above lowest point

- Exception:
  - Single family residence and stacks under 3 stories

# Suds Relief in the Drainage System

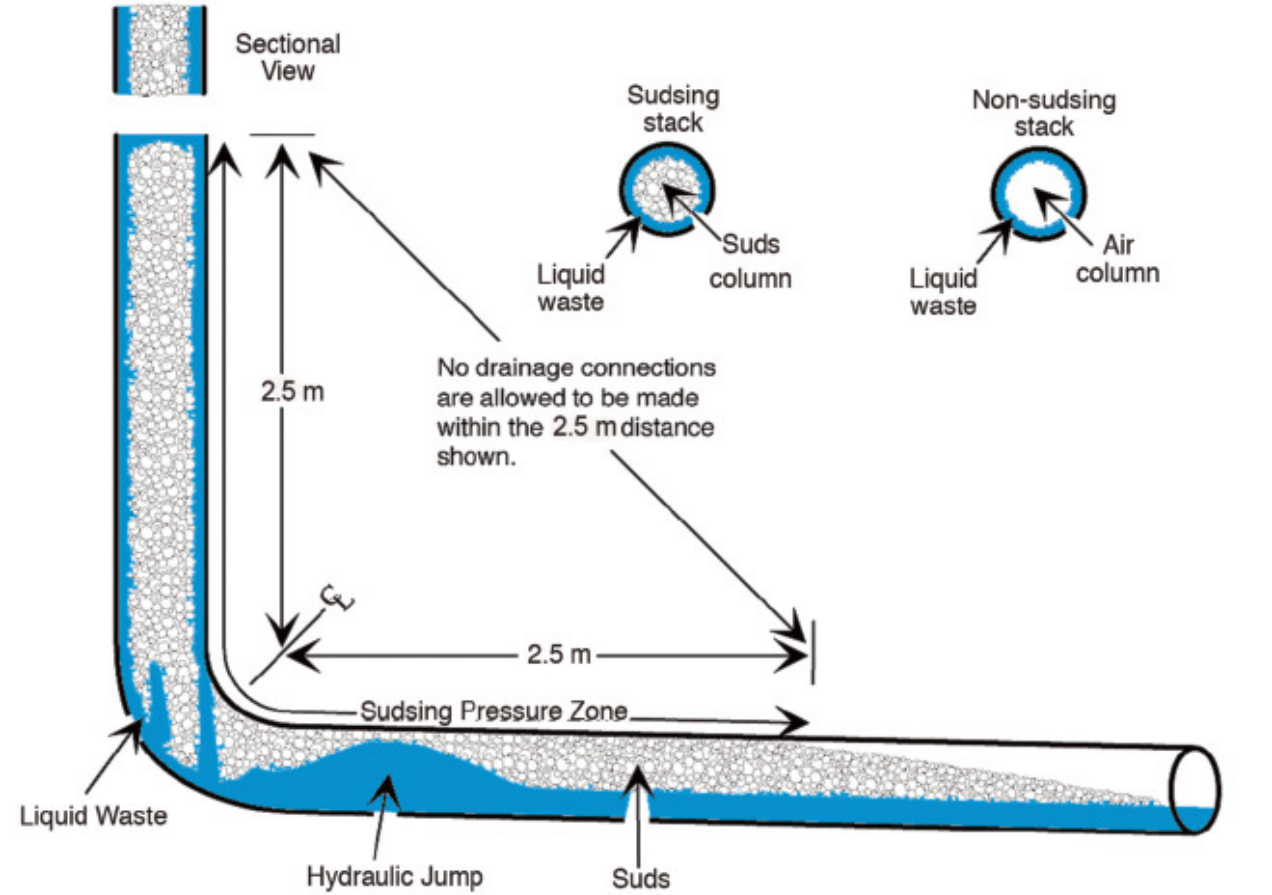
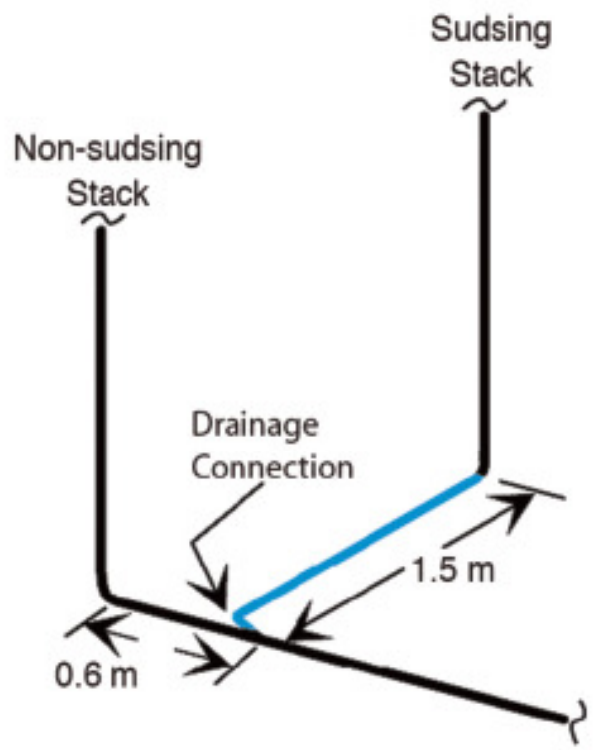
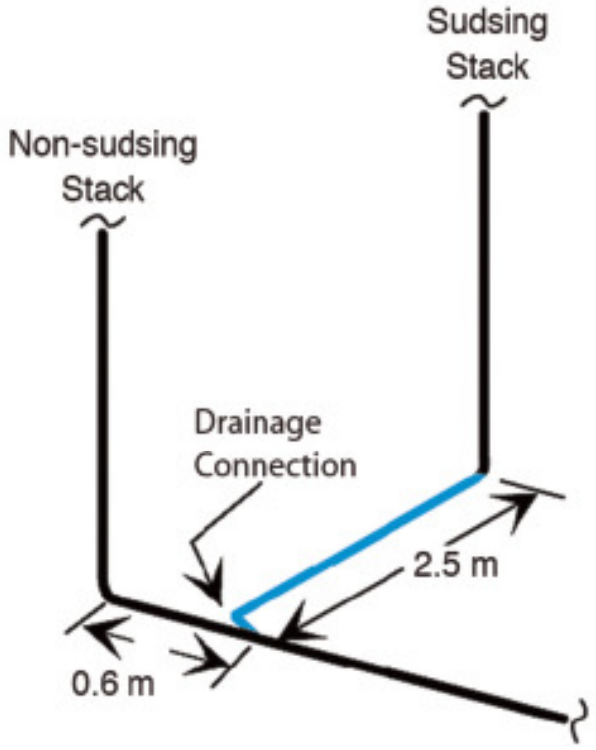



**Figure 711.1a**
**Suds Relief in the Drainage System**

# Suds Relief in the Drainage System




**INCORRECT**
Does not comply with requirements of Section 711.0




**CORRECT**
Complies with requirements of Section 711.0

# Testing

**Media.**

The piping of the plumbing drainage, and venting systems shall be tested with water or air, except that plastic pipe shall not be tested with air. **Air Test** to be conducted with a min. uniform pressure of 0.35 bar for min. 15 minutes.

The **Water Test** shall be applied to the drainage and vent systems either in its entirety or in sections with min. 1,800 mm head of water for min. 15 minutes.

Precautions shall be taken while doing **Smoke Test** on plastic DWV system since certain smokes are knows to affect plastic pipes.

## Smoke Test

All soil pipes, waste pipes and vent pipes when above ground shall be approved gas tight by a smoke test conducted under a pressure of 25 mm of water and maintained for 15 minutes after all trap seals have been filled with water. The smoke is produced by burning waste or tar paper or similar material in the combustion chamber of smoke machine.

## Water Test

All soil pipes and waste pipes shall be subjected to a test pressure of at least 1.8 m head of water at the highest point of the section under test. The tolerance figure of 2 litre/ cm of diameter/ Km may be allowed during a period of 10 min. The test shall be carried out by suitably plugging the low end of the drain and the ends of connections and filling the system with water and testing for a period of 15 min.

# Part II - Building Sewers


In India, large building complexes such as this will need the provision of external drainage / building sewers with gulleys, chambers, manholes and a sewer trap.

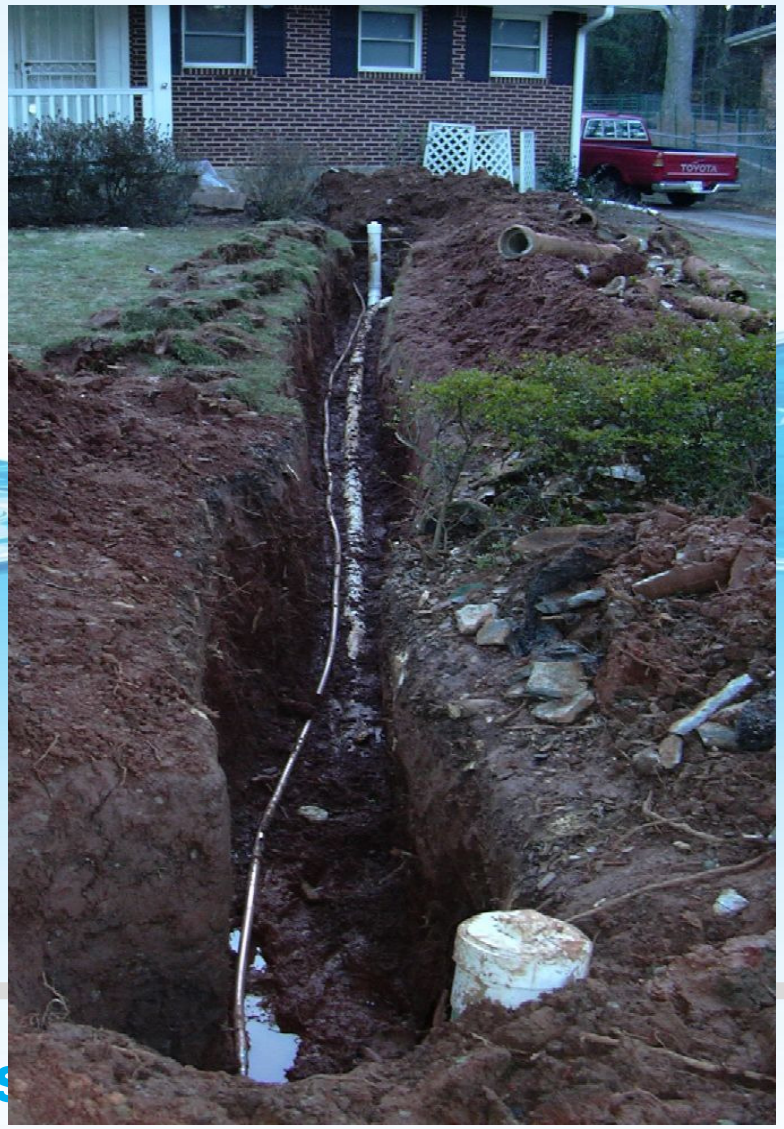
This is because of use of underground RCC pipes which do not have matching fittings. We therefore can not adopt fully sealed system.

- Sewer Definition:

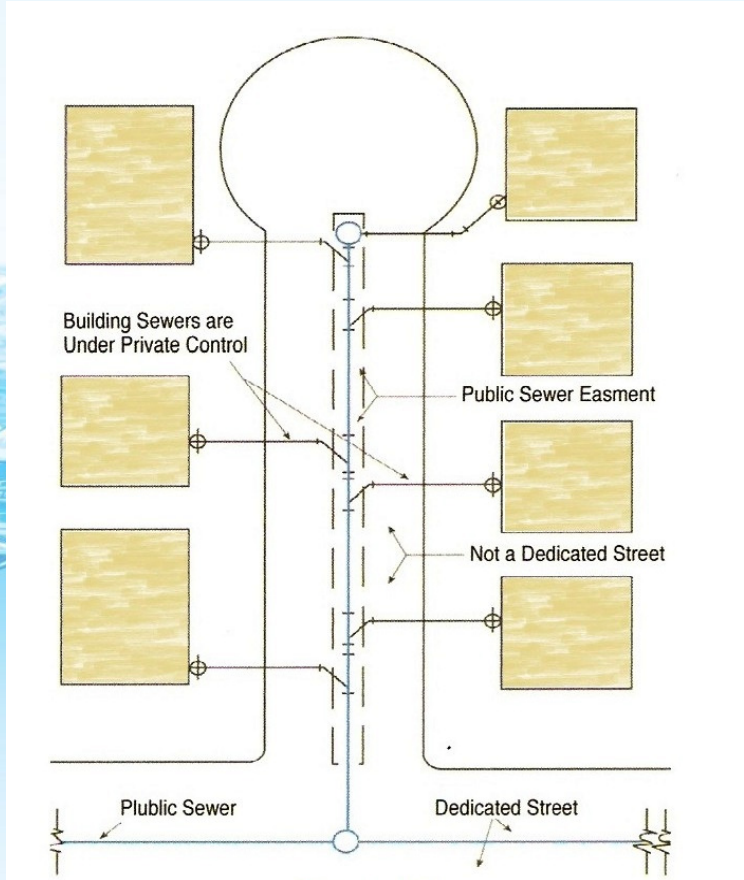
That part of the horizontal piping of a drainage system which extends from the end of the building drain (600 mm outside of the building) and;

- Receives the discharge of the building drain and;

- Conveys it to a public sewer, private sewage disposal system or other point of disposal



# Public Sewer System – Individual Connections

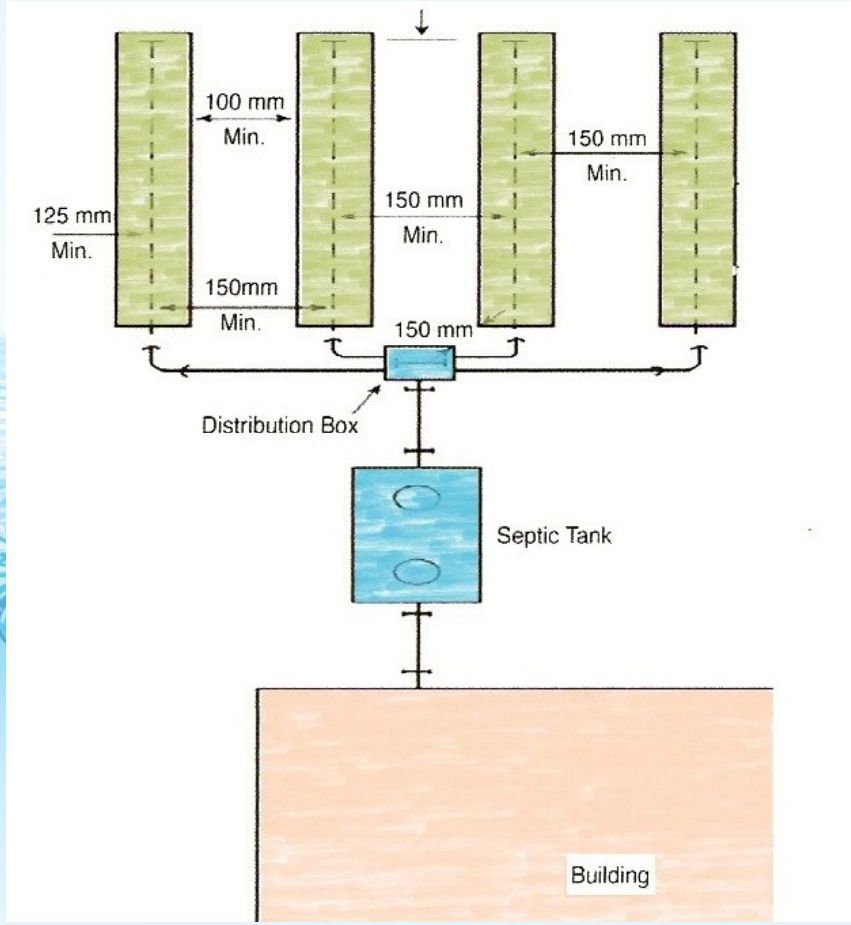



This type of system is not practiced in India.

In India the Vertical drains from the building are connected to Chambers which in turn connect to Manholes on the street

# Private Sewage Disposal System

## If public sewer is non-existent



# Damage to Public Sewer or Private Sewage Disposal System.

It shall be unacceptable for any person to deposit any ashes, solids; flammable, poisonous, or explosive liquids or gases; oils, grease etc. that would cause damage to the public sewer, private sewer, or private sewage disposal system.

- No rain, surface, or subsurface water shall be connected to or discharged into any drainage system.

# Sizing of Building Sewers.

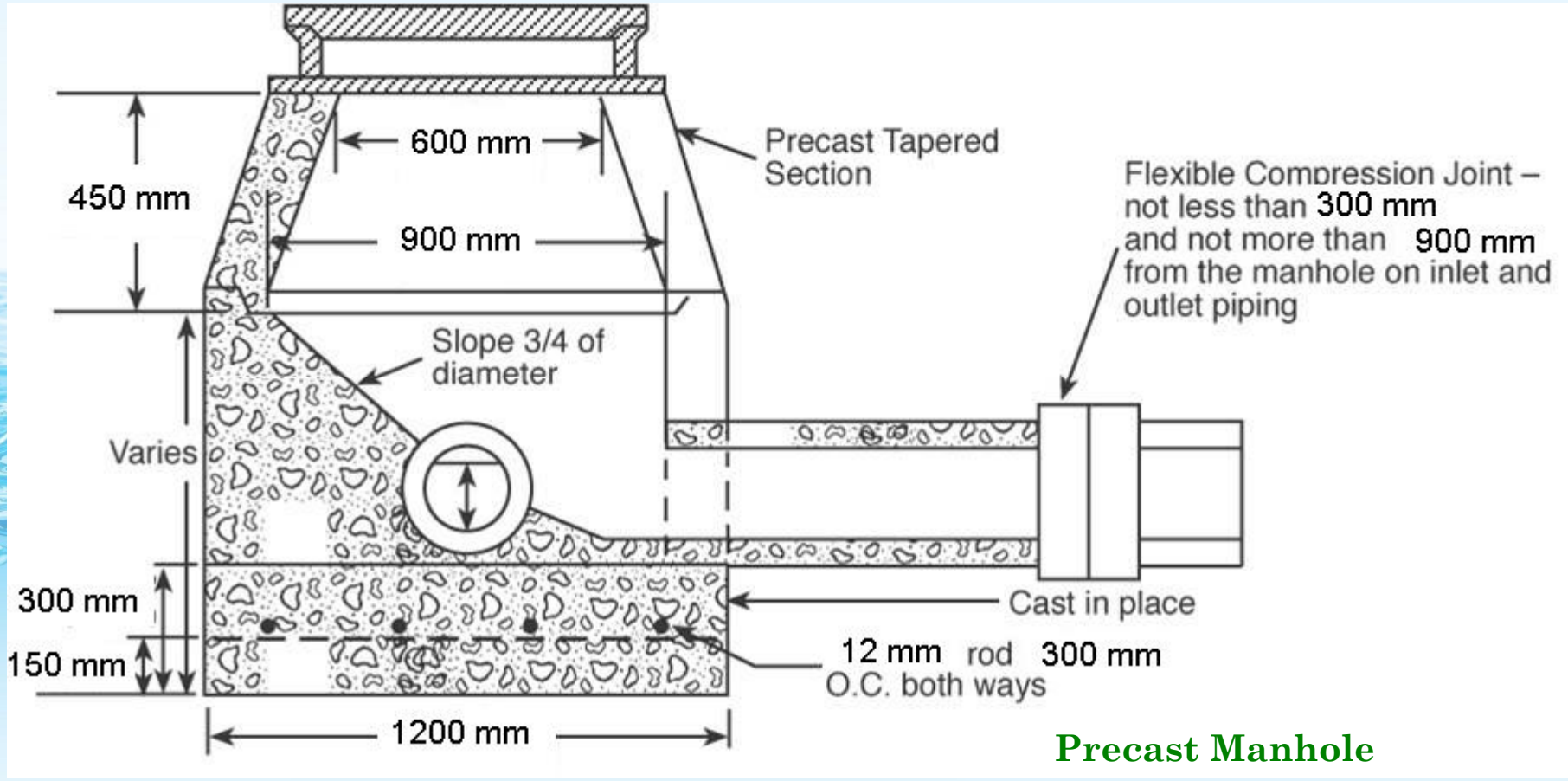
The minimum size of any building sewer shall be determined on the basis of the total number of DFU drained by such sewer

**TABLE 717.1**
**Maximum/Minimum Fixture Unit Loading on Building Sewer Piping**

| Size of Pipe | Slope | | |
|---|---|---|---|
| (mm) | 1:200 (0.5%) | 1:100 (1%) | 1:50 (2%) |
| 150 | (As specified in Table 703.2/No minimum loading) | | |
| 200 | 1,950/1,500 | 2,800/625 | 3,900/275 |
| 250 | 3,400/1,600 | 4,900/675 | 6,800/300 |
| 300 | 5,600/1,700 | 8,000/725 | 11,200/325 |

*See also Appendix H, Private Sewage Disposal Systems. For alternate methods of sizing drainage piping, see Appendix C*

# Construction of Manholes




Precast Manhole

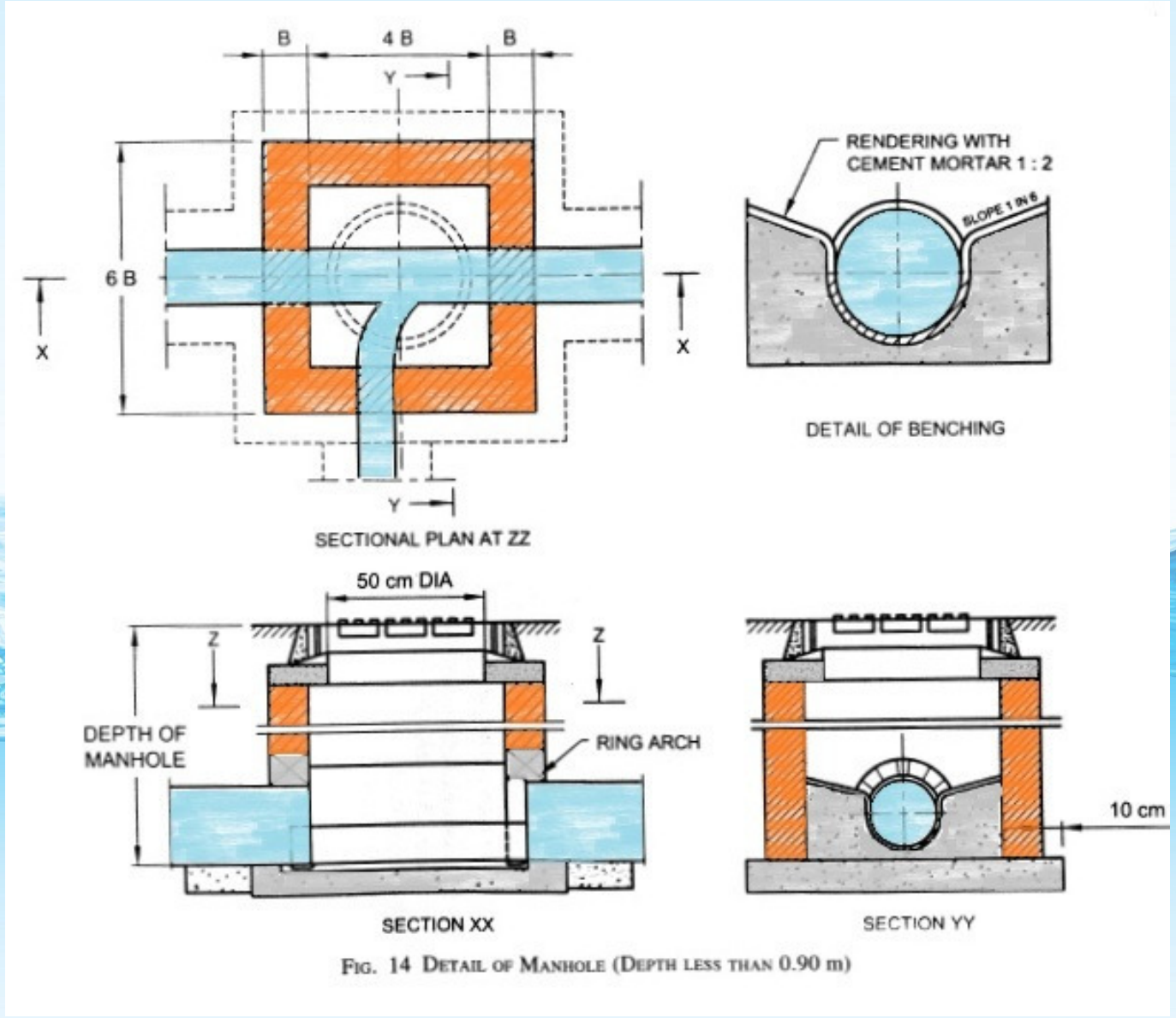
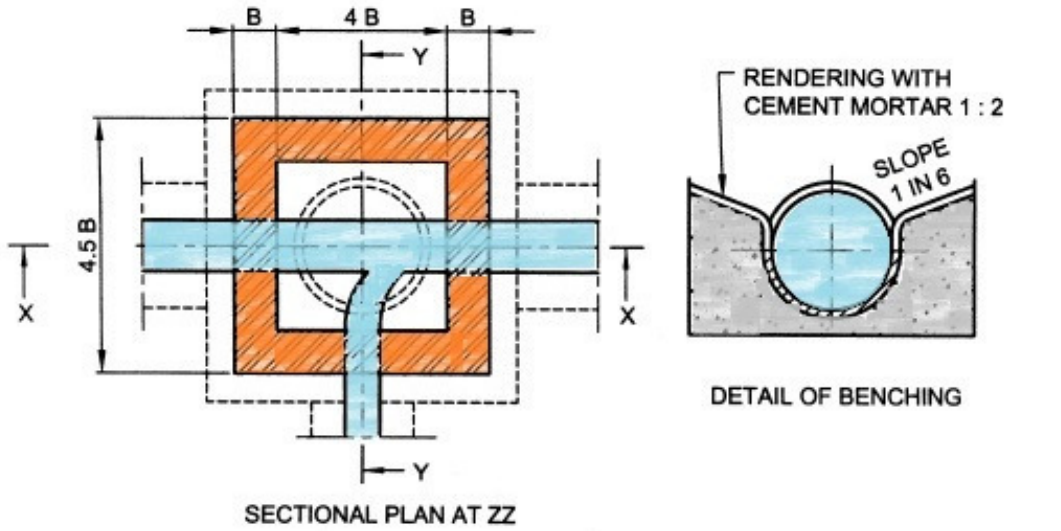
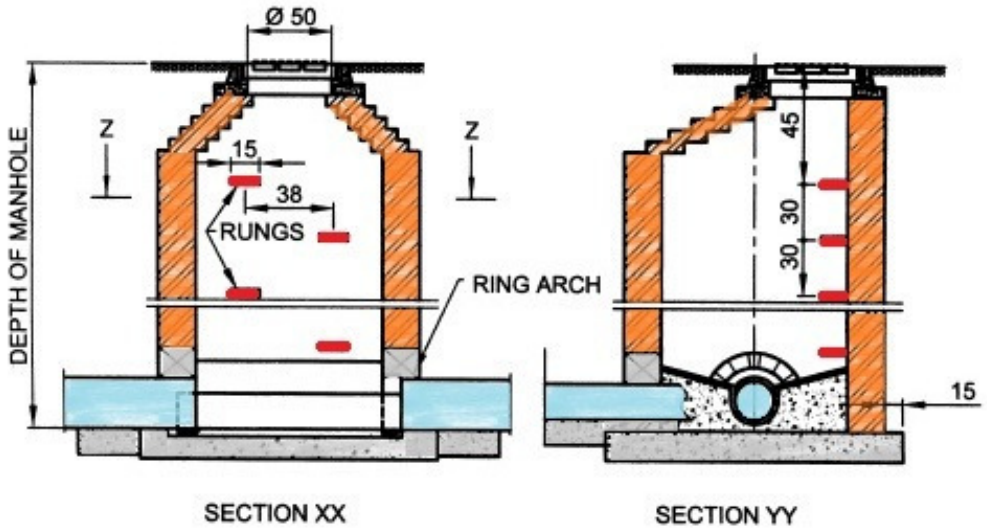


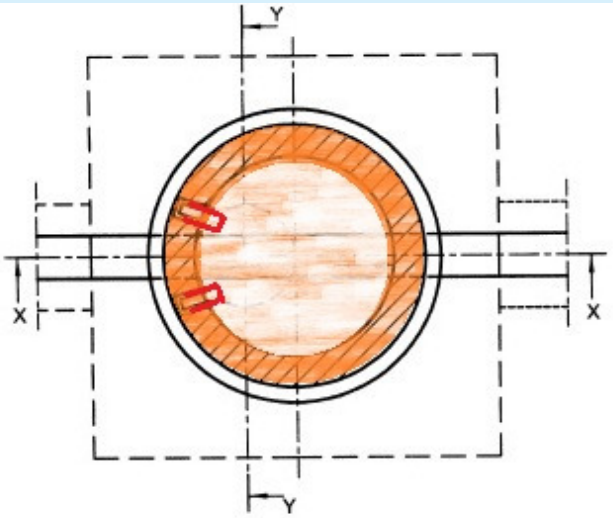

FIG. 14 DETAIL OF MANHOLE (DEPTH LESS THAN 0.90 m)



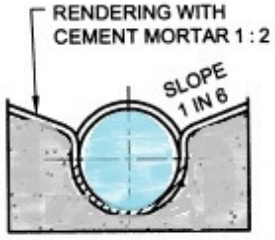




All dimensions in centimetres.

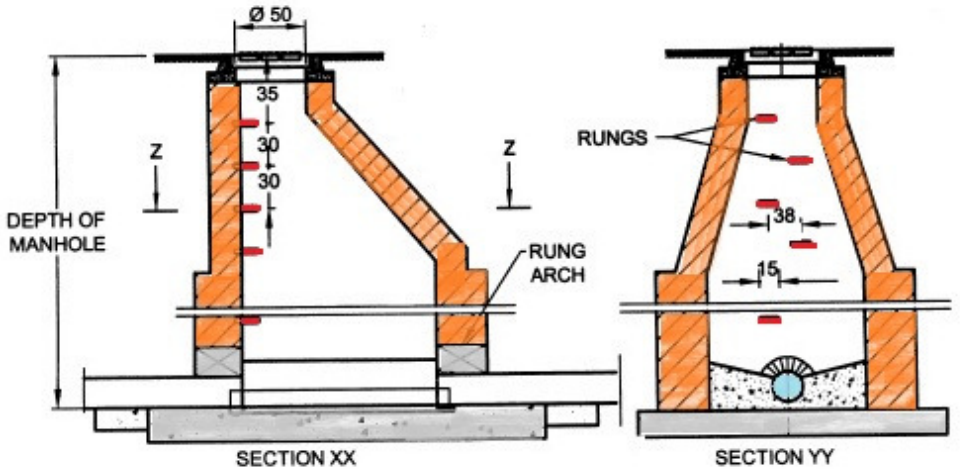
FIG. 15 DETAIL OF MANHOLE (DEPTH FROM 0.9 m AND UP TO 2.5 m)




SECTIONAL PLAN AT ZZ

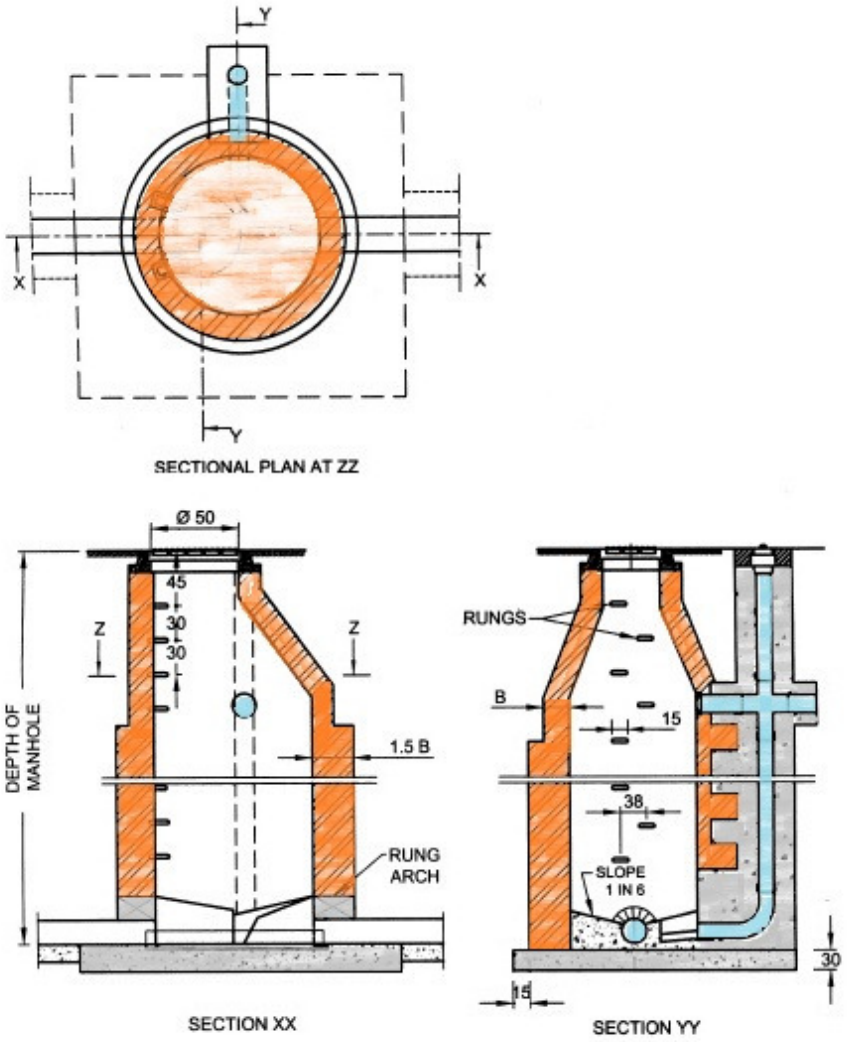



DETAIL OF BENCHING




All dimensions in centimetres.

FIG. 16 DETAIL OF MANHOLE (DEPTH 2.5 m AND ABOVE)




**Drop Manhole**

# Sewer and Water Pipes

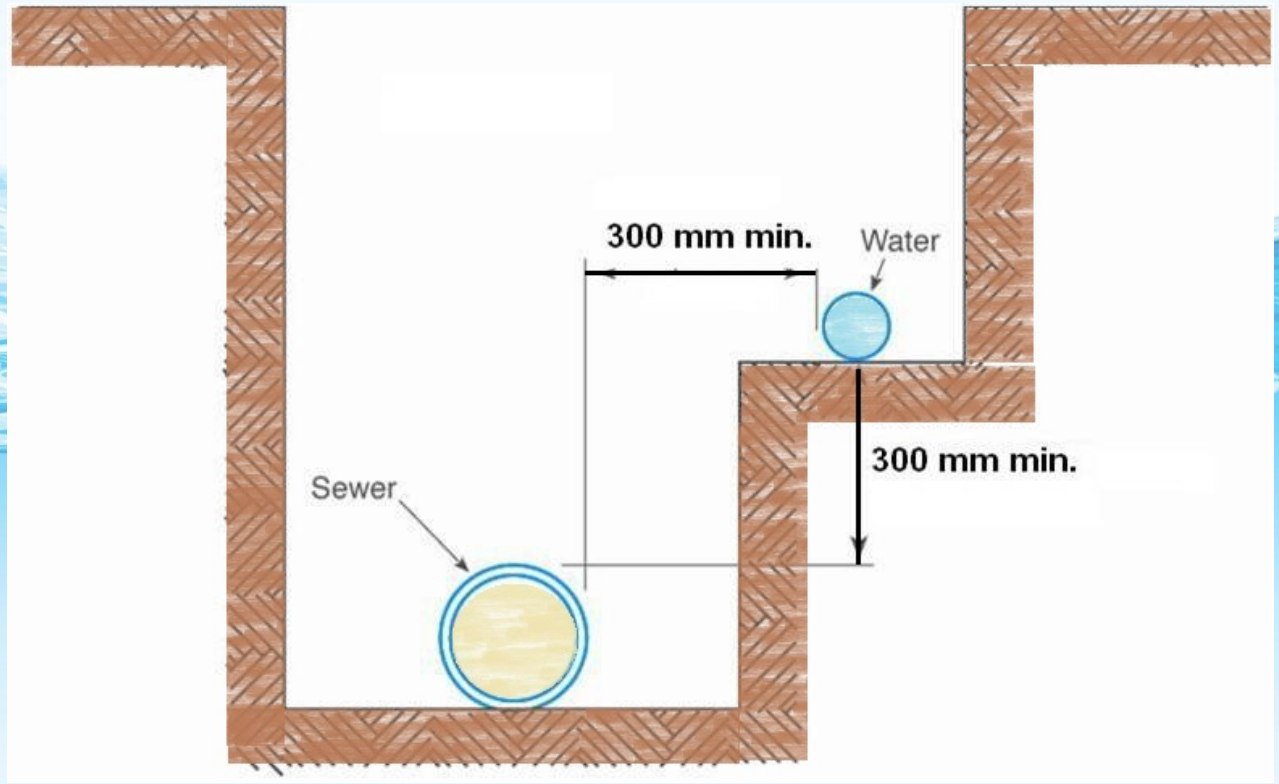
Piping of clay or other materials not approved within the building shall not be run in same trench with water lines unless;

- Bottom of water pipe 300 mm above sewer at all points
- Water pipe shall be placed on a solid shelf at one side of the common trench with a horizontal clearance or at least 300 mm from the drain
- Water line crossing shall be 300 mm above

# Grade, Support, and Protection of Building Sewers

- Building sewer piping shall be laid on a firm bed throughout its entire length, and any such piping laid in made or filled-in ground shall be laid on a bed of approved materials and shall be adequately properly supported as required to the satisfaction of by the Authority Having Jurisdiction.

# Separation of Sewer and Water Lines

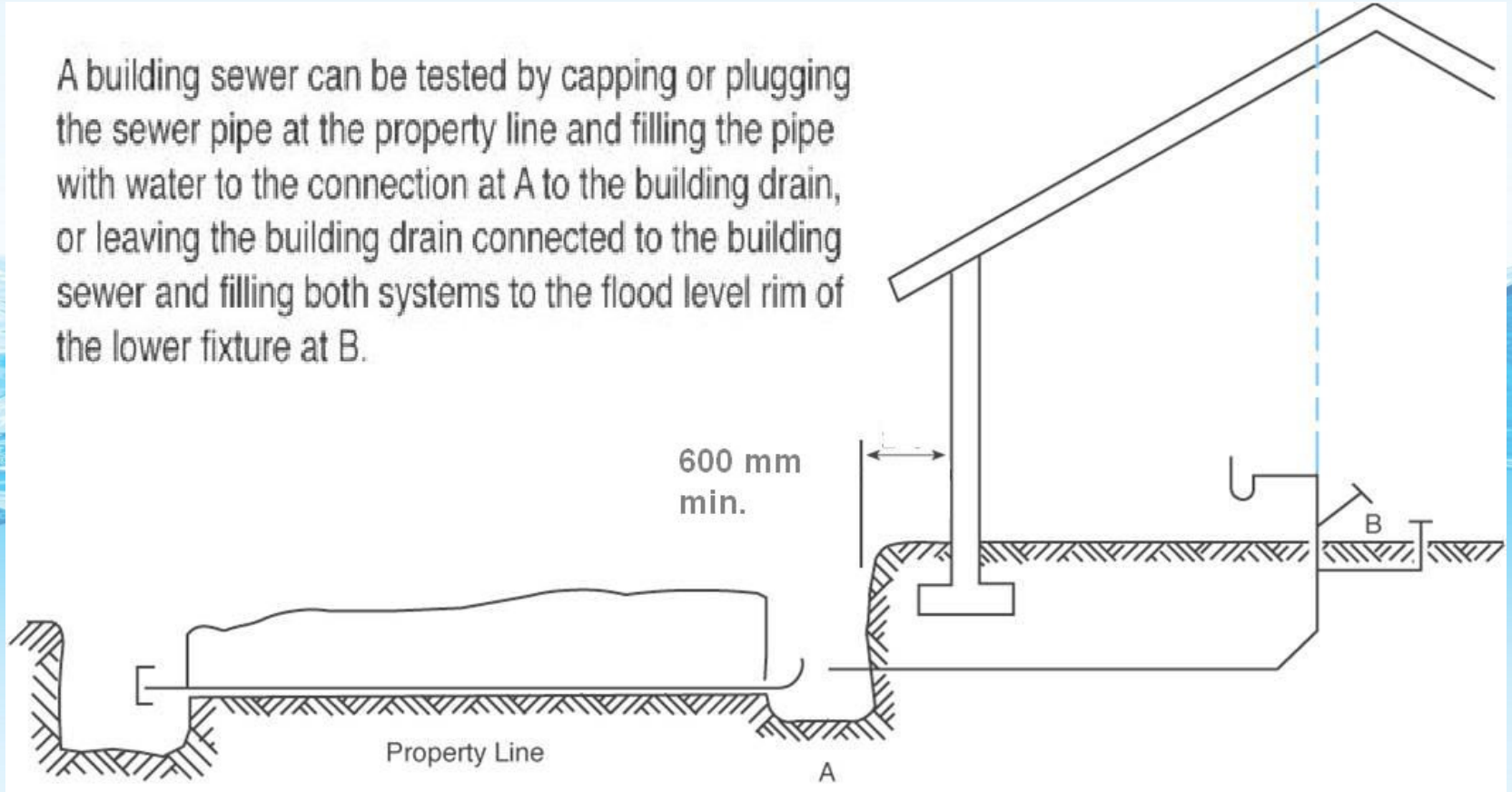


# Location.

| Minimum Horizontal Distance Required From Building Sewer | |
|---|---|
| Buildings or structures[1] | 600 mm |
| Property line adjoining private property | Clear |
| Water supply wells | 15 m |
| Streams | 15 m |
| On-site domestic water service line | 300 mm |
| Public water main | 3 m |

# Building Sewer Test

A building sewer can be tested by capping or plugging the sewer pipe at the property line and filling the pipe with water to the connection at A to the building drain, or leaving the building drain connected to the building sewer and filling both systems to the flood level rim of the lower fixture at B.



# Sewer Sizing

| 1 : 50 | | 1 : 100 | |
|---|---|---|---|
| A | 100 mm | A | 100 mm |
| B | 75 mm | B | 75 mm |
| C | 100 mm | C | 100 mm |
| D | 75 mm | D | 100 mm |
| E | 75 mm | E | 75 mm |
| F | 100 mm | F | 100 mm |
| G | 100 mm | G | 100 mm |
| H | 100 mm | H | 100 mm |
| J | 75 mm | J | 100 mm |
| K | 100 mm | K | 100 mm |
| L | 100 mm | L | 100 mm |
| M | 100 mm | M | |
| N | 100 mm | N | |
| O | 100 mm | O | |
| P | | P | |
| Q | | Q | |
| R | | R | |

(m) not permitted on
1 : 100 Section 708.0

See Table 703.2, footnote 4, for limitations on the number of water closets on 75 mm horizontal or vertical piping

This job has been sized for 21 mm/m slope and also 10 mm/m slope.
See the sizing chart at the left for correct pipe size, and compare.

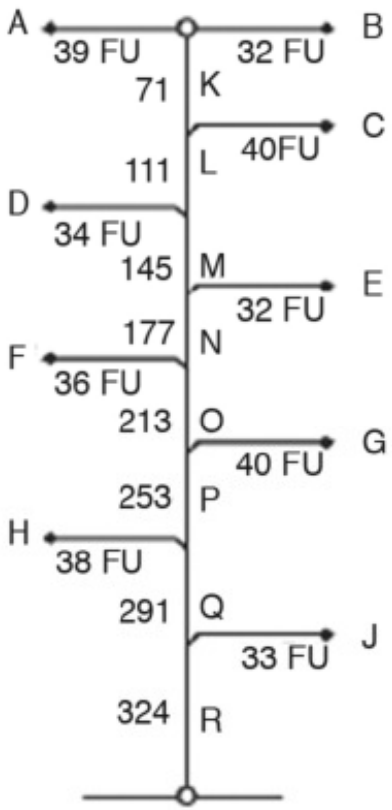



**Figure 717.1**
**Example of Sewer Sizing**

## Preamble

In the absence of municipal sewer systems in most parts of India, property owners are often required to construct own sewer networks leading to on-site treatment plants.

Many of these installations call for construction of sewage pump stations to cater to drainage from toilets, kitchens etc located in basement floors or as intermediate external pump stations to minimize depth of gravity sewers.

Project sites with varying contours also may necessitate installation of intermediate pump stations as part of the overall sewer network.

Submersible centrifugal pumps with guide-rails and lifting chains (each pump sized to handle 100% design flow) are commonly used in India.

An automatic weatherproof control panel will be part of the installation. The panel will include provision for alternating of duty pump, audio and visual alarms.

Circular sumps are preferred to avoid solids accumulating on sharp corners. The cover should have an opening large enough for withdrawal of pumps (using guide-rails and lifting chains) from ground level.

The typical example provided here is for partial black and gray water flow from a building.

## Sump Capacity

Effective holding capacity will need to be worked out in liters (cu.m).

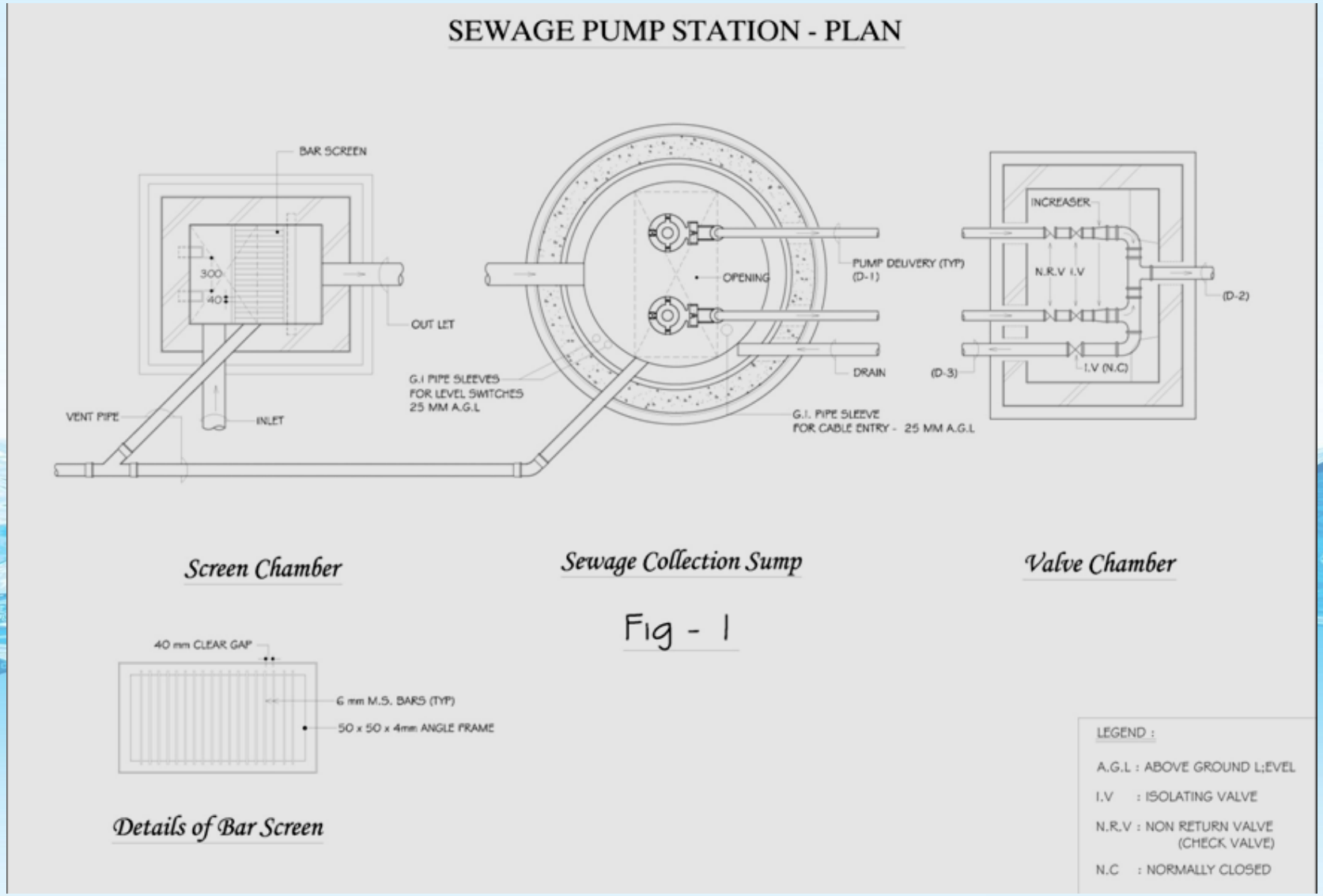
Total flow from all sanitary fixtures draining to the sump needs to be calculated in LPS ($m^3$/Hr).

The retention time of sewage in the sump should be determined limiting the number of starts of pump(s) per hour.

Various manufacturers specify differing number of starts permissible per hour (usually 20 to 30). A retention time of 10 minutes can be considered limiting number of the starts to 12 per hour with single pump operating.

# Salient Features

- DFUs are not exactly comparable to WSFUs. DFU indicates the probable overlapping discharge flows in the drainage system, whereas WSFU indicates the probable water supply demand of fixtures operating simultaneously.
- Calculate the flow into the pump station in terms of WSFU. Using Table 6.9 of UIPC-I, WSFU can be converted to LPS/GPM.
- In India, the pump discharge is invariably connected to the gravity drain at an inspection chamber/manhole where the high velocity will be dissipated. Often an additional inspection chamber ('break-chamber') receives the pump discharge before connection to an inspection chamber/manhole on the gravity sewer.


SEWAGE PUMP STATION - PLAN
BAR SCREEN
300
400
OUT LET
VENT PIPE
INLET
G.I PIPE SLEEVES
FOR LEVEL SWITCHES
25 MM A.G.L
OPENING
PUMP DELIVERY (TYP)
(D-1)
DRAIN
(D-3)
G.I. PIPE SLEEVE
FOR CABLE ENTRY - 25 MM A.G.L
INCREASER
N.R.V I.V
(D-2)
I.V (N.C)
Screen Chamber
Sewage Collection Sump
Valve Chamber
Fig - 1
40 mm CLEAR GAP
6 mm M.S. BARS (TYP)
50 x 50 x 4mm ANGLE FRAME
Details of Bar Screen
LEGEND :
A.G.L : ABOVE GROUND LEVEL
I.V : ISOLATING VALVE
N.R.V : NON RETURN VALVE
(CHECK VALVE)
N.C : NORMALLY CLOSED

# SEWAGE PUMP STATION - SECTION

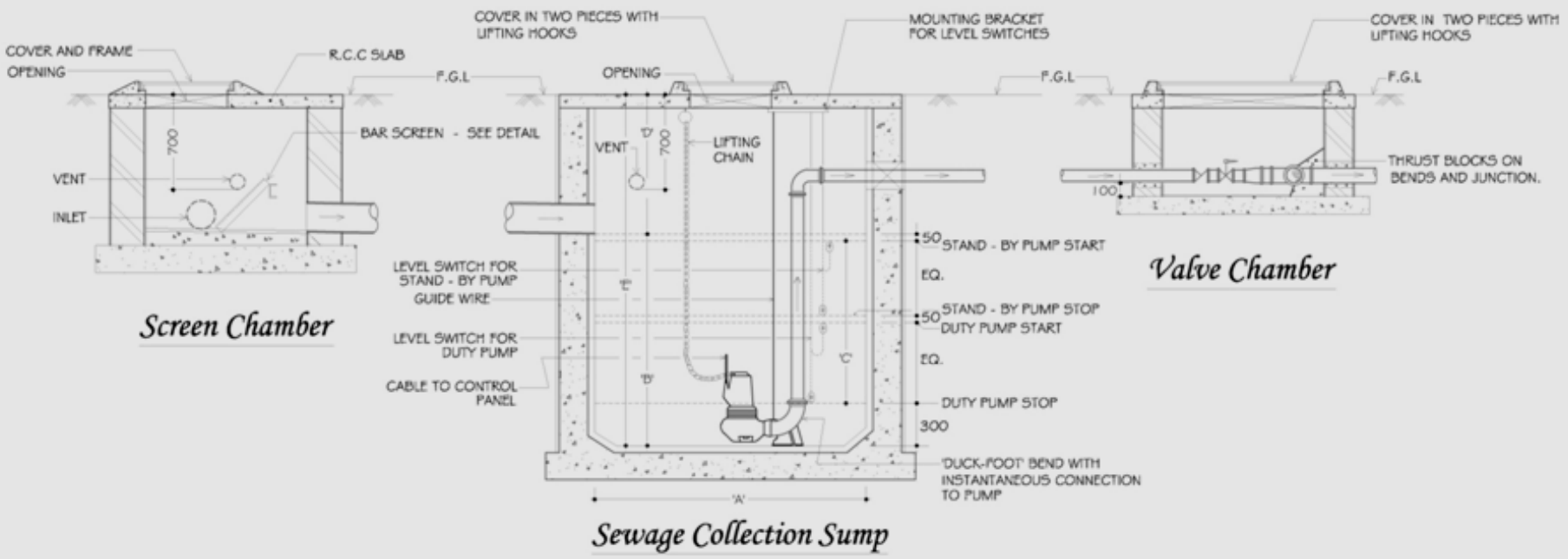



Fig - 2

## By-pass Connection (Drain)

Sudden rise/drops and loops must be avoided along the route of the pump discharge pipe in order to avoid accumulation of solids and entrapment of air. As an additional precaution, a by-pass (drain) connection can be provided ('D-3' Fig 1) for periodic flushing of the discharge pipe.

## Screen Chamber/Valve Chamber

In order to prevent large objects such as clothes, sanitary napkins, rags etc. entering the sewage sump, the gravity drain to the sump shall be connected through a screen chamber incorporating a bar screen, for periodic manual cleaning.

# Thank you

- Any Questions?

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