

**Part 8**  
**Building Services**

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**7.5.3 Annulment of Licence**

The licence of a licensed plumber may be nullified by the Authority, if it is proved that a plumbing work has been completed and certified by the licensed plumber violating the provisions of this Code deliberately setting aside the approvals given in the permit or without receiving the permit from the Authority.

**7.6 DRAINAGE AND SANITATION REQUIREMENT**

**7.6.1 General**

**7.6.1.1** Each family dwelling unit on premises abutting a public sewer or with a private waste disposal system shall have at least one water closet and one kitchen sink or washing facilities. It is recommended to have at least one bathroom with a bath tub or shower to meet the basic requirements of sanitation and personal hygiene and in that case bath and water closet shall be separately accommodated.

**7.6.1.2** All other structures for human occupancy or use on premises abutting a sewer or with a private waste disposal system shall have adequate sanitary facilities but in no case less than one water closet and one other fixture for cleaning purposes.

**7.6.1.3** There shall be one water tap and arrangement for drainage in the vicinity of each water closet in all buildings.

**7.6.1.4** There shall be at least one water tap and arrangement for drainage in the vicinity of each urinal or group of urinals in all buildings.

**7.6.1.5** There shall be separate facilities for each sex for public toilets and for public bathing places based on the percentage of each anticipated sex.

**7.6.1.6** Where drinking water fountain is provided, it shall not be installed in toilet room.

**7.6.1.7** Rooms containing water closets or urinals shall be separated by partition wall from places where food will be prepared and served.

**7.6.2 Minimum Number of Fixtures**

Table 8.7.1 and Sec 7.6.2.1 and 7.6.2.2 provide the minimum number of fixtures required for different categories of buildings according to their occupancy classifications. The fixture requirement for the occupancy not provided in these sections shall be subject to the approval of the Authority.

**7.6.2.1 Physically Handicapped Plumbing Facilities :** All buildings other than residential, educational, storage and hazardous according to building occupancy classification, having public toilet facilities with required number of fixtures shall have at least one water closet for each sex (or one unisex water closet facility) and one drinking fountain accessible to and usable by physically handicapped persons. The water closet compartment for physically handicapped persons shall be in accordance with Sec 7.9.4.

**7.6.2.2 Drainage and Sanitation Requirements for Traffic Terminal Stations**

a) The minimum sanitary conveniences provided at any traffic terminal station like railway station, bus station etc. shall consist of nonservice type latrines one for each sex, and one nonservice type urinal for males for a daily passenger volume up to 300 persons. For large stations and airports, sanitary arrangements shall be in accordance with Table 8.7.1.

b) There shall be adequate arrangements for satisfactory drainage of all sewage, sullage and waste water. The drainage shall be so designed as to cause no stagnation at the maximum discharge rate for which the different units are designed.

c) Adequate scavenging arrangements shall be provided to keep the stations or terminals clear of all refuse. Refuse containers shall be placed at convenient points.

**7.6.3 Accessibility**

The fixtures specified in Sec 7.6.2 for public building shall be located not more than one floor above nor more than one floor below the floor occupied by the people for whose use the fixtures are intended, unless elevator service is available, except that in buildings which are accessible to the physically handicapped, there shall be minimum facilities as specified by the Code. It is desirable that the path of travel to the facilities shall not exceed a travel distance of 150 m.

**7.7 MATERIALS AND APPLIANCES**

Different sanitary appliances, materials and fittings listed in Tables 8.7.2 to 8.7.5 and 8.6.9 (Chapter 6) shall conform to the standard or one of the standards cited against them. For other appliances, materials and fittings not provided in Tables 8.7.2 to 8.7.5 and 8.6.9 (Chapter 6) shall be subject to the approval of the Authority. Applicable standards for different materials and appliances have also been listed in Part 5.



Table 8.7.1  
Plumbing Fixtures Requirement

Type of Building Occupancy	Water Closets *	Urinals **	Wash Basins ***	Bathtubs or Shower	Drinking Fountains	Other Fixtures
<b>A Residential Buildings</b>						
A1 Detached Single Family Dwelling						
A2 Flats or Apartments	1 per dwelling or apartment	—	1 per dwelling or apartment	1 per dwelling or apartment	—	1 kitchen sink per dwelling or apartment
A4 Minimum Standard Housing						
A3 Mess, Boarding Houses and Hostels						
For Residence and Residential Staff	Males: 1 for 8 persons Females: 1 for 6 persons	Males: 1 for 25 persons upto 150 persons. Add 1 fixture for each additional 50 persons.	Males: 1 for 8 persons Females: 1 for 6 persons	Males: 1 for 8 persons Females: 1 for 6 persons	1 for 75 persons	1 kitchen sink in each kitchen
For Nonresidential Staff	Males: 1 for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-100 persons Females: 1 for 1-12 persons 2 for 13-25 persons 3 for 26-40 persons 4 for 41-57 persons 5 for 58-77 persons 6 for 78-100 persons	Males: Nil upto 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons	Males: 1 for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-1000 persons Females: 1 for 1-12 persons 2 for 13-25 persons 3 for 26-40 persons 4 for 41-57 persons 5 for 58-77 persons 6 for 78-100 persons	—	1 for 100 persons	—
Rooms wherein Outsiders are Received	Males: 1 for 100 persons upto 400 persons and add 1 fixture for additional 250 persons Females: 2 for 100 persons upto 200 persons and add 1 fixture for additional 100 persons.	Males: 1 for 50 persons	Males: 1 per water closet and 1 per urinal or group of urinals Females: 1 per water closet	—	—	—

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Table 8.7.1 (Contd.)  
Plumbing Fixtures Requirement

Type of Building Occupancy	Water Closets *	Urinals **	Wash Basins ***	Bathubs or Shower	Drinking Fountains	Other Fixtures
Houses For Residential Public and Staff	1 for 8 persons omitting the occupant of the room with attached water closet; minimum of 2, if both sex are lodged.	—	1 for 10 persons omitting the wash basins installed in the room or suite.	1 for 10 persons omitting the occupants of the room with bath in suite.	1 for 100 persons	1 kitchen sink in each kitchen
For Public Rooms	Males: 1 for 100 persons upto 400 persons and add 1 for additional 250 persons or part thereof. Females: 2 for 100 persons upto 200 persons and add 1 for additional 100 persons or part thereof.	Males: 1 for 50 persons	Males: 1 per water closet and 1 per urinal or group of urinals Females: 1 per water closet	—	1 for 100 persons	—
For Nonresidential Staff	Males: 1 for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-100 persons Females: 1 for 1-12 persons 2 for 13-25 persons 3 for 26-40 persons 4 for 41-57 persons 5 for 58-77 persons 6 for 78-100 persons	Males: Nil upto 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons	Males: 1 for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-100 persons Females: 1 for 1-12 persons 2 for 13-25 persons 3 for 26-40 persons 4 for 41-57 persons 5 for 58-77 persons 6 for 78-100 persons	—	1 for 100 persons	—

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Table 8.7.1 (Contd.)  
Plumbing Fixtures Requirement

Type of Building Occupancy	Water Closets *	Urinals **	Wash Basins ***	Bathtubs or Shower	Drinking Fountains	Other Fixtures
<b>B Educational Building</b>						
B1 Education Facilities	Males: 1 for 40 persons Females: 1 for 25 persons	Males: 1 for 20 persons	Males: 1 for 60 persons but minimum 2 Females: 1 for 40 persons but minimum 2	—	1 for 50 persons	Service sink: 1 per floor.
B2 Preschool Facilities	1 for 15 children	—	1 for 15 children	—	1 for 50 children	Service sink: 1 per floor.
<b>C Institutional Buildings</b>						
C1 Institution for Care of Children	Boys: 1 for 8 boys Girls: 1 for 6 girls	Urinals may be provided in boys toilet rooms in lieu of water closets but for not more than 1/2 of the required number of water closets	Boys: 1 for 8 boys Girls: 1 for 6 girls	1 for 8 persons (boys or girls)	1 for 50 persons (boys or girls)	Service sink: 1 per floor
C2 Custodial Institutions for Physically Capable	1 unisex facility or 1 for each sex for 1-100 persons	—	1 for 200 persons	1 for 10 persons but not less than 1 for use by both sexes.	1 for 100 persons	Service sink: 1 per floor
C3 Custodial Institution for the Incapable	2 unisex facilities or 1 unisex facility and 1 for each sex for 100-200 persons. Over 200 persons one additional unisex facility or 1 for each sex for each additional 100 persons.	—	—	—	—	—
C4 Penal and Mental Institutions	1 per cell	—	1 per cell	1 for 15 persons	1 for 100 persons	Service sink

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Table 8.7.1 (Contd.)  
Plumbing Fixtures Requirement

Type of Building Occupancy	Water Closets *	Urinals **	Wash Basins ***	Bathtubs or Shower	Drinking Fountains	Other Fixtures
<b>D Health Care Building</b>						
D1 Normal Medical Facilities (Indoor Patient Ward)	1 for 8 patient (male or female)	—	2 upto 30 patients and add 1 fixture for additional 30 patients	1 for 8 patients	1 for 75 patients	Service sink: 1 for each word. Bed pan washing sink: 1 for each ward. Kitchen sink: 1 for each kitchen
D2 Emergency Medical Facilities and Outdoor Patient Ward	Males: 1 for 100 persons Females: 2 for 100 persons	Males: 1 for 50 persons	1 for 100 persons	—	1 for 500 persons	Service sink: 1 for each ward
<b>E Assembly Building</b>						
E1 Large Assembly with Fixed Seats						
E2 Small Assembly with Fixed Seats						
F3 Large Assembly without Fixed Seats						
E4 Small Assembly without Fixed Seats						
Mosque	1 for 30 persons	—	—	1 for 100 persons	1 for 1000 persons	Water taps with drainage arrangement: 1 for 10 persons Service sink : 1 per floor
Junction Stations, Intermediate Stations, Terminal Stations and Bus Terminals	Males: Min 2, 4 for 1000 persons and add 1 for additional 1000 persons. Females: Min 2, 5 for 1000 persons and then add 1 for additional 1000 persons	Males: Min 2, 4 for 1000 persons and then add 1 for additional 1000 persons	Males: Min 2, 4 for 1000 persons and add 1 for additional 1000 persons. Female: Min 2, 6 for 1000 persons and then add 1 for additional 1000 persons	—	1 for 300 persons	

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Table 8.7.1 (Contd.)  
Plumbing Fixtures Requirement

Type of Building Occupancy	Water Closets *	Urinals **	Wash Basins ***	Bathtubs or Shower	Drinking Fountains	Other Fixtures
Domestic Airport Minimum for 200 persons for 400 persons for 600 persons for 800 persons for 1000 persons	Males: 2 Females: 2 Males: 4 Females: 5 Males: 6 Females: 8 Males: 8 Females: 10 Males: 9 Females: 13 Males: 10 Females: 13	Males: 1 Males: 2 Males: 4 Males: 5 Males: 6 Males: 7	2 4 6 8 9 10	—	1 per 300 persons	Service sink: 1 per floor
International Airport for 200 persons for 600 persons for 1000 persons	Males: 6 Females: 10 Males: 12 Females: 20 Males: 18 Females: 29	Males: 8 Males: 22 Males: 22	10 20 25	4 shower stalls in the females or males toilet in the transit and departure lounge and also in the main concourse	1 for 300 persons	Service sink: 1 per floor
Cinemas, Concert halls, Theatres (for public use)	Males: 1 for 100 persons upto 400 persons. Add 1 for each additional 250 persons. Females: 3 for 100 persons upto 200 persons. Add 2 for each additional 100 persons.	Males: 1 for 25 persons	1 for 200 persons	—	1 for 500 persons	Service sink : 1
Cinemas, Concert halls, Theatres (for permanent employee use)	Males: 1 for 1-15 persons 2 for 16-35 persons Females: 1 for 1-12 persons 2 for 13-25 persons	Males: Nil up to 6 persons 1 for 7-20 persons 2 for 21-45 persons	Males: 1 for 1-15 persons 2 for 16-35 persons Females: 1 for 1-12 persons 2 for 13-25 persons upto 200 persons and then add 1 for additional 250 persons	—	1 for 500 persons	—
Art Galleries, Libraries, Museums (for public use)	Males: 1 for 200 persons upto 400 persons. Add 1 for each additional 250 persons Females: 1 for 100 persons upto 200 persons.	Males: 1 for 50 persons	1 for 200 persons up to 200 persons and then add 1 for additional 250 persons	—	1 for 500 persons	Service sink: 1

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Table 8.7.1 (Contd.)  
Plumbing Fixtures Requirement

Type of Building Occupancy	Water Closets *	Urinals **	Wash Basins ***	Bathtubs or Shower	Drinking Fountains	Other Fixtures
	Add 1 for each additional 150 persons					
Art Galleries, Libraries, Museums (for permanent employee use)	Males: 1 for 1-15 persons 2 for 16-35 persons Females: 1 for 1-12 persons 2 for 13-25 persons	Males: Nil upto 6 persons 1 for 7-20 persons 2 for 21-45 persons	Males: 1 for 1-15 persons 2 for 16-35 persons Females: 1 for 1-12 persons 2 for 13-25 persons	—	1 for 100 persons	—
E5 Sports Facilities	Males: 1 for 75 persons Females: 1 for 50 persons	Males: 1 for 75 persons	1 for 60 persons	1 for 50 persons	1 for 300 persons	Service sink: 1
<b>F Business and Mercantile Building</b>						
F1 Offices	Males: 1 for 25 persons Female: 1 for 15 persons	Males: Nil upto 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons Add @ 3% for 101-200 persons and @ 2.5% for over 200 persons.	1 for 25 persons	—	1 for 100 persons	Service sink: 1 per floor.
F4 Garages and Petrol Stations						
F5 Essential Services						
F2 Small Shops and Markets	1 for 500 persons	Urinals may be provided in toilet room in lieu of water closets for men but for not more than 1/2 of the required number of water closets.	1 for 750 persons	—	1 for 1000 persons	Service sink: 1
F3 Large Shops and Markets						

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Table 8.7.1 (Contd.)  
Plumbing Fixtures Requirement

Type of Building Occupancy	Water Closets *	Urinals **	Wash Basins ***	Bathtubs or Shower	Drinking Fountains	Other Fixtures
<b>G Industrial Buildings</b> <b>Factories</b>	Males: 1 for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-1000 persons Females: 2 for 13-25 persons 3 for 26-40 persons 4 for 41-57 persons 5 for 58-77 persons 6 for 78-100 persons	Males: Nil upto 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons. Add @ 3% upto 200 persons and for over 200 persons add @ 2.5%	1 for 25 persons	As required by particular trades or occupations	1 for 100 persons	Service sink: 1 per floor
<b>H Storage Buildings</b>	1 for 100 persons	—	1 for 100 persons	Provisions for emergency shower	1 for 1000 persons	Service sink: 1
<b>J Hazardous Buildings</b>	1 for 100 persons	—	1 for 100 persons	Provisions for emergency shower	1 for 1000 persons	Service sink : 1

\* Some of the water closets may be of European style. The water closet(s) shall not be oriented in the east-west direction.  
 \*\* The urinal(s) shall not be oriented in the east-west direction.  
 \*\*\* Toilet(s) of public use shall have atleast one water tap with adequate drainage arrangement for ablution purpose when the number of devotees exceed twenty.



Table 8.7.2  
Sanitary Appliances

Appliances	Standard
Ceramic wash basin and pedestals	BDS 1162-87
Ceramic wash down water closet pans	BS 1213
Foot rest vitreous china	BDS 1163-87 parts 1 & 4
Integrated squatting pans vitreous china	BDS 1163-87 parts 1 & 5
Metal hand rinse basin	BS 1329
Metal sink for domestic purpose	BS 1244
Urinals (bowl type) vitreous china	BDS 1163-87 parts 1 & 3
Washdown water closet pans, vitreous china	BDS 1163-87 parts 1 & 2
Water closet seat plastic	BS 1254
Water closet flushing cisterns and pipes	BS 1125

Table 8.7.3  
Building Drainage and Vent Pipe

Material	Standards
Acrylonitrile butadiene styrene (ABS plastic pipe)	ASTM D2661, ASTM F 628
Aluminum tubing	ASTM B429, ASTM B745M
Brass pipe	ASTM B43
Cast iron pipe	ASTM A74
Copper or Copper-alloy tubing	ASTM B75M, ASTM B88M, ASTM B251M, ASTM B306
Galvanized steel pipe	ASTM A53
Lead pipe	IS 404
Polyvinyl chloride plastic pipe	ASTM D2665, ASTM D2949, ASTM F891

Table 8.7.4  
Building Sewer or Building Storm Sewer Pipe

Material	Standards
Acrylonitrile butadiene styrene (ABS plastic pipe)	ASTM D2261, ASTM D2751, ASTM F628, ASTM D2321
Asbestos	BDS 428, BDS 429
Bituminized fibre pipe	ASTM D1861, ASTM D1862
Cast iron pipe	ASTM A74
Concrete pipe	ASTM C14M, ASTM C76M
Copper or Copper-alloy tubing	ASTM B75, ASTM B88M, ASTM B251M
Polyvinyl chloride (PVC) plastic pipe	ASTM D2665, ASTM D2949, ASTM D3034, ASTM D2321, ASTM F891
Vitrified clay pipe	ASTM C4, ASTM C700

Table 8.7.5  
Subsoil Drainage Pipe

Material	Standard
Asbestos cement pipe	ASTM C508
Bituminous fibre pipe	ASTM D2311
Cast iron pipe	ASTM A74
Concrete pipe	ASTM C654 M
Polyethylene (PE) plastic pipe	ASTM F405
Polyvinyl chloride (PVC) plastic pipe	ASTM D2729, ASTM F891
Vitrified clay pipe	ASTM C4, ASTM C700

7.8 HANGERS AND SUPPORT AND PIPE JOINTING

7.8.1 Hangers and Support

The piping, fixtures and equipment used for drainage system shall be provided with hangers and support in accordance with Sec 6.13 in Chapter 6.



7.8.2 **Pipe Joints**

The joints between different pipings and fittings shall conform to the standards cited against them in Table 8.7.6. The requirements for the joints not specified in the table shall be subject to the approval of the Authority.

7.9 DESIGN CONSIDERATIONS

7.9.1 **Objective**

For the design of drainage and sanitation system of different buildings according to building classification, the objective shall be to safeguard against fouling, deposit of solids and clogging and with adequate cleanouts and inspection chambers so arranged that the drains may be readily cleaned without the risk of health hazard.

7.9.2 **General**

- a) The plumbing system shall be designed and adjusted to use the minimum quantity of water consistent with proper performance and cleaning.
- b) Plumbing fixtures, devices and appurtenances shall be supplied with required volume of water at pressures adequate to enable these to function properly and without undue noise under normal conditions of use.

7.9.3 **Different Plumbing Systems**

For the design and installation for drainage piping, one of the following plumbing systems shall be used :

- i) single stack system,
- ii) one-pipe system, and
- iii) two-pipe system.

**Table 8.7.6**  
**Joints Between Different Pipes and Fittings**

Material	Standard
ABS plastic pipe and fittings	ASTM D2235, ASTM D2661, ASTM D3212, ASTM F628 ASME B1.20.1
Aluminium tubing	ASTM C564
Asbestos cement pipe and fittings	ASTM D1869
Brass pipe and fittings	ASME B1.20.1
Cast iron pipe and fittings	ASTM C564
Concrete pipe and fittings	ASTM C443
Copper or Copper-alloy pipe and fittings	ASTM B32, ASME B1.20.1
Copper-alloy tubing and fittings	ASTM B32
CPVC plastic pipe and fittings	ASTM F493, ASME B1.20.1
Galvanized steel pipe and fittings	ASME B1.20.1
PE plastic pipe and fittings	ASTM D2657
PVC plastic pipe and fittings	ASTM D2657, ASTM D2855, ASTM D3139, ASTM D3212, ASTM F402, ASTM F656, ASME B1.20.1
Vitrified clay pipe and fitting	ASTM C425

- a) Single stack system may be used with 100 mm diameter stack for buildings up to 5-storey height. The fixtures in each floor shall be connected to a single stack for increasing the rate of discharge in the downward direction. There shall be at least 200 mm vertical distance between the waste branch and the soil branch connection, while the soil pipe will be connected to stack above the waste pipe. The size of soil branch shall not be less than 100 mm. The horizontal branch distance for fixtures from stack and bend(s) at the foot of stack to avoid back pressure as well as the vertical distance between the lowest connection and the invert of drain shall be as shown in Fig 8.7.1. The recommended depth of water seal trap for different fixtures shall be in accordance with Table 8.7.7.
- b) Where all types of waste from the building are desired to be discharged into a common sewer or into same waste disposal system, one pipe system may be used (Fig 8.7.2).
- c) Where the sullage from kitchen and bath will be dealt with separately, the two pipe system shall be used (Fig 8.7.3).

7.9.4 **Water Closet Compartment for Physically Handicapped**

**7.9.4.1 Provision for Wheelchair Users :** The water closet compartment for wheelchair users shall have at least the dimensions and fittings as shown in Fig 8.7.4.

**7.9.4.2 Provision for Ambulant Disabled People :** The minimum dimension for water closet compartment and the fittings for ambulant disabled people shall be as shown in Fig 8.7.5.



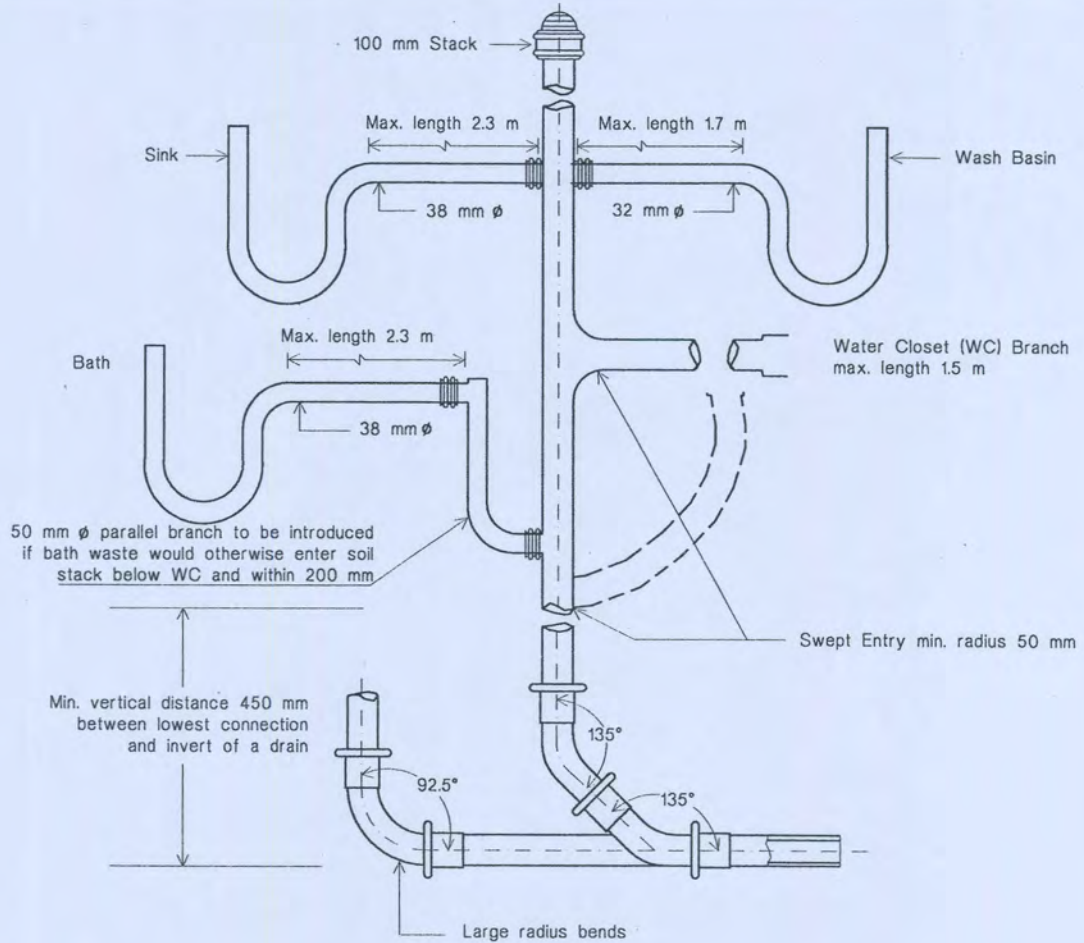


Fig. 8.7.1 Single Stack System

Table 8.7.7  
Recommended Depth of Water Seal Trap for Different Fixtures

Fixture	Water Seal (mm)
Water Closets	50
Floor Traps	50
For Waste Branch of 75 mm diameter or More	40
For Waste Branch of Less Than 75 mm diameter	75

7.9.5 Installation of Drainage System

7.9.5.1 All plumbing fixtures shall be made of smooth and nonabsorbent materials, free from concealed fouling surfaces and may be located in ventilated enclosures.

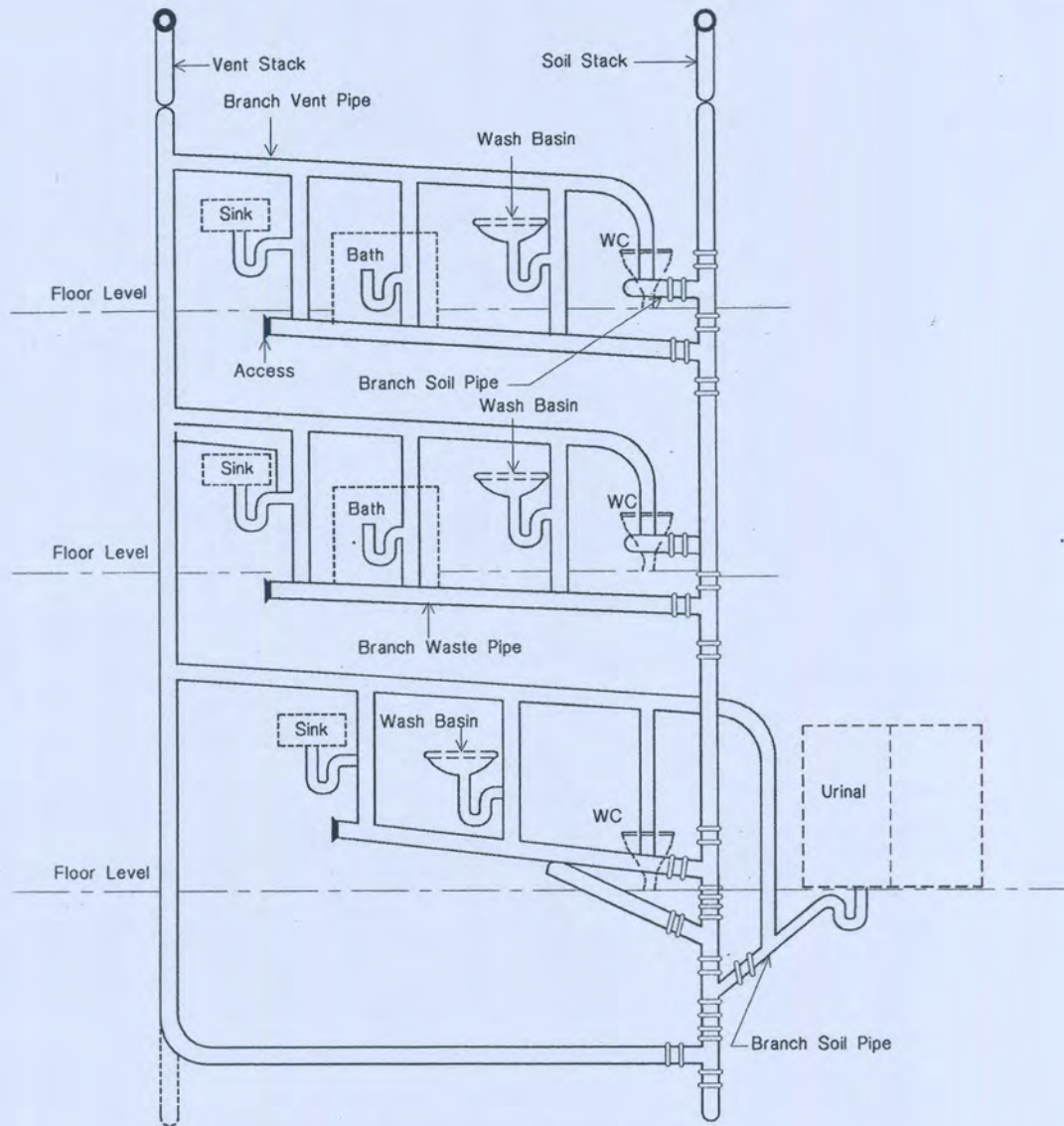
7.9.5.2 Whenever possible, all drainage system shall be drained to the public sewer or private waste disposal system by gravity.

7.9.5.3 Horizontal drainage piping of 75 mm diameter and less shall be installed with a fall of not less than 20 mm per m.

Horizontal drainage piping larger than 75 mm diameter shall be installed with a fall of not less than 10 mm per m.

It is a good policy to design the system for the highest possible velocity. However, consideration should be given to the fact that the high velocities in pipes with slopes greater than 20 mm per m may cause self-siphonage of trap seal.





**Fig. 8.7.2 Diagram of One-Pipe System**

7.9.5.4 Where conditions do not permit building drains and sewers to be laid with a fall as great as that specified, a lesser slope may be permitted provided the computed velocity in the drains will not be less than 0.6 m per second. The maximum recommended velocity will be 2.5 m per second.

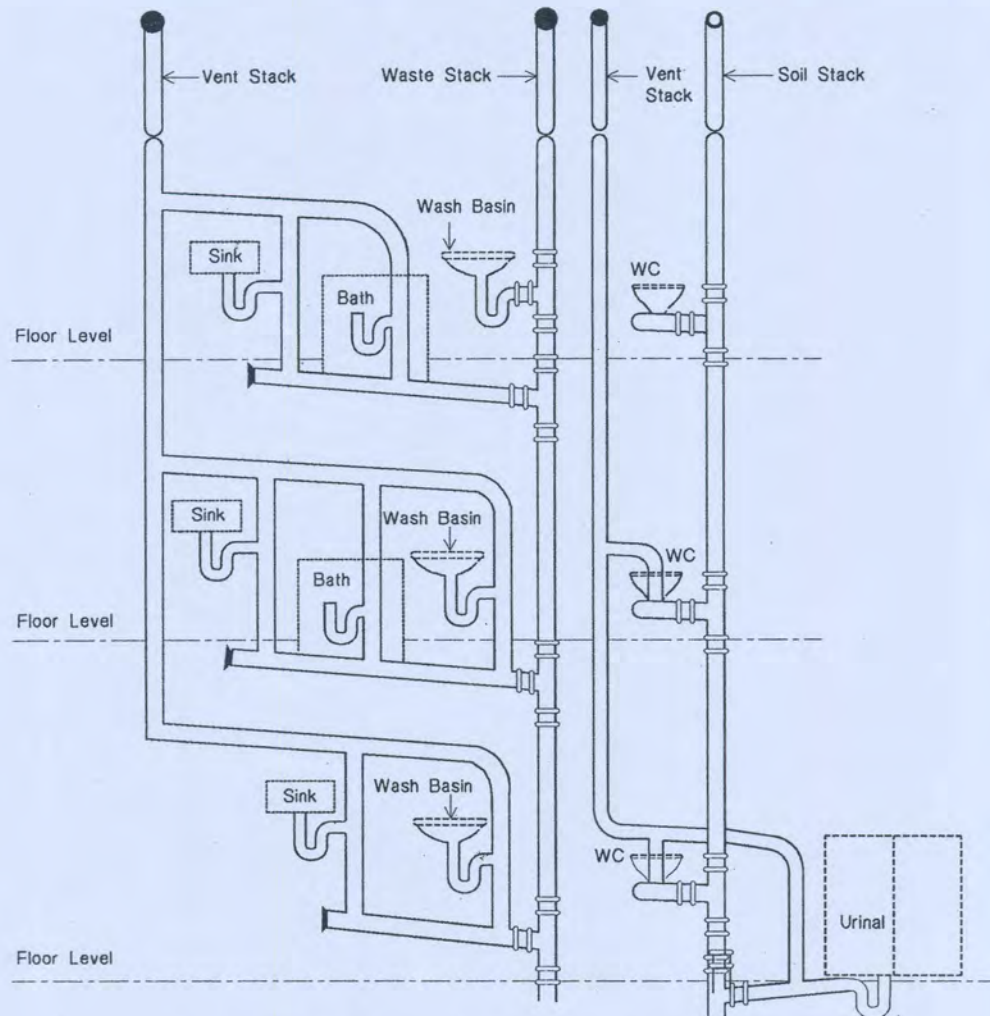
7.9.5.5 The soil pipe conveying any solid or liquid filth to a drain shall be circular with a minimum diameter of 100 mm.

7.9.5.6 The waste branch from bath room, wash basin or sink shall be of 32 mm to 50 mm diameter and shall be trapped immediately beneath such wash basins or sink by an efficient siphon trap with adequate means of inspection and cleaning. The minimum recommended size of waste stack is 75 mm.

7.9.5.7 The soil and waste stack shall be continued upward undiminished in size 0.6 m above the roof surface when the roof will be used only for weather protection. Where the roof will be used for any purpose other than weather protection, the soil and vent stack shall run at least 2 m above the roof surface so that there shall be the least possible nuisance.

7.9.5.8 The soil and waste stack shall be firmly attached to the wall with a minimum clearance of 50 mm from the wall.





**Fig. 8.7.3 Diagram of Two-Pipe System**

7.9.5.9 All (soil, waste, vent or antisiphonage) stacks shall be covered on top with a copper or heavily galvanized iron wire dome or cast iron terminal guards.

**7.9.6 Installation of Venting System**

7.9.6.1 The vent stack or main vent shall be installed in conjunction with a soil or waste stack in a building containing five or more branch intervals. One vent stack may serve not more than two soil or waste stacks.

7.9.6.2 The building with building drain shall have at least one 100 mm vent stack or stack vent carried full size to outdoor air above the roof in accordance with Sec 7.9.5.7 above.

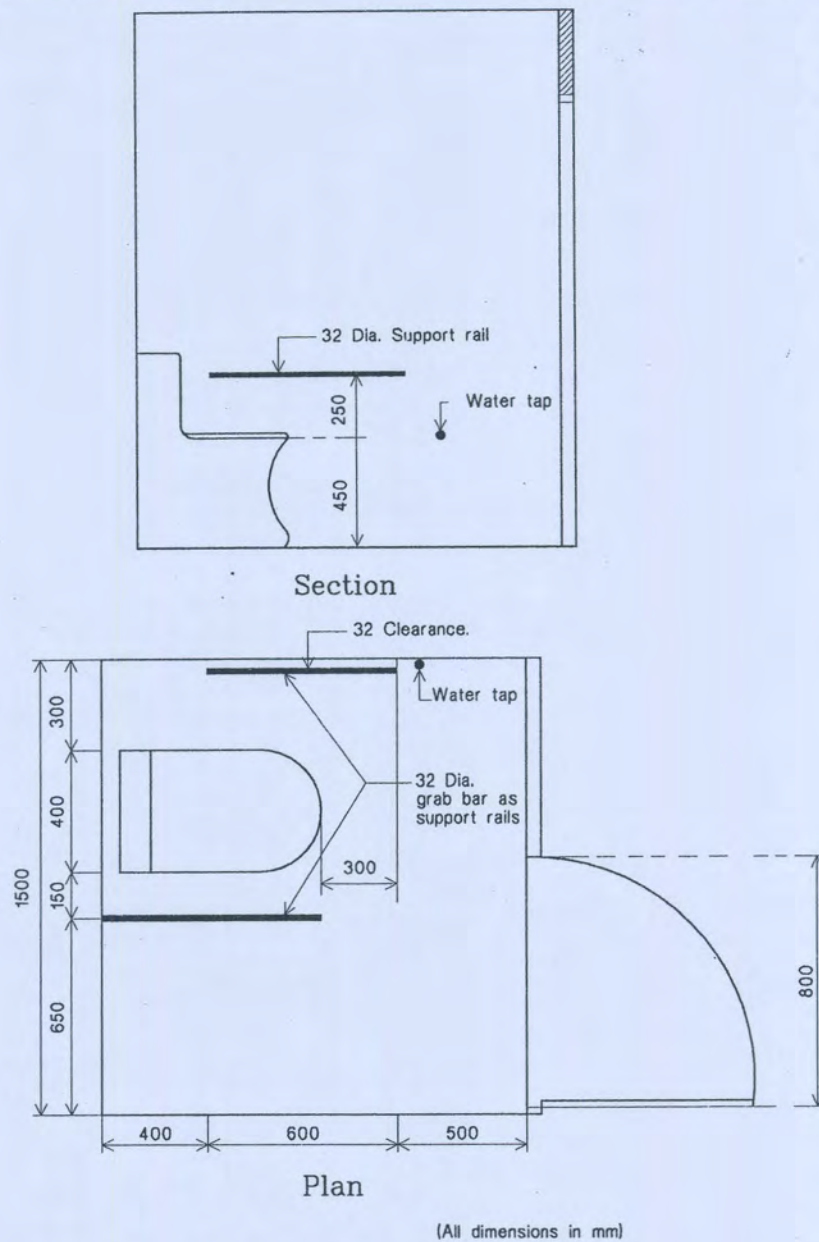
7.9.6.3 The diameter of a vent stack shall not be less than 50 mm.

7.9.6.4 The diameter of a branch vent pipe on a waste pipe shall not be less than 25 mm or two-thirds of the diameter of the branch waste pipe ventilated.

7.9.6.5 The branch vent pipe on a soil pipe shall not be less than 32 mm in diameter.

7.9.6.6 All main vents or vent stacks shall connect full size at their base to the building drain or to the soil or waste stack at or below the level of the lowest drainage connection to them. All vent stacks shall extend undiminished in size above the roof or shall be reconnected to a vent header or to the stack vent portion of the soil or waste stack, at least 150 mm above the flood level of the highest fixture connection discharging into the soil or waste stack. Where the roof is to be used for any purpose other than weather protection, the vent extension shall be in accordance with the Sec 7.9.5.7.





**Fig. 8.7.4 Water Closet Compartment for Wheelchair User**

7.9.6.7 Offset in the stack vent portion of soil or waste stack, offset in vent stack and connection of vent stack at the bottom to soil or waste pipe or to the building drain shall be at an angle of at least 45 degrees to the horizontal.

7.9.6.8 All vent and branch vent pipe shall be so graded and connected that sufficient slope is provided for condensation to drain back to soil or waste pipe by gravity.

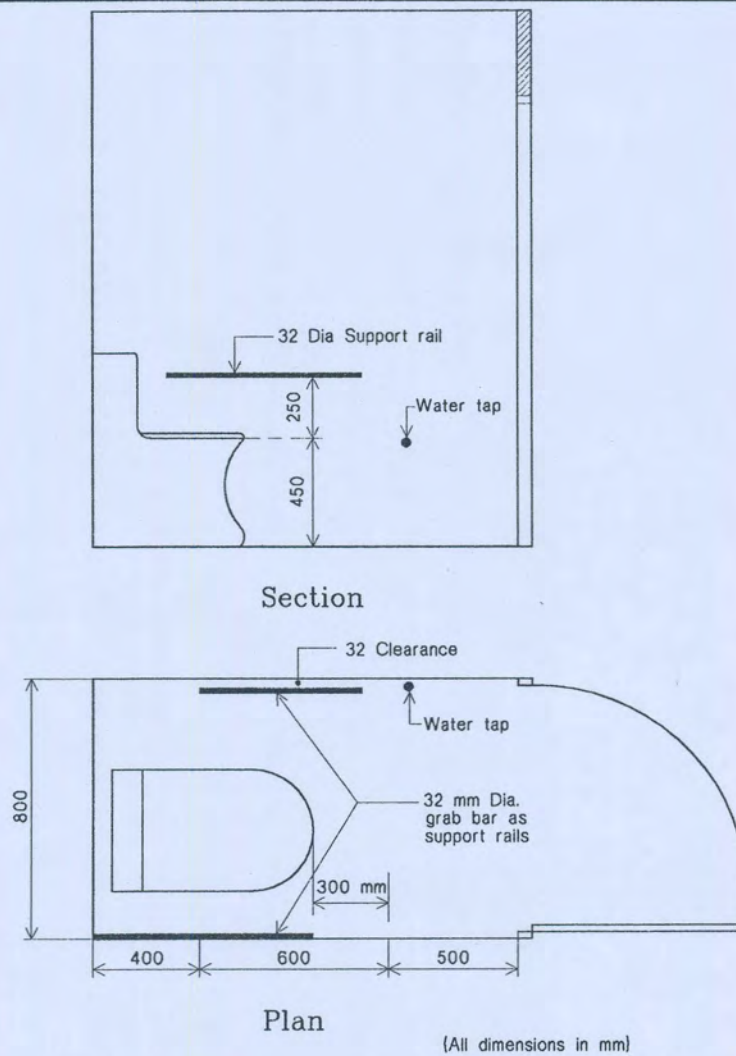
7.9.6.9 Where fixtures other than water closets discharge into the stack downstream of a water closet, each fixture connecting downstream shall be individually vented.

7.9.6.10 Soil and waste stacks in a building having more than 10 branch intervals shall be provided with a relief vent (Fig 8.7.6) at each tenth interval counting from the top floor.

**7.9.7 Clearance of Blockages**

7.9.7.1 There shall be sufficient and suitable access points at every change of alignment, gradient or diameter or at bends and junctions for clearing blockages from drains which cannot be reached by any other





**Fig. 8.7.5 Water Closet Stall for Ambulant Disabled People**

means. Tables 8.7.8 and 8.7.9 show the maximum spacing and the recommended minimum dimensions for access fittings and chambers for the specified depth.

**Table 8.7.8  
Maximum Spacing of Access Points**

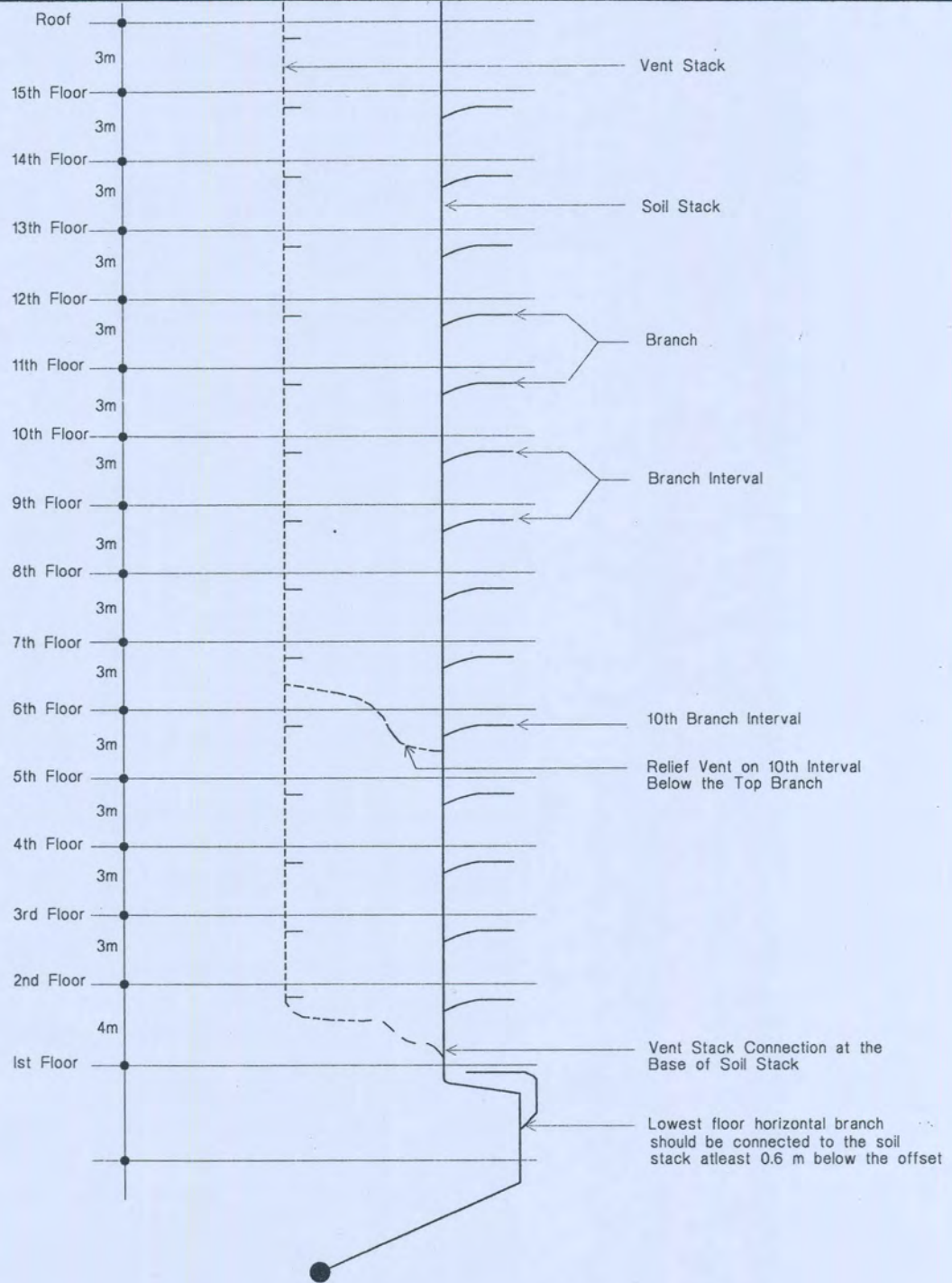
From	To			
	Access Fitting (m)	Junction (m)	Inspection Chamber (m)	Manhole (m)
Start of external drain	12	-	22	45
Rodding eye	22	22	45	45
Access fitting †	-	12	22	22
Inspection chamber	22	22	45	45
Manhole	22	-	45	90

† higher spacing may be used for larger size access fitting.

**7.9.7.2** Access should be one of the following four types :

- i) rodding eyes - capped extensions of the pipes,
- ii) access fittings - small chambers (or an extension of the pipes) but not with an open channel,
- iii) inspection chambers - chambers with working space at ground level, and
- iv) manholes - large chambers with working space at drain level.





**Fig. 8.7.6 Relief Vents for Stack of More Than Ten Branch Intervals**

7.9.7.3 Inspection chambers and manholes shall have removable nonventilating covers of durable material and be of suitable strength. Inspection chambers and manholes in buildings shall have mechanically fixed airtight covers unless the drain itself has watertight access covers. Manholes deeper than 1 m shall have metal step iron or fixed ladders. Fig 8.7.7 and 8.7.8 show the details of typical manholes at smaller depth (<1 m) and at higher depth (>1 m) respectively. Fig 8.7.9 shows the details of a drop manhole. The drop manhole is a manhole that serves as a junction and receives sewer lines at two different elevations.



Table 8.7.9  
Minimum Dimensions for Access Points

Access Points	Depth (m)	Internal Sizes		Cover Sizes	
		Length x width (mm x mm)	Diameter (mm)	Length x width (mm x mm)	Circular (mm)
Rodding eye		min. 100 mm or size of drains			
Access fitting	0.6 or less	150 x 100	150	150 x 100	150
Inspection chamber	1.0 or less	450 x 450	450*	450 x 450	450*
Manhole	1.5 or less	1200 x 750	1050	600 x 600	600
	over 1.5	1200 x 750	1200	600 x 600	600
	over 2.7	12000 x 840	1200	600 x 600	600

\* 190 mm dia may be used for depth ≤ 0.6 m

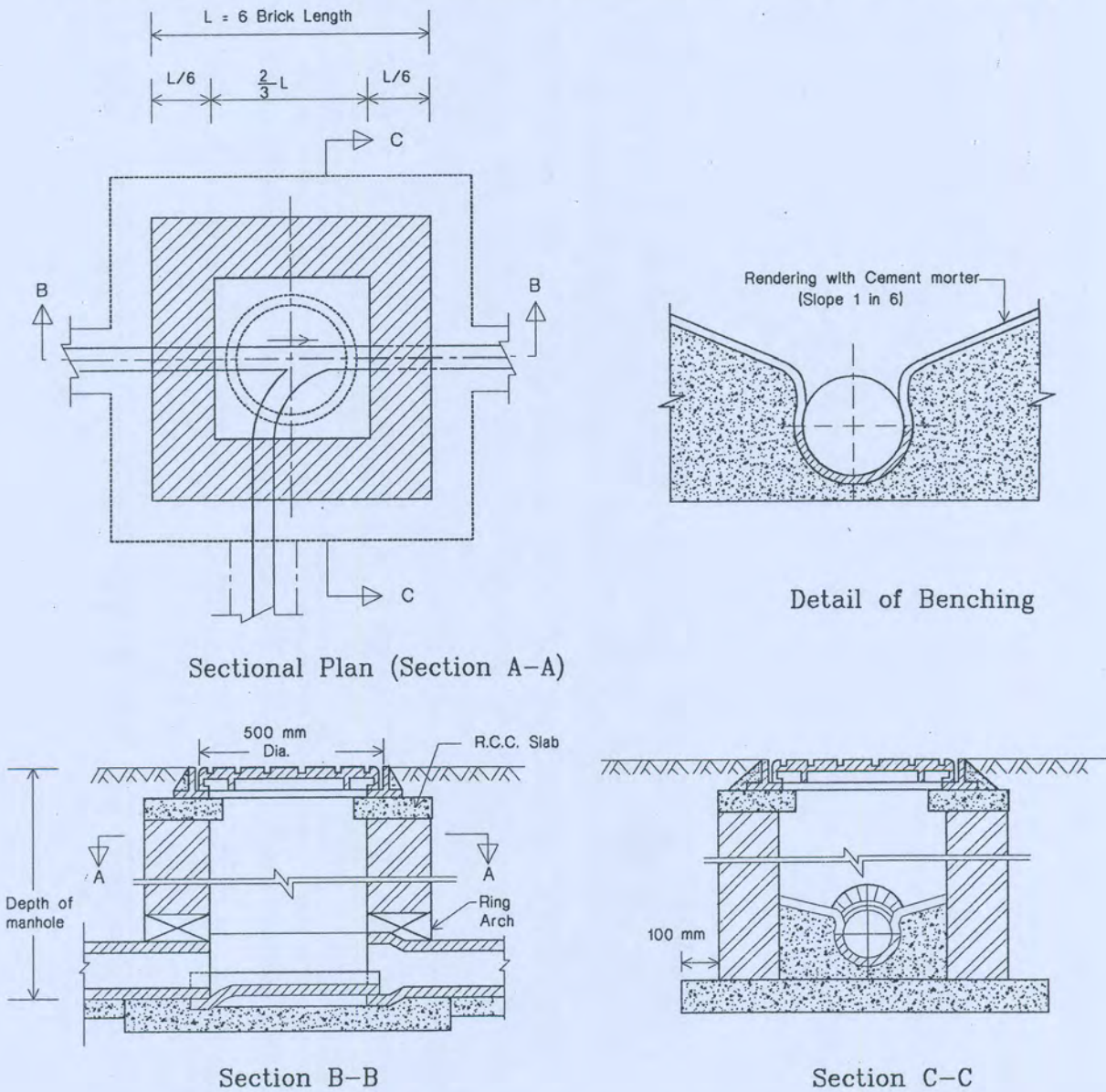
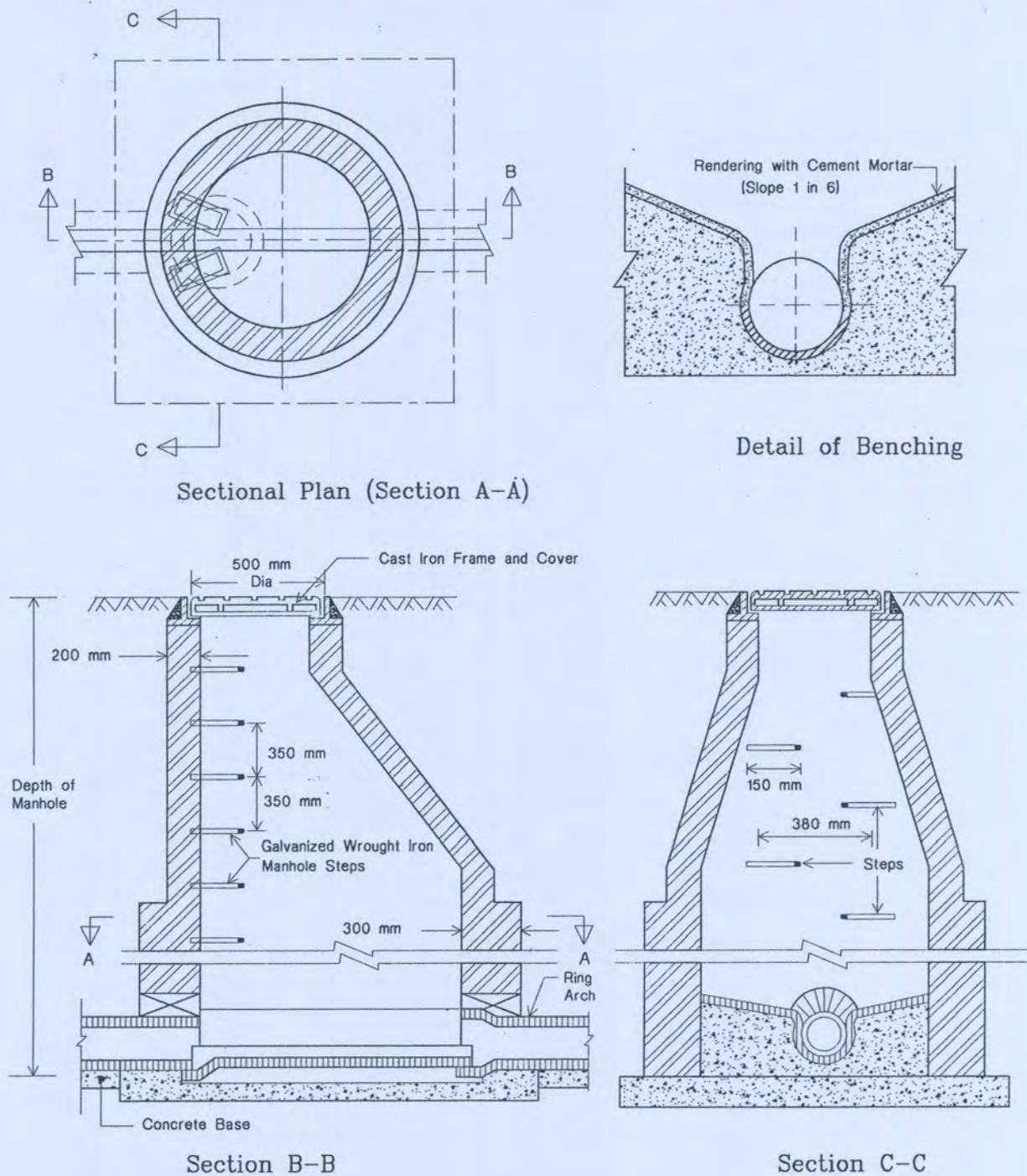


Fig. 8.7.7 Details of Manhole (Depth 1 m and Below)





**Fig. 8.7.8 Details of Manhole (depth more than 1 m)**

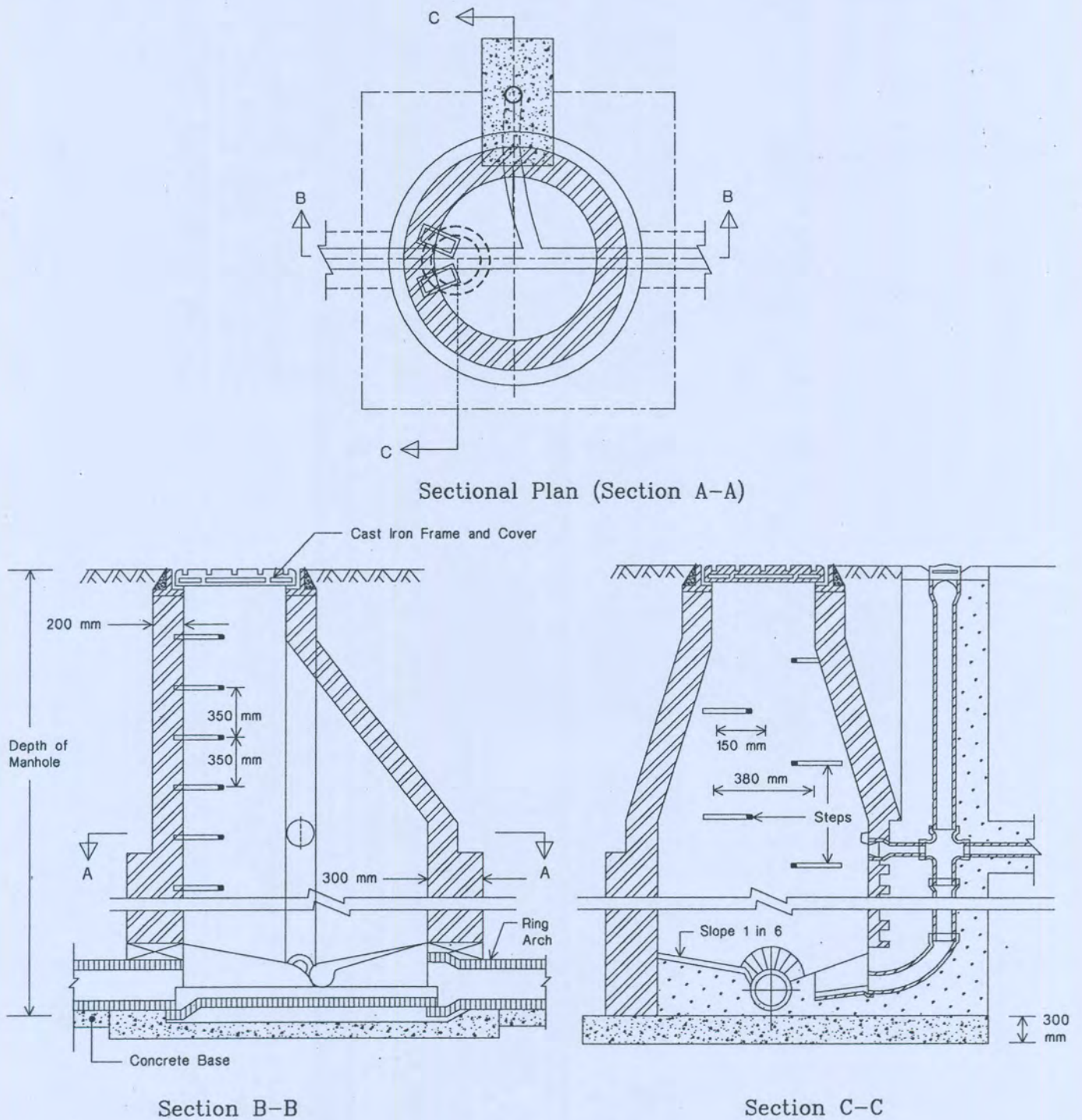
**7.9.8 Protection Against Rodent**

Holes through walls shall be such that they will not provide passage of rodent or other insects from room to room or from floor to floor. Materials used for embedding pipes shall be rodent proof.

**7.9.9 Bedding and Backfilling**

The choice of bedding and backfilling depends on the depth of the bed, and size and strength of the materials. Fig 8.7.10 and Table 8.7.10 show the two types of bedding and backfilling and minimum and maximum depth of cover for each type of bedding for rigid pipings. The bedding and backfilling for flexible





**Fig. 8.7.9 Drop Manhole**

pipings is shown in Fig 8.7.11. The minimum depth of bedding for flexible pipings shall be 0.9 m under any road and 0.6 m in fields and gardens.

The depth shall not be more than 10 m. The flexible pipe may be laid with less cover in fields and gardens. The bedding and backfilling shall be in accordance with Fig 8.7.12.



Table 8.7.10  
Limits of Cover (m) for Standard Strength Rigid Pipes in any Width of Trench

Pipe Bore (mm)	Bedding Class	Fields and Gardens		Light Traffic Roads		Heavy Traffic Road	
		Min	Max	Min	Max	Min	Max
100	Type 1	0.3	7.4	0.4	7.4	0.4	7.2
	Type 2	0.3	5.8	0.5	5.8	0.5	5.5
150	Type 1	0.6	5.0	0.6	5.0	0.6	4.6
	Type 2	0.6	3.9	0.7	3.8	0.7	3.3

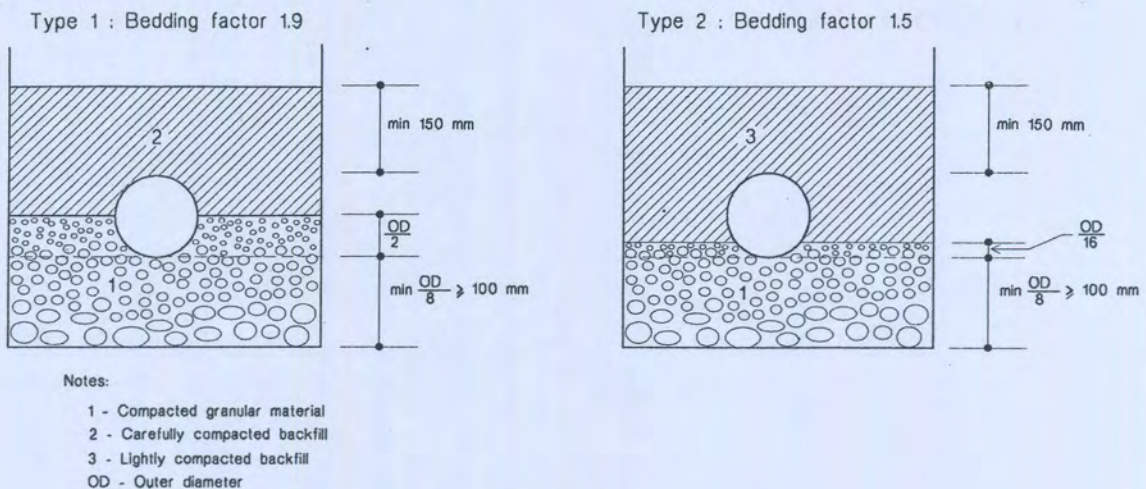


Fig. 8.7.10 Bedding for Rigid Pipes

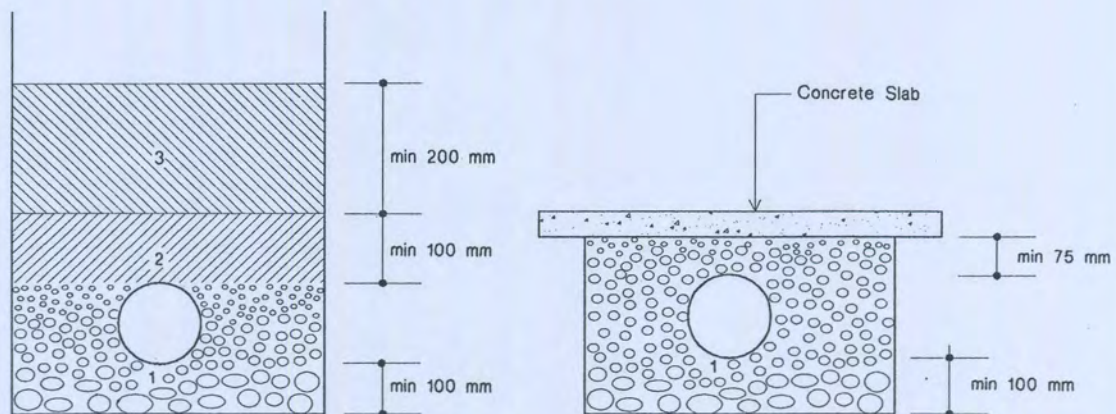


Fig. 8.7.11 Bedding for Flexible Pipes

Fig. 8.7.12 Flexible Pipe Bedding Under Concrete Slab

- 1 - Angular granular material, 6 mm to 40 mm size (similar to ASTM D2321 Class I material)
- 2 - Selected fills or granular fills free from stones larger than 40 mm (similar to ASTM D2321 Class II material)
- 3 - Selected finely divided material free from debris, vegetable matter and stones larger than 40 mm (similar to ASTM D2321 Class III material)



7.9.10 Rainwater Drainage

7.9.10.1 Rainwater data for the locality of the building shall be studied to arrive at the design parameters for rainwater drainage in accordance with Appendix S.

7.9.10.2 In case of inclined roof, the horizontal projection shall be considered as the roof drainage area.

7.9.10.3 Rainwater from roof or from building premises shall not be discharged into septic tank. This will be drained into storm sewer or combined sewer system where available or into private disposal methods (water course or dry well, Fig 8.7.13 and 8.7.14), or storage tank, where rainwater will be used for domestic purpose.

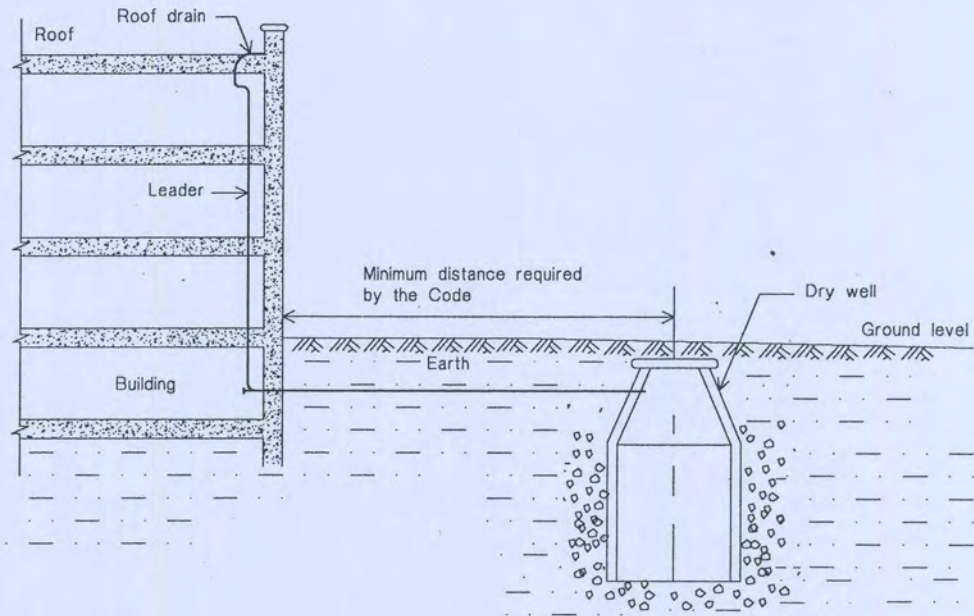


Fig. 8.7.13 Typical Location of a Dry Well

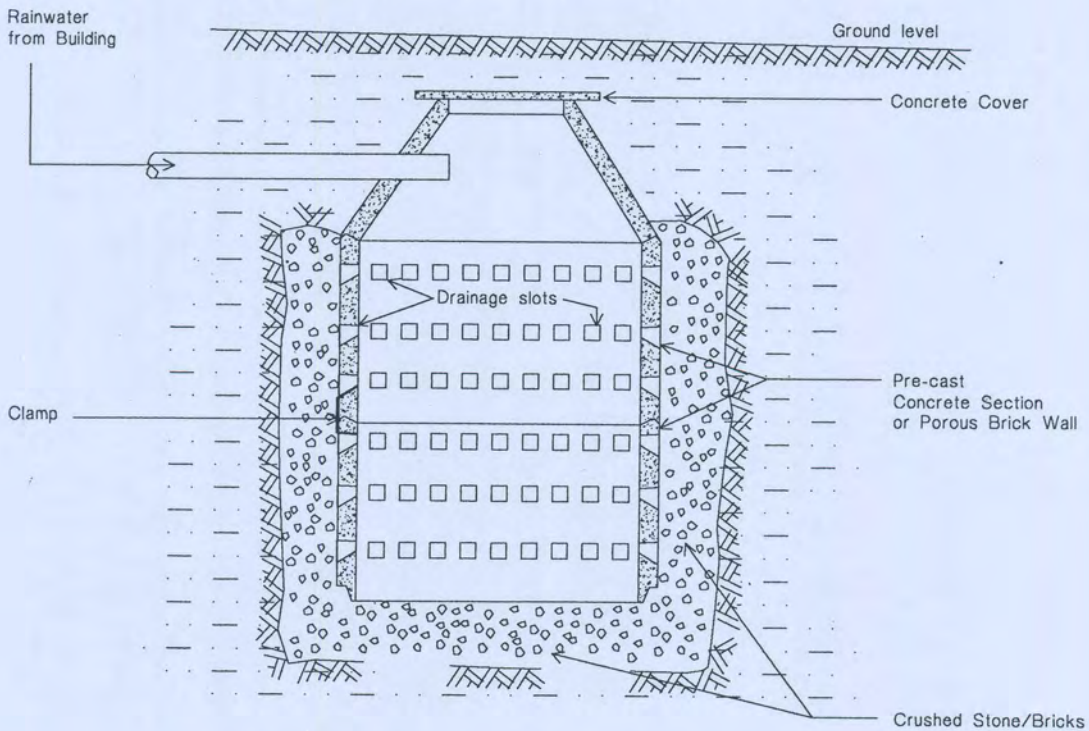


Fig. 8.7.14 Installation Details of a Dry Well



7.9.10.4 Large dry well shall be constructed in accordance with the requirements for seepage pit (Sec 7.9.12). However, for small dry wells handling limited quantities of rainwater, the pit may consist of an one metre length of 0.45 m diameter pipe filled with crushed stone.

7.9.10.5 Where rainwater will be used for domestic purpose, rainwater from roof or terrace may be led straight from conductor (or leader) to one or more storage tanks. Storage tanks shall be provided with ventilating covers. An arrangement shall be made in the rainwater leader to divert the first washings from the roof or terrace catchment as they will contain more undesirable materials. The open end of all pipes shall be covered with mosquito (insect) proof wire net.

7.9.10.6 Individual rain water traps shall be installed on the rainwater drain branch serving each leader or a single trap shall be installed in the main rainwater drain (building storm drain) just before its connection with the combined building sewer, main drain or public sewer.

7.9.10.7 No traps shall be required for rainwater drains which will be connected to a sewer draining rainwater exclusively.

7.9.10.8 Subsurface drainage pipings for rainwater drainage shall not be less than 100 mm in diameter. The subsoil drainage system shall be protected by an accessibly located backwater valve in case the building is subject to backwater or flooding. Subsoil drains shall discharge to a trapped area drain, sump, dry well or an approved location above grade.

7.9.10.9 Rainwater pipes shall not be used as soil, waste or vent pipes.

7.9.10.10 All roof areas, except those draining to hanging gutters, shall be equipped with roof drains with strainers extending not less than 100 mm above the surface of the roof and shall have an available inlet area not less than two times the area of the leader to which the drain will be connected.

7.9.10.11 It is recommended to have more than one rainwater drainage pipe for primary roof drainage system to minimize blockage.

7.9.10.12 It is recommended to provide secondary rainwater drainage system at a suitable elevation from the roof that has been considered in the calculation of rainwater load to design the building structure. The secondary drainage system shall be a separate drainage piping up to storm sewer or private waste (rainwater) disposal system. The size of secondary rainwater drainage piping shall not be less than the size required for primary rainwater drainage piping.

7.9.10.13 French drains may be employed as surface water drains for drainage of unpaved surfaces.

7.9.11 Septic Tank

7.9.11.1 Septic tank(s) (Fig 8.7.15 and 8.7.16) discharging into either a subsurface disposal field or one or more seepage pits shall be required for the approval of drainage and sanitation plans for the places where public sewers are not available.

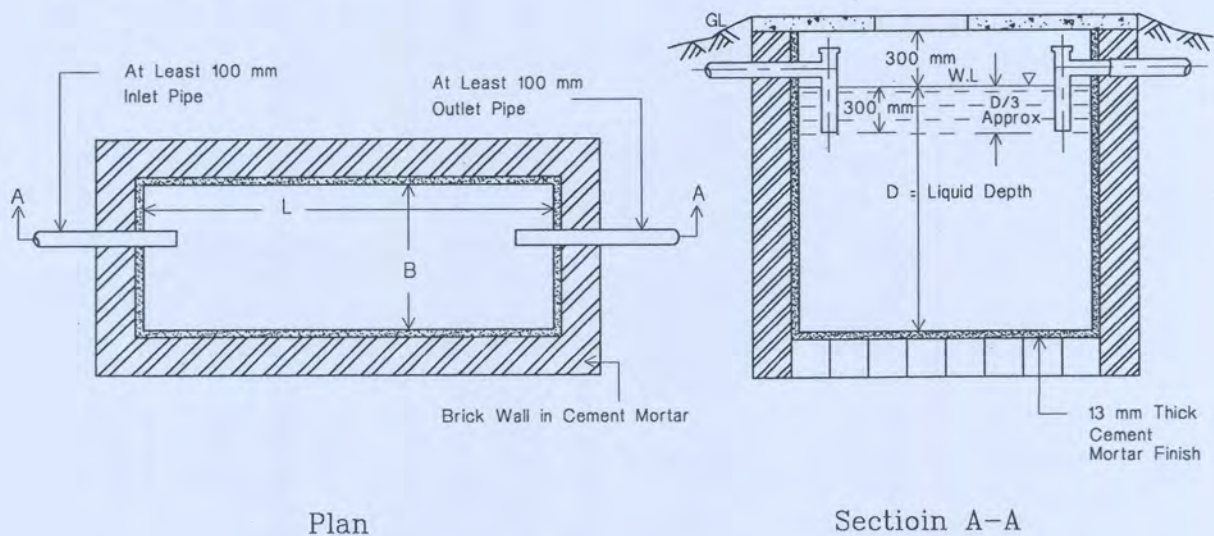
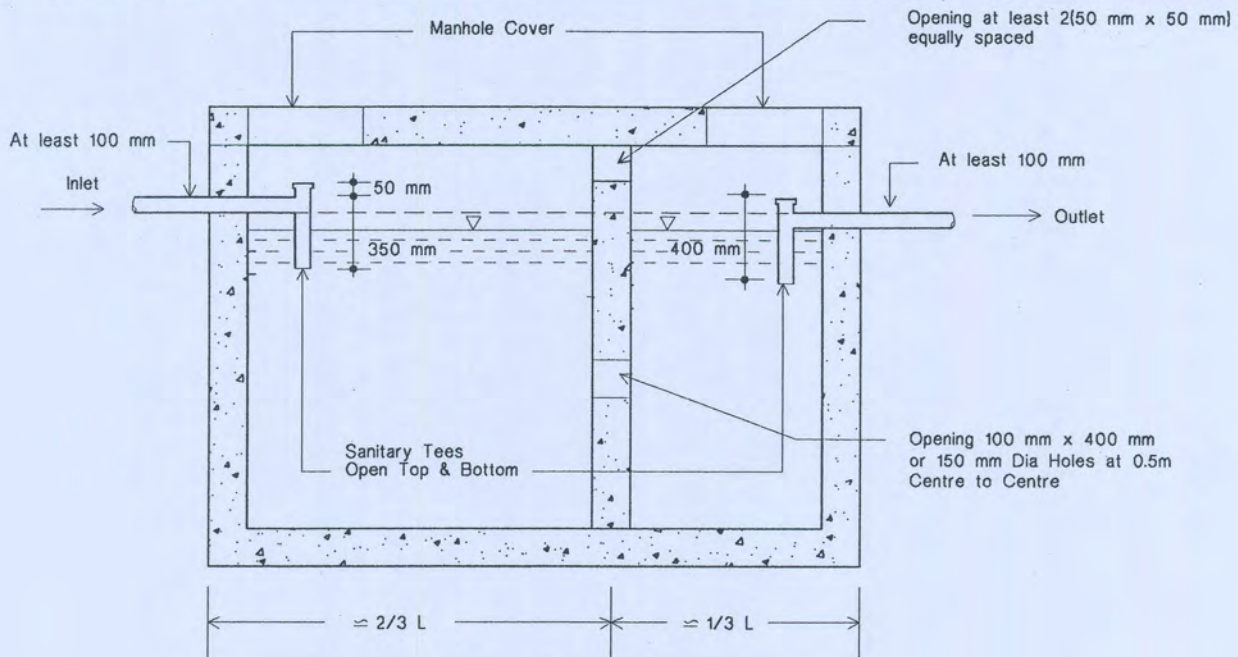
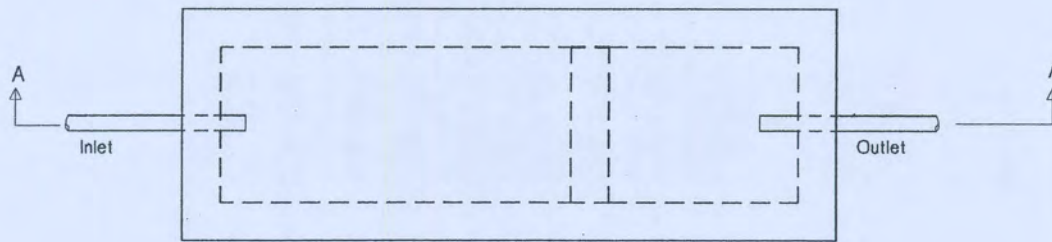


Fig. 8.7.15 Typical One Chamber Brick Septic Tank





Section A-A



Plan

**Fig. 8.7.16 Typical Two Chamber Concrete Septic Tank**

7.9.11.2 Such disposal method shall be designed by a licensed professional in accordance with the requirement of the provisions of this Code.

7.9.11.3 The design of such system shall be on the basis of location with respect to wells or other sources of water, soil permeability, ground water elevation, area available and maximum occupancy of the building.

7.9.11.4 Rainwater or ground water shall not be discharged into the septic tank.

7.9.11.5 Septic tank(s) shall not discharge into open water courses.

7.9.11.6 The minimum distance for various components of the disposal system shall be in accordance with Table 8.7.11.

7.9.11.7 The flow into a septic tank may be calculated on the basis of water consumption rate or on the basis of plumbing fixtures discharging simultaneously into it.

7.9.11.8 The septic tank shall have a minimum liquid capacity of 2000 litres, minimum width 1 m and minimum liquid depth 1 m. The length of a septic tank shall be at least twice its width. It is recommended that the length of a septic tank be not more than 4 times its width.

7.9.11.9 The maximum size of a septic tank shall be limited to the number of users not exceeding 300 persons for residential buildings (occupancy groups A, C, and D) and 1000 persons for all other occupancy groups. It is recommended to use independent parallel chamber septic tank for a population more than



100 persons for residential buildings (for occupancy groups A, C and D) and 350 persons for all other occupancy groups.

7.9.11.10 The diameter of a circular septic tank shall not be less than 1.4 m and shall have a operating liquid depth not less than 1 m.

7.9.11.11 The volume required for digested sludge and scum may be computed on the basis of 0.04 m<sup>3</sup>/capita/year.

7.9.11.12 The liquid retention time of a septic tank shall be at least 1 day.

7.9.11.13 The desludging frequency of a septic tank shall be at least once a year.

7.9.11.14 It is recommended to use two chamber septic tank when the capacity of a septic tank exceeds 3000 litres. The inlet compartment of a two chamber septic tank shall have a capacity not less than two-third of its total capacity (Fig 8.7.16).

Table 8.7.11  
Location of Components of Sewage Disposal System

System Component	Distance (m)				
	Building Foundation	Well	Stream	Seepage Pit	Dry Well
Septic tank	1.5	8	-	1.5	-
Disposal field	3	15	7.5	6	6
Seepage pit	4.5	15	15	6	6
Dry well	3	15	-	6	-

7.9.11.15 The septic tank shall be constructed of corrosion resistant material and be of permanent water tight construction. The manhole cover and the roof of the tank shall be designed for at least 7 kPa live load. The inlet compartment shall be provided with a manhole. Outlet compartment may also be provided with a manhole. The design guideline of a septic tank is presented in Appendix T.

7.9.12 Disposal Field and Seepage Pit

7.9.12.1 A distribution box shall be provided to receive the effluent from the septic tank to assure equal distribution to each individual line of disposal field. The distribution box shall be connected to the septic tank by a watertight sewer line and shall be located at the upper end of disposal field. Fig 8.7.17 shows the plans and sections of typical distribution boxes.

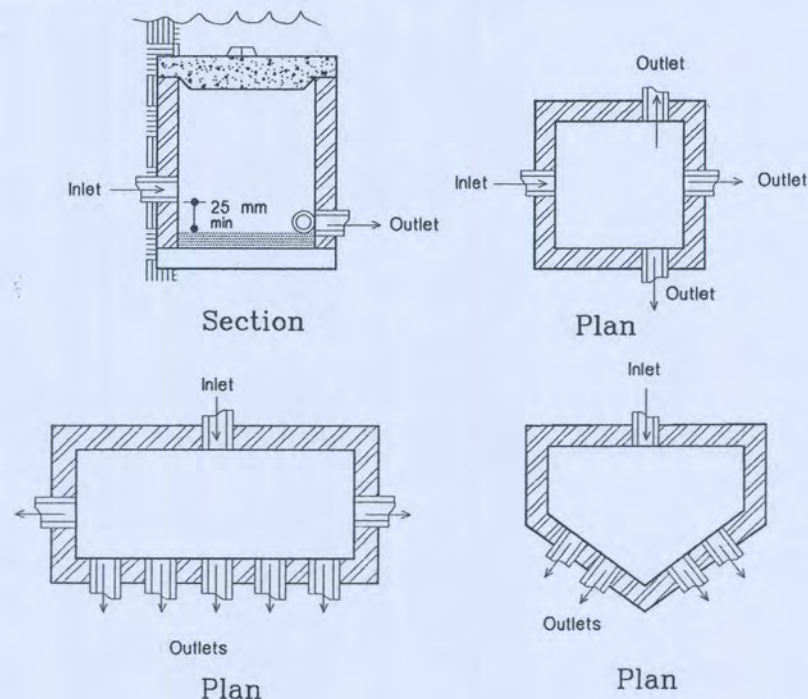


Fig. 8.7.17 Distribution Boxes



7.9.12.2 Soil percolation tests (at least for three holes) shall be performed at the site of a proposed individual sewage disposal system installation to determine the suitability of soil and site.

7.9.12.3 The liquid capacity (volume below inlet line) of seepage units (disposal field or seepage pit) shall be at least twice that of a septic tank. Effective absorption area of seepage unit may be computed in accordance with Table 8.7.12.

7.9.12.4 No seepage unit shall be extended into water table directly

7.9.12.5 Each disposal field shall have at least two outlet distribution lines from the distribution box. No portion of disposal field shall be installed under any pavement or any area where there will be vehicular traffic or parking

7.9.12.6 Minimum standards for disposal field construction shall be as shown in Table 8.7.13.

Table 8.7.12  
Absorptive Capacity of Disposal Field and Seepage Pit

Percolation Test Rate in Minutes for Water to Fall 25 mm	Effluent Allowance Rate of Seepage Unit in litre per m <sup>2</sup> per day	
	Disposal Field Trenches (bottom of trench)	Seepage Pit (wall area)
2 or less	128	172
5	96	128
10	68	92
30	32	44
60 (not recommended)	16	24
over 60 (not suitable)	-	-

Table 8.7.13  
Design Features of Disposal Field

Number of lateral branches	2
Maximum length of branch	20 m
Minimum diameter of field distribution pipe	100 mm
Maximum slope of field distribution pipe	3.3 mm per m
Depth of trench	0.45 m to 9 m
Trench bottom, minimum above ground water	0.61 m
Trench bottom width	0.45m to 0.75m
Depth of coarse material under pipe	150 mm
over pipe	50 mm
Size of coarse material	12 mm to 63 mm

7.9.12.7 Seepage pit (soak pit) shall be lined with stone, brick or concrete blocks laid up dry with open joints that are backed up with at least 75 mm coarse aggregate. The joints above the inlet shall be sealed with cement mortar. A reinforced concrete cover shall be provided. For cover area more than 0.75 m<sup>2</sup> the pit shall have an access manhole. The bottom of the pit shall be filled with coarse gravel, or crushed stone/brick to a depth of 0.3 m. Figure 8.7.18 provides the details of a seepage pit.

## 7.10 DESIGN OF DRAINAGE AND SANITATION SYSTEM

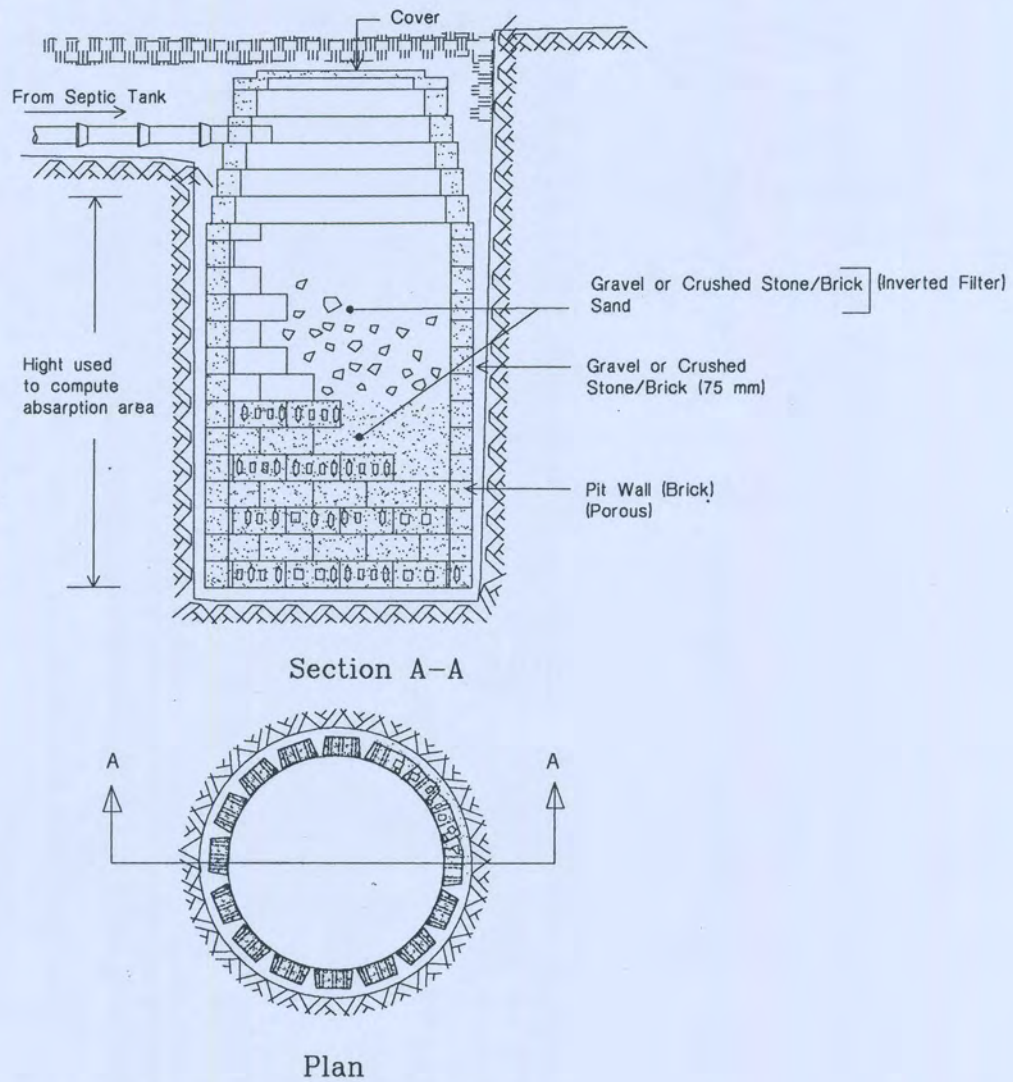
### 7.10.1 Estimation of Maximum Load Weight of Waste Water

The design of drainage piping depends on the load weight of all connected fixtures that might operate at any one time. The total load weight in soil or waste pipes is related to the probability of usage of connected fixtures to those pipes. To estimate the total load weight carried by a soil or waste pipe, the relative load weight for different kinds of fixtures are provided in Table 8.7.14. Table 8.7.15 provides an approximate rating of those fixtures not listed in Table 8.7.14. Therefore, the maximum load weight on any piping in terms of fixture units may be estimated knowing the number and type of connected fixtures to a pipe using Tables 8.7.14 and 8.7.15.

### 7.10.2 Gradient and Size of Pipe

7.10.2.1 The building drains and sewer shall be designed to discharge the peak simultaneous load weight flowing half-full with a minimum self-cleansing velocity of 0.75 m per second. However, flatter gradient may be used if required but the minimum velocity shall not be less than 0.6 m per second. Again, it is undesirable to employ gradients giving a velocity of flow greater than 2.5 m per second.





**Fig. 8.7.18 Typical Seepage Pit**

7.10.2.2 The maximum number of fixture units that may be connected to a given size of building sewer, building drain, horizontal branch or vertical soil or waste stack shall be as provided in Tables 8.7.16 and 8.7.17.

**7.10.3 Size of Rainwater Piping**

7.10.3.1 The size of vertical leaders shall be based on the maximum projected roof area according to Table 8.7.18.

7.9.3.2 The size of building storm drain, storm sewer or any of their horizontal branches shall be based on the maximum projected roof or paved area to be drained in accordance with Table 8.7.19.

7.10.3.3 The size of semi-circular gutter shall be based on maximum projected roof area according to Table 8.7.20.

**7.10.4 Size of Vent Piping**

7.10.4.1 The size of vent piping shall be determined from its length and the total of the fixture units connected thereto in accordance with Table 8.7.21.

7.10.4.2 The branch vent shall be sized in accordance with Table 8.7.22.



7.11 CONSTRUCTION RELATING TO CONVEYANCE OF RAINWATER AND SANITARY WASTES

7.11.1 Conveyance of Rainwater

7.11.1.1 All junctions and joints of rainwater piping shall be watertight.

7.11.1.2 Roof gutters shall be of suitable material of required thickness. All joints shall be watertight.

7.11.1.3 Construction of french drains (if used) shall be in accordance with established engineering practices.

7.11.2 Conveyance of Sanitary Wastes

7.11.2.1 The layout of drainage systems shall be simple. Change of direction and gradient shall be minimized and shall be as easy as practicable.

7.11.2.2 The excavation, where necessary, shall be made in accordance with Table 8.7.23.

Table 8.7.14  
Fixture Units for Different Sanitary Appliances or Groups

Type of Fixture	Fixture Unit Value as Load Factors
One bathroom group consisting of water closet, wash basin and bath tub or shower stall :	
a) Flush Tank water closet	6
b) Flush-valve water closet	8
Bathtub*	3
Bidet	3
Combination sink and tray (drain board)	3
Drinking fountain	0.5
Floor trap†	1
Kitchen sink, domestic	2
Wash basin, ordinary‡	1
Wash basin, surgeon's	2
Shower stall, domestic	2
Shower (group) per head	3
Urinal, wall lip	4
Urinal, stall	4
Water closet, tank operated	4
Water closet, valve operated	8
* A shower head over a bath tub does not increase the fixture unit value.	
† Size of floor trap shall be determined by the area of surface water to be drained.	
‡ Wash basin with 32 mm and 40 mm trap have the same load value.	

Table 8.7.15  
Fixture Unit Values for Fixtures Based on Fixture Drain or Trap Size

Fixture Drain or Trap Size	Fixture Unit Value
30 mm and smaller	1
40 mm	2
50 mm	3
65 mm	4
75 mm	5
100 mm	6



Table 8.7.16  
Maximum Number of Fixture Units that can be Connected to Branches and Stacks

Diameter of Pipe (mm)	Maximum Number of Fixture Units that can be Connected			
	Any Horizontal Fixture Branch <sup>a</sup>	One Stack of 3 Storeys in Height or 3 Intervals	More than 3 Storeys in Height	
			Total for Stack	Total at One Storey or Branch Interval
30	1	2	2	1
40	3	4	8	2
50	6	10	24	6
65	12	20	42	9
75	20	30	60	16
100	160	240	500	90
125	360	540	1100	200
150	620	960	1900	350
200	1400	2200	3600	600
250	2500	3800	5600	1000
300	3900	6000	8400	1500
375	7000	b	b	b

a Does not include branches of the building sewer.  
b Sizing load based on design criteria

Table 8.7.17  
Maximum Number of Fixture Units that can be Connected to Building Drains and Sewers

Diameter of Pipe (mm)	Maximum Number of Fixture Units that can be Connected to any Portion* of the Building Drain or the Building Sewer for Various Slopes			
	1/200	1/100	1/50	1/25
100	-	180	216	250
150	-	700	840	1000
200	1400	1600	1920	2300
250	2500	2900	3500	4200
300	2900	4600	5600	6700
375	7000	8300	10000	12000

\* Includes branches of building sewer

Table 8.7.18  
Size of Vertical Leaders\*

Size of Leader ** (mm)	Maximum Projected Roof Area and Flow	
	(m <sup>2</sup> )	(ℓ/min)
50	202	87
65	367	155
75	598	253
100	1287	544
125	2336	986
150	3790	1602
200	8180	3450

\* Table 8.7.18 is based upon a maximum rainfall of 25 mm per hour for a 1-hour duration. The figure for drainage area shall be adjusted to local conditions (Appendix T).  
\*\* The equivalent diameter of square leader will be the diameter of that circle which can be inscribed within the cross-sectional area. The equivalent diameter of the rectangular leader will be the short dimension of the rectangular leader. However, the ratio of width to depth of rectangular leader shall not exceed 3:1.



Table 8.7.19  
Size of Horizontal Building Storm Drains and Building Storm Sewer \*

Diameter of Drain (mm)	Maximum Projected Area and Flow for Various Slopes					
	10 mm per m		20 mm per m		40 mm per m	
	m <sup>2</sup>	ℓ/min	m <sup>2</sup>	ℓ/min	m <sup>2</sup>	ℓ/min
75	299	125	422	177	599	252
100	668	288	965	406	1370	577
125	1215	515	1715	725	2430	1030
150	1950	823	2745	1157	3900	1645
200	4185	1765	5940	2500	8380	3540
250	7550	3185	10650	4500	15100	6370
300	12140	5100	17140	7236	24280	10250
375	21700	9120	30600	12900	43400	18300

\* Table 8.7.19 is based upon a maximum rainfall of 25 mm per hour for 1-hour duration. The figure for drainage area shall be adjusted to local conditions in accordance with Appendix T.

Table 8.7.20  
Size of Semicircular Roof Gutters\*

Dia of Gutter (mm)	Maximum Projected Roof Area for Gutter of Various Slopes							
	5 mm per m		10 mm per m		20 mm per m		40 mm per m	
	m	ℓ/min	m <sup>2</sup>	ℓ/min	m <sup>2</sup>	ℓ/min	m <sup>2</sup>	ℓ/min
75	61	25	87	36	123	51	174	73
100	130	55	185	77	260	110	370	155
125	227	96	320	136	455	192	645	273
150	350	148	495	210	700	296	1010	425
175	503	210	710	300	1000	425	1420	600
200	725	307	1020	430	1300	610	2040	862
250	1300	555	1850	785	2610	1110	3650	1540

\* Table 8.7.20 is based upon a maximum rainfall of 25 mm per hour for 1-hour duration. The figure for drainage area shall be subject to local conditions in accordance with Appendix T.

7.11.2.3 The depth of cover shall be in accordance with Sec 7.9.8.

7.11.2.4 The pipe shall be laid to even gradients and change of gradient shall be combined with an access point (Sec 7.9.6). However, access points shall be provided only if blockages could not be cleared without them.

7.11.2.5 The joints and connection in drainage and venting system shall be gastight and watertight for the pressures required by the test, with the exception of those portions of perforated or open joint piping which will be installed for the purpose of collecting and conveying ground or seepage water to the underground storm drains.

7.11.2.6 Piping in a drainage and venting system shall be installed without undue strains and stresses and provision shall be made for expansion, contraction and structural settlement. Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the piping and its content. The horizontal piping shall be supported at sufficiently close intervals (Sec 7.8) to keep it in alignment and to prevent sagging.

## 7.12 REFUSE CHUTE SYSTEM

7.12.1 All buildings higher than 6-storeys shall be provided with refuse chute system for transporting and collecting refuse from different floors in a sanitary way. The refuse shall be received from the respective floor through an inlet hopper in to the chute which conveys refuse and discharges into the collection chamber. The refuse from the collection chamber shall be cleared at suitable intervals.

7.12.2 The refuse chute, inlet hopper and collection chamber shall be constructed with smooth and nonflammable materials.

7.12.3 The hopper shall be self-cleaning and shall be fitted with self-closing shutter to prevent the passage of foul gases inside the building.

7.12.4 The diameter of the chute shall not be less than 300 mm. It shall be adequately ventilated at the top. The chute shall be provided with suitable arrangements for flushing with water for the full length.



Table 8.7. 21  
Size and Length of Vent Stacks and Stack Vents

Diameter of Soil or Waste Stack (mm)	Total Fixture Unit (FU) Connected to fixture	Maximum Development Length of Vent (m)* for Diameter (mm) of Vent Pipes																			
		30	40	50	65	75	100	125	150	200	250	300									
30	2	9																			
40	8	15	45.5																		
40	10	9	30.5																		
50	12	9	22.5	61																	
50	20	8	15	45.5																	
65	42	9	30.5	91.5																	
75	10	12.5	45.5	109.5	317																
75	21	9.5	33.5	82	247																
75	53	8	28.5	70	207																
75	102	7.5	26	64	189																
100	43	10.5	26	76	298.5																
100	140	8	19.5	61	228.5																
100	320	7	16.5	52	195																
100	540	6.5	15	45.5	176.5																
125	190	8.5	25	97.5	301.5																
125	490	6.5	19	76	231.5																
125	940	5.5	16	64	204																
125	1400	4.5	15	58	180																
150	500	10	39.5	122	305																
150	1100	6.5	30.5	94.5	237.5																
150	2000	6	25.5	79	201																
150	2900	23.5	73	183																	
200	1800	9.5	29	73	286.5																
200	3400	7	22	58	219.5																
200	5600	6	19	48.5	186																
200	7600	5.5	17	42.5	170.5																
250	4000	9.5	23.5	94.5	292.5																
250	7200	7	18	73	225.5																
250	11000	6	15.5	61	192																
250	15000	5.5	14	55	173.5																
300	7300	9.5	36.5	116	286.5																
300	13000	7	28.5	91.5	219.5																
300	20000	6	24	76	186																
300	26000	5.5	22	70	152.5																
375	15000	12	39.5	94.5	286.5																
375	25000	9.5	29	73	219.5																
375	38000	8	24.5	61	192																
375	50000	7	22.5	55	173.5																

\* The development length shall be measured from the vent connection to the open air

7.12.5 The collection chamber shall be of suitable size and located at ground level.

7.12.6 The design and arrangement of the system shall be in accordance with established engineering practices.

7.13 HEALTH CARE DRAINAGE SYSTEM

7.13.1 General

The health care drainage system shall comply with applicable drainage and venting requirements specified in this chapter and with this section.

7.13.2 Special Fixtures and Equipment

The hospital shall be provided with clinical sink, bedpan washer and such other fixtures and equipment for disposal of bedpan contents and for the cleansing and disinfection of such fixtures. A clinical sink shall not be considered as a substitute for service sink.



Table 8.7.22  
Minimum Diameter and Maximum Length of Individual, Branch,  
and Circuit Vents for Horizontal Drainage Branches

Diameter of Horizontal Drainage Branch (mm)	Slope of Horizontal Drainage Branch (mm/m)	Maximum Development Length of Vent (m) for Diameter (mm) of Vent Pipe													
		30	40	50	65	75	100	125	150	200	250				
30	20	NL*													
	40	NL													
40	20	NL	NL												
	40	NL	NL												
50	10	NL	NL	NL											
	20	88	NL	NL											
	40	45	115	NL											
65	10	54	137	NL											
	20	29	73	NL	NL										
	40	15	39	NL	NL										
75	10	-	58	NL	NL	NL									
	20		29.5	128	NL	NL									
	40		15	67	NL	NL									
100	10		-	58	NL	NL	NL								
	20			30	94	NL	NL								
	40			14.5	48.5	125	NL								
125	10				58	149	NL	NL							
	20				29.5	76	NL	NL	NL						
	40				14	39.5	NL	NL	NL						
150	10					58	NL	NL	NL	NL					
	20					29.5	76	NL	NL	NL	NL				
	40					14	39.5	NL	NL	NL	NL				
200	10						58	NL	NL	NL	NL	NL			
	20						27.5	94.5	NL	NL	NL	NL	NL		
	40						11.5	45.5	125	NL	NL	NL	NL	NL	
250	10							58	152	NL	NL	NL	NL	NL	
	20							26	73	NL	NL	NL	NL	NL	
	40							9.5	33.5	NL	NL	NL	NL	NL	
300	10								54.5	NL	NL	NL	NL	NL	
	20								24	128	NL	NL	NL	NL	
	40								8	61	NL	NL	NL	NL	

\* NL means no limit; Actual value in excess of 150 m.

Table 8.7.23  
Minimum Width at Bottom of Trench

Depth of Trench (m)	Width of Trench (m)
Up to 1.2	Diameter of pipe plus 0.4
Above 1.2	Diameter of pipe plus 0.45

Note: Trench top width shall not be less than 0.75 m for depths exceeding 0.9 m

7.13.3 Bedpan Washer and Clinical Sink

Bedpan washer and clinical sink shall be connected to soil stacks through a water seal trap. The bedpan washer with vapour vent connection shall be provided with additional local vent stack. The minimum vent stack size for bedpan washer shall be in accordance with Table 8.7.24.

Table 8.7.24  
Minimum Vent Stack Size

No of Bedpan Washer	Diameter (mm)
Up to 3 bedpan washers at different floors	50
4 to 6 bedpan washers	75
7 to 12 bedpan washers	100

The bottom of the bedpan local vent stack (except for one bedpan washer) shall be drained indirectly into sanitary drainage system through traps. The size of the trap and connecting pipe shall be at least the size of



the vent stack. At least 6 mm diameter water supply piping shall be taken from each flush supply of each bedpan washer on the discharge side of vacuum breaker, trapped to form 75 mm or more trap seal and connected to the local vent stack on each floor.

**7.13.4 Sterilizer Vent Stack**

The pressure or nonpressure sterilizer shall have vent connection to the sterilizer vent stack. This vent connection shall be accessible for inspection and cleaning. The size of sterilizer vent stack shall be as follows:

**7.13.4.1 Pressure Sterilizers :** The minimum diameter for pressure sterilizer vent stack shall be 63 mm. The stack size for combinations of pressure sterilizer exhaust shall be in accordance with Table 8.7.25.

**7.13.4.2 Pressure Instrument Washer Sterilizers :** The minimum size of sterilizer vent stack for instrument washer sterilizer shall be 50 mm for up to two sterilizers. The 75 mm stack will serve up to four sterilizers.

**7.13.4.3 Nonpressure Sterilizers :** The minimum diameter of nonpressure sterilizer vent stack shall be 50 mm for utensil sterilizer and 38 mm for instrument sterilizer. Multiple installation shall be sized in accordance with Table 8.7.26.

**7.13.4.4 Bedpan Steamers :** The diameter for one bedpan steamer shall be 38 mm. The stack size for combinations shall be in accordance with Table 8.7.26.

**Table 8.7.25  
Pressure Sterilizer Vent Stack Size**

Stack Size (mm)	Number of Connections Permitted for Different Combination Sizes (mm)			
	19	25	31	38
38	3	-	-	-
38	-	2	-	-
38	-	-	1	-
38	2	1	-	-
50	6	-	-	-
50	-	3	-	-
50	-	-	2	-
50	-	-	-	1
50	3	2	-	-
50	2	1	1	-
50	1	1	-	1
75	15	-	-	-
75	-	7	-	-
75	-	-	5	-
75	-	-	-	3
75	1	5	-	1
75	-	1	2	2

**7.13.5 Vent Extension**

The termination of vent stack shall be in accordance with Sec 7.9.5.7 and 7.9.6.6.

**7.13.6 Special Fixture Drainage**

The device, appurtenance and appliance required for special purposes such as refrigerators, ice boxes, cooling or refrigerating coils etc. shall be protected against backflow with adequate air gap between the equipment outlet and drainage inlet.

**Table 8.7.26  
Nonpressure Sterilizer Vent Stack or Bedpan Steamer Sizes**

Stack Sizes (mm)	No of Connections Permitted for Different Connection Sizes(mm)	
	38	50
38	1	-
50	2	-
50	-	1
50	1	1
75	4	-
75	-	2
75	2	2
100	8	-
100	-	4
100	4	4



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**7.13.7 Mental Health Care Centre**

The pipes and traps used in mental health care buildings shall not be exposed and all fixtures shall be securely bolted through walls.

**7.14 INSPECTION, TESTING AND COMPLETION CERTIFICATE**

**7.14.1 Inspection**

The new drainage and sanitation system or part of existing system shall not be covered or enclosed or put into operation until it has been inspected, tested and approved by the Authority. The Authority may examine the appliances and fittings before their installation or during the progress of the work. An installation of plumbing work, whether new or existing, which is found to be defective or unsafe shall not be allowed to continue in use unless corrections have been made to comply with the Code requirements.

**7.14.2 Testing**

**7.14.2.1 Drainage and Venting System :** The piping of drainage and venting system shall be tested first with water. The final test of completed drainage and venting system may be done by smoke test. The water and smoke tests shall be performed as described below:

- a) **Water Test :** The water test shall be applied to the drainage and venting system either for the whole system or part (section) thereof. For the entire system, all openings in the piping except the highest opening shall be closed, and the system filled with water to the point of overflow. For the system to be tested in sections, each opening shall be tightly plugged except the highest opening of the section under test and each section shall be filled with water but no section shall be tested with less than a 3 m head of water. In testing successive sections, at least the upper 3 m of the next preceding section shall be tested so that no joint or pipe in the building (except the top most 3 m of the system) shall have been submitted to a test of less than a 3 m head of water. The water shall be kept in the system or in the portion under test for at least 15 minutes before the inspection starts. The system or the part of the system under test shall be watertight at all points.
- b) **Smoke Test :** The final test for gas and watertightness of the completed drainage and venting system may be performed by smoke test. The test is performed by filling all traps with water and then introducing smoke into the system produced by one or more smoke machines. When the smoke appears at the stack openings on the roof, they shall be closed and a pressure equivalent to 25 mm head of water shall be built and maintained for 15 minutes before inspection starts.

**7.14.2.2 Building Sewer :** The Connection between building sewer and public sewer or individual sewage disposal system shall be closed by inserting a test plug. The building sewer shall be filled with water under a pressure of not less than 30 kPa for at least 15 minutes. The system shall be able to maintain the test pressure.

**7.14.3 Completion Certificate**

After the installation of drainage and sanitation system, the licensed plumber shall give a completion certificate to the authority in a prescribed form (Appendix U) for inspection and testing. After testing, the Authority will give the final approval (as presented in completion certificate form, in the Appendix U) to use the system.

**7.15 GUIDE TO MAINTENANCE**

**7.15.1** The drainage and sanitation system shall be maintained in a sanitary and safe operating condition by the owner or his designated agent. All device or safeguards required by the Code shall be maintained in working order.

**7.15.2** The following operations shall be carried out during periodical cleaning of a drainage and sanitation system:

- a) The covers of inspection chambers and manholes shall be removed and the side benching and channels shall be scrubbed.
- b) All lengths of main and branch drains shall be rodded by means of drain rods and a suitable rubber or leather plunger. After rodding, the drains shall be thoroughly flushed with clean water.
- c) The ladders/rings in deep manholes and the manhole covers shall be painted.
- d) All surface water drains shall be cleaned.
- e) All subsoil drains shall be examined for obstruction at the open joints.
- f) Refuse chute system shall be cleaned.
- g) The rain water drainage system with primary drainage piping alone shall be properly maintained to avoid stagnation of water due to blockages.



**Related Appendices**

Appendix R	Application for Permit to Construct Drainage and Sanitation System
Appendix S	One-hour Rainfall
Appendix T	Design Guideline of a Septic Tank
Appendix U	Completion Certificate (Drainage and Sanitation Works)



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CHAPTER **8**

# Fuel Gas Supply

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8.1 GENERAL

8.1.1 **Scope**

**8.1.1.1** This chapter provides the requirements for safe use of fuel gas for fuel and lighting purposes in buildings.

A number of safety requirements regarding the installation and operation of gas piping systems on consumers' premises are laid down.

**8.1.1.2** The requirements of this chapter are aimed at safeguarding life and property in nonindustrial gas piping systems for use with fuel gases such as natural gas (NG) and liquefied petroleum gas (LPG) in the vapour phase used for fuel or lighting purposes.

**8.1.1.3** This chapter does not cover the safety requirements and rules for gas burning appliances. The requirements of National Fuel Gas Code of ANSI (1974 edition) and NFPA 58-1989 of the USA shall apply for such appliances.

**8.1.1.4** The requirements of this chapter do not apply to gas piping systems for industrial installation and applications.

**8.1.1.5** This chapter covers the aspects of design, fabrication, installation, test, operation, inspection and maintenance of gas piping systems from the point of delivery to the connections with each utilization device. The point of delivery is defined in this chapter as the outlet of the service regulator or the service shutoff valve where there is no meter.

**8.1.1.6** Piping systems covered here are limited to a maximum operating pressure of 3.45 kPa (14 inches of water column or  $\frac{1}{2}$  psig).

**8.1.1.7** While applying the provisions of this chapter, reference should also be made to the manufacturers' instructions, gas supply company's regulations and other applicable codes and standards listed in this chapter or required by the authority having jurisdiction.



**8.1.2 Terminology**

This section provides an alphabetical list of all terms used and applicable to this chapter of the Code. In case of any conflict or contradiction between a definition given in this section and that in any other chapter or part of the Code, the meaning specified in this chapter shall govern for interpretation of the provisions of this chapter.

**APPLIANCE** : Any device which utilizes gas to produce heat, light, power, refrigeration or air-conditioning.

**BRANCH LINE** : Gas piping which carries gas from a supply line to the appliance.

**BURNER** : A device for the final conveyance of the gas or a mixture of gas and air, to the combustion zone.

**CONCEALED GAS PIPING** : Gas piping, which, when in place in a finished building would require removal of permanent construction to gain access to the piping.

**CONSUMER'S CONNECTION** : Piping tapped on riser to supply each individual consumer.

**CYLINDER** : A portable container constructed in accordance with a recognized standard/ code such as the ASME code, used for transporting or storing LPG. The maximum size permitted is 454 kg water capacity.

**DIVERSITY FACTOR** : Ratio of the maximum probable demand to the maximum possible demand.

**DRIP** : The container placed at a low point in a piping system to collect condensate from which it may be removed.

**EXPOSED PIPING** : Gas piping which will be in view in the finished structure.

**GAS FITTER** : An employee of the gas supply company authorized to work on gas piping system/installation.

**GAS PIPING SYSTEM** : Piping from the meter, or service regulator when there is no meter, to an appliance or appliances.

**LABELED** : Equipment or materials to which a label, symbol or other certifying mark of a nationally recognized testing laboratory has been attached that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with nationally recognized standards or the conduct of tests to determine suitable usage in a specific manner.

**LISTED** : Equipment or materials included in a list published by a nationally recognized testing laboratory, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specific manner.

**METER** : An instrument installed to measure the volume of gas delivered through it.

**METER SET ASSEMBLY** : The piping and fitting installed by the gas supply company to connect the inlet side of the meter to the gas service and to connect the outlet side of the meter to the customer's house or yard piping.

**PILOT** : A small flame which is utilized to ignite the gas at the main burner or burners.

**PIPING** : It refers to either pipe or tubing or both. Pipe refers to a rigid conduit of iron, steel, copper, brass, aluminium or plastic. Tubing refers to a semi-rigid conduit of copper, steel, aluminium or plastic.

**PRESSURE REGULATOR** : A device designed to reduce and limit the gas pressure coming from the supply main and to maintain it essentially constant downstream. The regulated pressure shall correspond to that of the gas appliances used. The device may be either adjustable or convertible.

**PURGE** : To free a gas conduit of air, or gas or a mixture of gas and air.

**QUALIFIED INSTALLING AGENCY** : Any individual, firm, corporation, or company which either in person or through a representative is engaged in and is responsible for the installation or replacement of gas piping on the outlet side of the meter or of the service regulator when there is no meter, or the connection, installation or repair of gas appliances, who is experienced in such work, familiar with all precautions required and has complied with all the requirements such as qualification, registration, licensing etc. of the Authority.

**RISER** : Piping, usually vertical on most of its length which supplies gas from the service pipe to the different floors of the building.

**SERVICE PIPE** : The pipe which brings the gas from the gas main to the riser in the case of multi-storied building or the meter in the case of an individual house.



**SERVICE SHUTOFF VALVE** : A device that will shut off the gas supply to the controlled, source of burner(s) in the event ignition fails. This device may stop the flow of gas to main burner(s) only or to the pilot(s) and main burner(s) under its supervision.

**VALVE** : A device used in piping to control the gas supply to any section of a system of piping or to an appliance.

**VENT PIPE** : A safety device to which certain regulators are connected to release to the atmosphere gas that may escape from the normal circuit when some part of the system is damaged or malfunctions or a safety valve opens.

**WATER HEATER** : An appliance for supplying hot water for domestic purposes other than for space heating.

### 8.1.3 General Precautions

**8.1.3.1 Turn Gas Off** : All gas piping work or gas appliance installation shall be performed with the gas turned off to eliminate hazards from leakage of gas.

**8.1.3.2 Notification of Interrupted Service** : It shall be the responsibility of the installing agency, when the gas supply is to be turned off, to notify all affected consumers.

**8.1.3.3 Before Turning Gas Off** : Before turning off the gas to premises for the purpose of installation, repair, test, inspection, replacement or maintenance of gas piping or appliances, all burners shall be turned off. When two or more consumers are served from the same supply system, precautions shall be taken to ensure that only supply to the concerned consumer is turned off.

**8.1.3.4 Checking for Gas Leaks** : Soap and water solution or other material approved for the purpose, shall be used in locating gas leakage. Use of matches, candles, flames or other sources of ignition shall be prohibited for this purpose.

**8.1.3.5 Use of Lights** : Artificial illumination used in connection with a search for gas leakage shall be restricted to battery operated flashlights (preferably of the safety type) or approved safety lamps. In searching for leaks, electric switches should not be operated. If electric lights are already turned on, they should not be turned off.

**8.1.3.6 Working Alone** : An individual shall not work alone in any situation where working practice desires that two or more persons are necessary to carry out the work safely.

**8.1.3.7 Handling Liquid from Drips** : Liquid which is removed from a drip in an existing gas piping shall be handled with proper precautions, and shall not be left on the consumers' premises.

**8.1.3.8 No Smoking** : When working on piping which contains or has contained gas, smoking shall be prohibited.

**8.1.3.9 Handling of Flammable Liquids** : Flammable liquids used by the installer shall be handled with proper precautions and shall not be left within the premises from the end of one working day to the beginning of the next.

**8.1.3.10 Work Interruption** : When interruptions in work occur, the system shall be left in a safe and satisfactory condition.

**8.1.3.11** Certain requirements related to work on the gas supply system are listed in Appendix V.

### 8.1.4 Notification of Completion

**8.1.4.1** When regulations so require, the completion of installation shall be notified to the gas supply company or the Authority.

## 8.2 GAS PIPING INSTALLATION

### 8.2.1 Piping Plan and Approval

**8.2.1.1** Plans for installation of gas piping system and gas appliances shall be prepared in accordance with requirements of the gas supply company and the Authority. Necessary approvals shall be obtained from the gas supply company and the Authority before installation of the gas piping system and the appliances. (See Appendix W).

**8.2.1.2** The plan shall include proposed location of the piping, layout and sketch of the piping system, sizes of different branches, and present and future gas demands.

**8.2.1.3** Approved plans shall bear the authorized seal and signatures of the gas supply company and the Authority.



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**8.2.2 Size of Piping to Gas Appliances**

**8.2.2.1** Gas piping shall be sized to ensure adequate supply of gas to meet the maximum demand without undue pressure drop between the meter, or service regulator when there is no meter, and the appliance or appliances.

**8.2.2.2** In order to select the gas pipe sizes the following factors shall be considered:

- a) Allowable pressure drop from meter, or service regulator when there is no meter, to appliance
- b) Maximum gas consumption to be provided
- c) Length of piping and number of fittings
- d) Specific gravity of the gas
- e) Diversity factor

**8.2.2.3** The size of each gas piping system shall be determined by standard engineering methods acceptable to the gas supply company and the Authority.

**8.2.2.4** Gas pipes smaller than 12 mm in diameter shall not be used.

**8.2.2.5** Straight lengths of piping shall be used as far as practicable. Where there are bends in the pipeline, these should have a radius of at least five times the diameter of the pipe or as approved by the gas supply company.

**8.2.3 Acceptable Piping Materials**

**8.2.3.1** Piping material shall be one of the materials listed in Table 8.8.1 conforming to the corresponding standards, or other materials as may be approved by the gas supply company or the Authority.

**Table 8.8.1**  
**Fuel Gas Pipe Materials**

Material	Standards
Steel pipe	ASTM A53; ASTM A106
Steel tubing	ASTM A539; ASTM A254
Wrought steel and wrought iron pipe	ANSI B36.10
Ductile Iron Pipe	ANSI A21.52; ASTM A377
Copper or copper-alloy pipe	ASTM B42; ASTM B302
Copper or copper-alloy tubing (Type K or L)	ASTM B75; ASTM B88; ASTM B280
Brass pipe	ASTM B43
Aluminium-alloy pipe and tubing	ASTM B210; ASTM B 241
Plastic pipe and tubing	ASTM D2513; ASTM D2517

**8.2.3.2** Fittings shall be of an approved type and material for gas piping systems accepted to the gas supply company. Bushings shall not be employed.

**8.2.3.3** All joints and connections shall be of an approved type and material for gas piping systems acceptable to the gas supply company. Joints and connections shall be gas tight at the test pressure. (see Sec 8.2.9.3 and 8.2.9.4)

**8.2.3.4** Flexible metal pipes or heavy rubber pressure tubing may be used only for direct connections to burners.

**8.2.4 Fabrication of Piping for Installation**

**8.2.4.1** Gas pipe or tubing and fittings shall be clear and free from cutting burrs and defects in structure or threading, and shall be thoroughly brushed with chips and scale blown. Defects in pipe or tubing or fittings shall not be repaired when defective pipe, tubing or fittings have been identified. The defective material shall be replaced.

**8.2.4.2** Pipe, tubing, fittings and valves removed from any existing installation shall not be used again until they have been thoroughly cleaned, inspected and ascertained to be equivalent to new material.

**8.2.4.3** Metallic pipes with threads which are damaged or defective shall not be used.

**8.2.4.4** Metallic pipes shall be threaded in accordance with approved standard acceptable to the gas supply company.

**8.2.4.5** When used in a corrosive environment, metallic pipes and fittings shall be protected with a corrosion resistant coating.

**8.2.4.6** Joints and joining compounds if used in LPG installation shall be resistant to the action of liquefied petroleum gas.



8.2.5 **Installation of Gas Pipes**

8.2.5.1 Installation, repair and replacement of gas piping or appliances shall be performed only by a qualified installing agency or gas fitter.

8.2.5.2 **Protection of Piping** : Piping shall be buried to a sufficient depth or covered in a manner so as to protect the piping from physical damage. Measures should be taken to protect the piping from physical damage when it passes through flower beds, shrub beds and other such cultivated areas.

8.2.5.3 **Protection Against Corrosion** : Gas piping in contact with earth or other materials which will corrode the piping shall be protected against corrosion in an approved manner. When dissimilar metals are joined underground, an insulated coupling shall be used. Metallic piping shall not be laid in contact with cinder or ash.

8.2.5.4 **Piping Through Foundation Wall** : Underground gas piping, when installed below grade through the outer foundation or basement wall of a building, shall be either encased in a sleeve or otherwise protected against corrosion. The piping or sleeve shall be sealed at the foundation or basement wall to prevent entry of gas or water.

8.2.5.5 **Piping Underground beneath Buildings** : If the laying of gas piping underground beneath buildings cannot be avoided, the piping shall be encased in a conduit. The conduit shall extend into a normally usable and accessible portion of the building and, at the point where the conduit terminates in the building, the space between the conduit and the gas piping shall be sealed to prevent the entrance of gas from any possible leakage. The conduit shall extend at least 100 mm outside the building, be vented above grade to the outside and be installed in such a way as to prevent the entrance of water or moisture.

8.2.5.6 **Building Structure** : The building shall not be weakened by the installation of any gas piping. Existing beams or joists shall not be cut or notched.

8.2.5.7 **Piping Supports** : Gas piping in buildings, shall be supported with pipe hooks, metal pipe straps, bands or hangers of an approved type and material suitable for the size of piping, and located at specified intervals so that the piping cannot be moved accidentally from the installed position. Gas piping shall not be supported by other piping.

8.2.5.8 **Piping Entrance to Buildings** : When gas pipe enters a building through a wall or floor of masonry or concrete, it shall be sealed against the entrance of water, moisture or gas.

8.2.5.9 **Piping in Floors** : Piping in solid floors, such as concrete, shall be laid in channels in the floor suitably covered to provide access to the piping with a minimum damage to the building.

8.2.5.10 Changes in direction of gas pipe shall be made by the use of approved fittings, factory bends or field bends. Field bends shall be made by employing approved procedures and equipment.

8.2.5.11 Gas piping inside any building shall not be run in or through an air duct, chimney or gas vent, ventilating duct or elevator shaft. Gas piping shall not be taken through inaccessible or concealed areas where its condition cannot be inspected and accumulation of gas due to undetected leakage may create a dangerous condition.

8.2.5.12 **Provide Drips where Necessary** : A drip shall be provided at any point in the line of pipe where condensate may collect. When condensation is excessive, a drip should be provided at the outlet of the meter. This drip should be so installed as to constitute a trap wherein an accumulation of condensate will shutoff the flow of gas before it will run back into the meter. All drips installed shall be readily accessible to permit cleaning, inspection or emptying.

8.2.5.13 **Cap All Outlets** : Each outlet, including a valve or cock outlet, shall be firmly closed gas tight with a threaded plug or cap immediately after installation and shall be left closed until an appliance is connected thereto. Similarly, when an appliance is disconnected from an outlet and the outlet is not to be used again immediately, it shall be firmly closed gas-tight. The outlet shall not be closed with tin caps, wooden plugs, corks or by other improvised means or objects. Use of a listed quick disconnect device is acceptable.

8.2.5.14 **Prohibited Devices** : Any device that will reduce the flow cross-sectional area or otherwise obstruct the free flow of gas shall not be inserted or placed inside the gas pipe or fittings.

8.2.5.15 **Branch Pipe Connection** : All branch pipe connections and outlets shall be taken from the top or sides of horizontal lines and not from the bottom.

8.2.5.16 **Electrical Bonding and Grounding** : The gas piping shall be electrically continuous throughout its length and earthed except in sections where cathodic protection system is used for protection against corrosion. The piping shall not be used to ground any electrical equipment.

8.2.5.17 **Distance from Electrical Wiring** : The distance between the gas piping and electrical wiring system shall be at least 60 mm. They shall be fixed to prevent contact due to movement. The gas piping should be installed below the electrical wiring.



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**8.2.5.18 Distance from Steam Piping :** The gas piping and steam piping, if installed parallel, shall be at least 150 mm apart. The gas piping should preferably be installed below the steam piping.

**8.2.5.19 Gas Piping to be Graded :** All gas piping shall be graded not less than 1 in 750 to prevent accumulation of condensate or liquids in the line. All horizontal lines shall grade to risers, and from the risers, to the meter, or service regulator when there is no meter, or to the appliance.

**8.2.5.20** The gas piping shall be painted red in order to differentiate it from other piping. Where the piping is exposed to sun rays, it shall be painted silver gray.

**8.2.5.21** Documentation shall be maintained for all gas supply installations. (See Appendix W).

**8.2.6 Pressure Regulators**

**8.2.6.1** Where the pressure of gas supplied to domestic installation or other low pressure gas piping systems in buildings is in excess of 3.45 kPa, a gas pressure regulator of approved type and size shall be installed in the service pipe of each such system to prevent pressure in excess of 3.45 kPa from being introduced into such a building piping. If the building pipe is of welded construction the pressure regulator may be located upstream of the gas meter in each consumer's premises. In these cases, the gas pressure in the piping downstream of the gas pressure regulator shall not exceed 3.45 kPa.

**8.2.6.2** If installed inside a building, the regulator shall comply with the following :

- a) If any of the diaphragms of the regulator ruptures, the gas shall be directed to an outlet vent pipe made of brass or plastic in order to vent the gas out of the building. The vent pipe shall be installed about 1 m above the topmost story of the building in open air. Measures shall be taken to maintain the vent pipe free from any kind of obstruction to ensure spontaneous discharge of the escaping gas to the atmosphere.
- b) If the gas pressure at the outlet of the regulator falls below 50 per cent of the operating gas pressure or rises above twice the operating pressure, the gas supply to the pressure regulator shall shut off.
- c) In the case of malfunctioning of this safety device, a supplementary device shall connect the low pressure circuit to the vent pipe as soon as the exit pressure reaches 3.45 kPa.

**8.2.6.3** The gas supply company shall ensure that the heating value and supply pressure of gas shall not exceed the stated values for the type of gas being supplied.

**8.2.7 Service Shutoff Valves**

**8.2.7.1** Service shutoff valves shall be provided on all new services including replacements and shall be installed in a readily accessible location.

**8.2.7.2** Service shutoff valves shall be located upstream of the meter if there is no regulator or upstream of the regulator if there is one.

**8.2.7.3** All gas piping installation operating at pressure greater than 3.45 kPa shall be provided with shutoff valve of approved type installed on the service pipe outside the building.

**8.2.7.4** Underground shutoff valves shall be located in a covered durable kerb box, manhole, vault, or stand pipe which is designed to permit ready operation of the valve. The covers so provided shall be clearly marked "GAS".

**8.2.7.5** Every gas outlet shall have an individual shutoff valve. The shutoff valve shall be accessible and adjacent to the appliance.

**8.2.8 Existing Work**

**8.2.8.1** Nothing herein shall prohibit the continued use of an existing gas piping system without further inspection or test unless the Authority has reason to believe that defects which make the system dangerous to life or property exist.

**8.2.9 Inspection of Services**

**8.2.9.1** No person shall use or permit the use of a new system or an extension of an old system of gas piping in a building or structure before the same has been inspected and tested to ensure that the system is safe and a certificate has been issued by the Authority. (See Appendix W).

**8.2.9.2 Test of Piping for Tightness :** Before any system of gas piping is finally put in service, it shall be carefully tested to assure that it is gas tight and safe. Where any part of the system is to be enclosed or concealed, this test should precede the work of closing in. To test for tightness, the piping may be filled in with fuel gas, air or inert gas, but not with any other gas or liquid. Oxygen shall never be used.

**8.2.9.3** Before appliances are connected, the piping systems shall be tested at a pressure of at least 155 mm mercury for a period not less than 10 minutes without showing any pressure drop. The source of pressure shall be isolated before the pressure tests are performed.



8.2.9.4 Systems for undiluted LPG shall withstand the pressure test in accordance with the Sec 8.2.9.3 above or, when appliances are connected to the piping system, shall be tested at a pressure of not less than 255 mm nor more than 360 mm water column for a period of not less than 10 minutes without showing any pressure drop. The source of pressure shall be isolated before the pressure tests are performed.

8.2.9.5 The Authority shall, within a reasonable time after being requested to do so, inspect and test the gas piping system that is ready for such inspection and test. If the system is found to comply with the requirements of inspection and test as laid down, it shall issue the certificate.

8.2.9.6 It shall be unlawful to supply gas in a building before the required certificate has been issued (see Sec 8.2.9.5 above), except that the Authority may give temporary permission for a limited time to supply and use gas before such an installation has been fully completed and the certificate issued.

8.2.10 **Check of Leakage**

8.2.10.1 **Close All Gas Outlets** : Before supplying gas under pressure into any piping, all openings and outlets from which gas can escape shall be closed.

8.2.10.2 **Check for Leakage** : No matches, flames or other sources of ignition shall be used to check for gas leakage from meters, piping or appliance. Checking for gas leakage with soap and water solution shall be recommended (see Sec 8.1.3.4 and 8.1.3.5 also).

8.2.10.3 **Checking for Leakage with Meter** : Immediately after supplying gas into the piping, the system shall be checked to ascertain that no gas is escaping. This may be checked by carefully watching the test dial of the meter to determine whether the gas is flowing through the meter. Under no circumstances shall a leakage test be performed using a gas meter without ascertaining the operability of the meter immediately prior to such test.

8.2.10.4 **Checking of Leakage not using a Meter** : This can be performed by attaching to an appliance orifice, a manometer or equivalent device (gauge) so that it can be read in increments of 2.5 mm water column and momentarily turning on the gas supply and observing the gauging device for pressure drop with gas supply shutoff. No drop in pressure shall occur during a period of 3 minutes thereafter.

8.2.10.5 **When Leakage is Indicated** : If the meter test hand moves or a pressure drop on the gauge occurs, all appliances or outlets supplied through the systems shall be checked to ensure that they are shut off and do not leak. If they are shut off firmly there is a leak in the piping system. The gas supply shall be shut off until the necessary repairs have been made, after which the test specified in Sec 8.2.10.3 or 8.2.10.4 above shall be repeated.

8.2.11 **Purging**

8.2.11.1 **Purging All Gas Piping** : After piping has been checked, all gas piping shall be fully purged. Piping shall not be purged into the combustion chamber of an appliance. A suggested method for purging the gas piping to an appliance is to disconnect the pilot piping at the outlet of the pilot valve.

8.2.11.2 **Lighting Pilots** : After the gas piping has been fully purged, all appliances shall be purged and the pilots lighted. The installing agency shall satisfy itself that all piping and appliances are fully purged and safe for use before leaving the premises.

8.2.12 **Rules for Turning Gas On**

8.2.12.1 A person, who is an employee of the gas supply company and authorized by the gas supply company, shall turn on the gas at a service shutoff valve or at any valve that controls the supply of gas to more than one consumer.

8.2.12.2 Gas shall not be turned on at any meter valve without specific permission from the gas supply company or the Authority if any of the following conditions are found:

- a) If the gas piping, appliances or meter supply through the meter valve are known to leak or otherwise be defective;
- b) If required inspection of the piping or appliance has not been performed;
- c) If the gas supply company or the Authority has requested that the gas be left turned off;
- d) If the meter valve is found shutoff for some reason not known to the gas fitter.

8.2.12.3 Gas shall not be turned on at any branch line valve if any of the conditions listed in Sec 8.2.12.2 above are found. Where a branch line valve is found closed, a gas fitter shall again turn the gas on at such valve only if measures to prevent leakage are taken and no other unsafe conditions are created thereby.

8.2.12.4 Gas shall not be turned on at either the meter valve or the service line unless all gas keys/cocks or valves installed on all outlets in the piping system are closed or all outlets in the piping system are capped or plugged.



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**8.2.13 Rules for Shutting Off the Gas**

**8.2.13.1** The gas fitter shall put the gas off to any appliance, pipe or piping system and shall leave the gas turned off, until the cause for interruption has been removed in any one of cases mentioned below:

- a) If ordered to do so by the Authority;
- b) If leakage of gas is found, which appears to be sufficient to cause fire, explosion or asphyxiation;
- c) If an installation is found to be such as to seriously endanger life and property;
- d) If any condition exists which threatens interruption of gas supply that may cause burner failure or otherwise lead to dangerous conditions.

**8.2.13.2** Before turning off the gas at the meter, for the purpose of installation, repair, replacement, test, inspection or maintenance of piping or appliances, all burners and pilot valves on the premises supplied with gas through the meter shall be turned off and the meter test hand observed for a sufficient length of time to ascertain that there is no flow of gas through the meter. Where there is more than one meter on the premises, the desired meter is to be turned off by taking proper precautions.

**8.2.14 Provision for Meter Location**

**8.2.14.1** The meter location shall be such that the meter can be easily read and the connections are readily accessible for servicing. Location, space requirements, dimensions and type of installation shall be acceptable to the gas supply company and be approved by the same.

**8.2.14.2** Gas piping at multiple meter installations shall be clearly marked by a metal tag or other permanent means provided by the installing agency, designating the building or the part of the building being supplied.

**8.3 USE OF LIQUEFIED PETROLEUM GAS (LPG)**

**8.3.1** The cylinders used for the storage and transportation of liquefied petroleum gas (LPG) shall conform to the standards approved by the Authority.

**8.3.2** The handling, use, storage and transportation of liquefied petroleum gas in cylinders exceeding 500 ml of water capacity shall be done in accordance with the standards approved by the Authority and the guidelines of the gas supply company.

**8.3.3 LPG Cylinder Installation**

**8.3.3.1** Personnel engaged and responsible for the installation of cylinders, equipment and piping should understand the characteristics of LPG and be trained in good practice of handling, installing, inspection, test and maintenance of installation.

**8.3.3.2** The joining compounds used in the piping system shall be resistant to the action of liquefied petroleum gas. Hemp and similar materials shall not be used at the joint. In any joint in which the thread provides a gas tight seal, joining compound shall be used on the male thread.

**8.3.3.3** Fire extinguishers of dry power or carbon dioxide type and water and sand filled buckets are recommended to be kept near the LPG cylinder installations including premises where they are stored. The guidelines of the LPG supply company and the Authority shall be followed in this respect.

**8.3.3.4** Liquefied petroleum gas shall not be transferred from the cylinders in which it is supplied to any other container.

**8.3.4 Cylinder Location**

**8.3.4.1 Stationary Installations**

- a) Stationary installation not exceeding 40 kg of LPG may be installed indoors on any floor. Recommended minimum floor area per installation is 5 m<sup>2</sup>.
- b) Stationary installations each not exceeding 40 kg of LPG may be installed indoors on any floor within the same workspace provided the minimum distance between two such installations is 3 m. Recommended minimum floor area per installation is 5 m<sup>2</sup> and the total quantity of all such installations should not exceed 200 kg.
- c) Stationary installation not exceeding 80 kg of LPG may be installed indoors on any floor provided the floor area per installation is not less than 12 m<sup>2</sup>.
- d) Stationary installations each not exceeding 80 kg of LPG may be installed indoors on any floor and within the same workspace provided the minimum distance between two such installations is 3 m. Recommended floor area per installation is 12 m<sup>2</sup> and the total quantity of all such installations should not exceed 200 kg.



- e) Stationary installation not exceeding 320 kg of LPG may be installed indoors in an enclosed section of a building or a room reserved exclusively for this purpose and ventilated at low level directly to the outside air.
- f) Stationary installation above 320 kg (200 kg in case provision as in (e) above is not possible) but not exceeding 1000 kg shall be installed outdoors on the ground level only. A minimum distance of 3 m shall be maintained between such an installation and any building, public place, roadways and other surroundings. The installation shall be protected against weathering by sun, rain, etc. and from tampering by unauthorized persons. A suitable shade of approved type and material may be provided for the purpose. Adequate ventilation at ground level to the outside air shall be provided. The distance between any two such installations shall be 3 m unless separated by a solid wall of fire resistant material up to at least 1 m above the height of the manifold valve.
- g) Cylinders shall be placed upright with the valve uppermost.
- h) Cylinders shall not be installed below ground level and shall be at least 1 m away from drains, culverts or entrances and openings leading to cellars and other depressions in which gas might accumulate.
- i) Cylinders shall be placed on a firm and dry base such as concrete or brick floor. For outdoor installations the base shall be elevated.
- j) Cylinders shall not be placed close to steam pipes or any other source of heat and shall be protected from the weather and direct sun. Cylinders shall be placed at a distance of 3 m from any other source of heat which is likely to raise the temperature of cylinders above the room temperature unless separated by metal sheet or masonry partition.
- k) When cylinders are being connected or disconnected, there shall be no open flame or any source of ignition near by and smoking shall be prohibited.

**8.3.4.2 Portable Installations :** When portability of cylinders is desired, the following requirements shall be met:

- a) The sum total capacity of the cylinders connected to each manifold shall not exceed 80 kg of LPG. The total quantity of gas thus installed in a workspace shall not exceed 200 kg.
- b) The regulator shall be connected directly to the cylinder valve or to a manifold which shall be connected to the cylinder valve by means of rigid connections to have the regulator firmly secured.
- c) At any time the total quantity of gas at portable installations shall not exceed the limits in proportion to the floor area specified in Sec 8.3.4.1 (a) to (d).

**8.3.5 Manifolds and Pressure Regulators**

**8.3.5.1** If pressure regulators, manifold headers, automatic change over devices, etc. are connected to cylinders by flexible or semi-flexible connectors, they shall be rigidly secured. Copper tube pigtailed and reinforced high pressure hoses are considered to be flexible or semi-flexible connectors for such application.

**8.3.5.2** Pressure regulator fitted with a safety valve shall be either :

- a) installed in the open air, or
- b) vented to the open air by means of a metal vent pipe connected to the safety valve discharge line.

**8.3.5.3** Precautions shall be taken that safety valve outlets do not get blocked with dust or other substances.

**8.3.5.4** Suitable line shutoff valves shall be provided with each appliance or burner when more than one appliance are connected to the gas supply. Both ends of the connection to portable appliances shall be firmly attached with clips. These shall be resistant to the action of LPG.

**8.3.5.5** The manifold headers which do not have to be taken off in normal use should be braced or welded using material conforming to approved standards and having a melting point not less than 540° C.

**8.3.5.6 Instructions to Consumers :** Necessary instructions dealing with the following aspects shall be supplied by the LPG supply company to each consumer in the form of a manual:

- a) operation of the whole system;
- b) how to recognize and detect gas leakage;
- c) action to be taken in case of leakage;
- d) action to be taken in case of fire; and
- e) action to be taken in case of damage to, or failure of any part of the installation.

**8.3.6** For detailed information regarding installation of LPG cylinders in commercial, educational and institutional premises, the LPG supply company shall be consulted.



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**8.4 INSTALLATION OF SPECIFIC APPLIANCES**

**8.4.1 General**

**8.4.1.1** Gas appliances, accessories, and equipment shall be "Approved". Listed and labeled appliances are acceptable.

**8.4.1.2** It shall be ascertained whether the appliance has been designed for use with the gas to which it will be connected. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the gas supply company or the appliance manufacturer for complete instructions.

**8.4.1.3** Safety shutoff devices of the complete shutoff type shall be installed on manually controlled water heaters and automatically controlled appliances, except domestic ranges.

**8.4.1.4** Gas appliances shall not be installed in any location where flammable vapours are likely to be present or accumulate, unless the design, operation and installation are such as to eliminate the possibility of ignition of the flammable vapours.

**8.4.1.5** Appliances shall be vented in accordance with the instructions of their manufacturers or the procedures of the gas supply company.

**8.4.1.6** Gas appliances shall be firmly supported. They shall not exert undue strain on the connected piping and connections.

**8.4.1.7** The installing agency shall conform with the appliance manufacturer's specific recommendations in completing an installation that will provide satisfactory performance and serviceability. The installing agency shall also leave the manufacturer's installation, operating and maintenance instructions in a readily accessible location on the premises for reference and guidance of the Authority, servicemen, and the consumer or operator.

**8.4.1.8** Every gas appliance shall be located with respect to building construction and other equipment so as to permit ready access to the appliance. Sufficient clearance shall be maintained to permit cleaning of heating surfaces, replacement of parts, adjustment and maintenance.

**8.4.1.9** Gas appliances shall be connected by one of the following :

- a) Rigid pipe
- b) Semi-rigid tubing extensions of a tubing/piping system
- c) Listed appliance connectors
- d) Semi-rigid tubing in lengths up to 2 m that are in the same room as the appliance
- e) Listed gas hose connectors as approved.

The connector or tubing shall be protected against physical damages.

Aluminum-alloy tubing and connectors shall be factory coated to protect against external corrosion where they are in contact with masonry, plaster or insulation or are subject to frequent wettings by such liquids as water (except rain water), detergents or sewage.

**8.4.1.10** Any appliance connected to a piping system shall have an accessible manual shutoff valve installed upstream of the union or connector and within 2 m of the appliance it serves.

**8.4.1.11** Appliance connectors may be connected to the building piping by means of a listed quick disconnect device, and when installed indoors, a manual shutoff valve shall be installed upstream of the quick disconnect device.

**8.4.1.12** Electrical connection between gas appliances and the building wiring shall conform to the accepted electrical code .

**8.4.1.13** No devices using or dependent upon electricity shall be used to control or ignite a gas supply if of such type that failure of the electricity would result in the escape of unburned gas, or in failure to reduce the supply of gas under conditions which would normally result in its reduction, unless other means are provided to prevent the creation of dangerous temperatures, pressures or the release of gas.

**8.4.2 Cookers/Burners**

**8.4.2.1** A listed (labeled) cooking appliance or accessory may be installed in accordance with its listing and the manufacturer's instruction.

**8.4.2.2** Listed cookers/burners when installed on combustible floors shall be set on their own bases or legs firmly and shall be installed in accordance with their listing and the manufacturer's instructions. In absence of clearance information, the appliances shall be installed in consultation with the gas supply company. The clearances shall not interfere with the flow of combustion air, accessibility for operation and servicing.



8.4.2.3 Unlisted appliances shall be installed with at least a 150 mm clearance at the back and sides to combustible material. Combustible floors under unlisted appliances shall be protected in an approved manner.

8.4.2.4 Appliances shall have a vertical clearance above the cooking top of not less than 750 mm to combustible material or metal cabinets.

8.4.2.5 Appliances shall be installed so that the top or oven racks are level.

8.4.3 **Illuminating Appliances**

8.4.3.1 Listed (labeled) illuminating appliances shall be installed in accordance with their listing and manufacturer's instructions.

8.4.3.2 Unlisted illuminating appliances may be used when acceptable to the Authority and they shall be installed in accordance with the guidelines of the Authority.

8.4.3.3 Illuminating appliances designed for wall or ceiling mounting shall be firmly attached to substantial structures in such a manner that they are not dependent on the gas piping for support.

8.4.3.4 Illuminating appliance designed for post mounting shall be firmly attached to a post which has proper strength and rigidity. Posts shall be rigidly erected.

8.4.4 **Water Heaters**

8.4.4.1 Water heaters, with the exception of those having direct vent system shall not be installed in bathrooms, bedrooms or any occupied rooms normally kept closed.

8.4.4.2 Water heaters shall be located as close as practicable to the chimney or gas vent. They should be located so as to provide short runs of piping to fixtures.

8.4.4.3 Listed (labeled) water heaters shall be installed in accordance with their listing and manufacturer's instructions for clearance. Unlisted water heaters shall be installed with a clearance of 300 mm on all sides and rear and they shall be installed with the approval of the Authority following its guidelines.

8.4.4.4 Water heaters shall be connected in a manner to permit observation, inspection, maintenance and servicing.

8.4.4.5 Water heaters shall be fitted with limiting switches for pressure and temperature and also with temperature, pressure and vacuum relief devices in accordance with nationally recognized standards for such devices.

**Related Appendices**

Appendix V Work on the Gas Supply System

Appendix W Documentation for the Piping Installation



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APPENDIX R	Application for Permit to Construct Drainage and Sanitation System
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**Appendix A  
Maximum Demand and Diversity**

Some information on the determination of the maximum demand for an electrical installation are provided in this appendix. It also includes some notes on the application of allowances for diversity. It is impossible however, to specify the appropriate allowances for diversity for every type of installation since determination of such allowances calls for special knowledge and experience. The figures shown in Table A1 are therefore, intended to act as guideline. The current demand of a final circuit is determined by summing the current demands of all points of utilization and equipment in the circuit. Typical values to be used for this summation are given in Table A2. For blocks of residential dwellings, large hotels, and industrial and large commercial premises, allowances are to be assigned by a competent engineer.

The current demand of a circuit supplying a number of final circuits may be assessed by applying the allowances for diversity given in Table A1 to the total current demand of all the equipment supplied by that circuit. In the table, the allowances are appraised either as percentages of the current demand or, where followed by the letters f.l., as percentages of the rated full load current of the current using equipment. After the design currents for all the circuits have been determined, enabling the conductor sizes to be chosen, it is necessary to check that the limitation on voltage drop is met.

**Table A1  
Allowances for Diversity**

Purpose of final circuit fed from conductors or switchgear to which diversity applies	Type of Premises		
	Individual household installations, including dwellings of a block	Small shops, stores, offices and business premises	Small hotels, boarding houses, guest houses, etc.
1. Lighting	66% of total current demand	90% of total current demand	75% of total current demand
2. Cooking appliances	10 amperes + 30% f.l. of connected cooking appliances in excess of 10 amperes + 5 amperes if socket outlet is incorporated in unit.	100% f.l. of largest appliance + 80% f.l. of 2nd largest appliance + 60% f.l. of remaining appliances	100% f.l. of largest appliance + 80% f.l. of 2nd largest appliance + 60% f.l. of remaining appliances
3. Motors (other than lift motors which are subject to special consideration)	—	100% f.l. of largest motor + 80% f.l. of 2nd largest motor + 60% f.l. of remaining motors	100% f.l. of largest motor + 50% f.l. of remaining motors.
4. Water heater (thermostatically controlled)	No diversity allowable		

**Table A2  
Current Demand to be Assumed for Points of Utilization and Current using Equipment**

Point of Utilization or Current-using Equipment	Current Demand to be Assumed
Socket outlets other than 5A socket outlets	Rated current
5A socket outlets	At least 0.5A
Lighting outlet	Current equivalent to the connected load, with a minimum of 100W per lamp holder
House hold cooking appliance	The first 10A of the rated current plus 30% of the remainder of the rated current plus 5A if a socket outlet is incorporated in the control unit
All other stationary equipment	Standard rated current or nominal current.