NEPAL NATIONAL BUILDING CODE

NBC 208 : 2003

SANITARY AND PLUMBING DESIGN REQUIREMENTS

Government of Nepal
Ministry of Physical Planning and Works
Department of Urban Development and Building Construction
Babar Mahal, Kathmandu, NEPAL
Reprinted : 2064

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तत्कालिन श्री ५ को सरकार (मन्त्रिपरिषद्) को मिति २०६०।४।१२ को निर्णयानुसार स्वीकृत

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Preface

This code has been prepared having considered the provisions of Water Resources Act 2049. It contains general guidelines for water supply installations, sewage/ waste water disposal installations and rainwater disposal installations in buildings. The objectives are to make adequate water supply available (without any interruption) for the purpose of drinking, bathing, flushing toilets and any domestic use including fire fighting; to provide a system of self cleansing conditions for conveyance of foul waste water and for the removal of such waste water/sewage to a sewer or outer outlet without risk of nuisance and hazard to health and to dispose rainwater in buildings. Due to the limited technical manpower in the country's construction industry, the code has been simplified for the ease of use and implementation. It is hoped that with the development of the manpower and modernization of construction processess, it will be possible to release more sophisticated set of sanitary installation guidelines in future.

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B) Waste Water Disposal

C) Rain Water Disposal

A) Water Supply:

Scope: This section gives guidelines for water supply provisions in different types of buildings. The main objectives of such guidelines are to make adequate water supply available (without any interruption) for the purpose of drinking, bathing, washing, flushing toilets and any other domestic use including fire fighting).

1. Water Supply Requirements for Buildings :

The water supply requirement for buildings (excluding fire fighting need) should be based on following:

Table- A 1

S.N	Type of Buildings	Minimum requirement per head per day
1	Apartment Buildings	100 lit
2	Auditorium (per seat)	15 lit
3	Hospitals (including laundry) per bed	
	a) Number of beds <100	340 lit
	b) Number of beds >100	450 lit
4	Cold Storage	45 lit
5	Buildings Higher than 4-Storey Commercial & Industrial)	45 lit
	Recommended	
6	Residences	100 lit
7	Office	45 lit
8	Hostels (including quarters for nurses etc.)	100 lit
9	Hotels (per bed)	100 lit
10	Restaurants (per seat)	50 lit
11	Schools and colleges	
	a) Day schools	15 lit
	b) Boarding Schools	100 lit
12	Cinemas, Theatre Halls, Concert hall (per seat)	15 lit
13	Factories	
	a) With bathing facilities	45 lit
	b) Without bathing facilities	30 lit
14	Terminal Stations (Bus and Railways)	15 lit
15	Airports (Internations)	70 lit
16	Airports (Domestic)	20 lit

2 Water Storage :

In case water is available in the city mains at sufficient pressure and quantity throughout the day to rise upto the highest floor, no storage will be necessary at all and all fixtures could be supplied directly But it is usually not so. Storage of water within a premises is thus necessary,

a) to tide over period of intermittent supply
b) to provide for interruption of the supply from the main itself, caused by various reasons like repairs in the system, failure of power etc.
c) to meet the peak flow requirements within a building if the city mains do not meet it.
d) to maintain a storage for fire fighting requirement of the building.

The storage capacity required for a building depends on hours of public supply, pressure in the mains, demand pattern in the building and the fire fighting need. Water storage is usually done in underground tank or tanks at the ground level or overhead tanks.

2.1 General Water Storage Tanks :

2.1.1 Water tanks should be strong enough to take the vertical load and the natural pressure of water when full, and also the negative pressure within the tanks when the water in drawn out.

2.1.2 Water tank should be water tight and constructed with non-corrosive, non-toxic materials and should have smooth surface inside.

2.1.3 Water tanks must have at least one number of manhole of size 450mmx450mm for access and repairs, together with a locking arrangement and corrosion resistant steps, catch-rings or ladders to reach the bottom for cleaning purpose and maintenance.

2.1.4 Water tanks should have a vent pipe for ventilation as well as for prevention of negative pressure when water is drawn out from the tanks.

2.1.5 Water tanks should have an over flow pipe which also acts as a 'warning pipe' to indicate over flow of water from the already full tank.

2.1.6 Water tanks should have a scour pipe/washout pipe with a plug at the lowest point so that they can be emptied easily at the time of need.

2.1.7 Under no circumstances should any overflow or scour pipe/wash-out pipe from a water tank be connected directly to any drain, gully trap or sewer to avoid possible contaminations. These connections should be discharged over properly designed drains with a minimum air gap of 75-100 mm.

2.1.8 The overflow pipes or vent shafts if provided shall have a wire gauge cover of 1.5 mm mesh properly screwed tight to the opening to prevent the entry of mosquitoes, vermin, insects etc.

2.1.9 The top of the tank shall be so leveled as to prevent any stagnation of water on top.

2.2 Underground Storage.

Underground storage tanks or tanks at ground level are necessary to collect water from the city water mains during hours of supply if it does not reach the point of supply or the overhead tanks. It is then pumped to overhead tank for use within the building.

2.2.1 The capacity of an underground storage tank or tank on the surface should be the net difference between the peak demand and the flow during the hours of supply. Provision should be made for supply interruption due to various reasons like main repair work or power failure etc.

2.2.2 For normal buildings with a reliable public supply, underground storage capacity is taken at 12-24 hours of the average daily water demand.

2.2.3 Underground tanks should be built watertight and should not leak when empty or full. There should be no possibility of any ingress of subsoil water.

2.2.4 Underground tanks should not be located in low-lying areas which may permit entry of surface water from the top. The manhole cover shall be raised 30 cm above the highest flood level in the locality or ground level whichever is higher.

2.2.5 The underground tanks should not be located near sewers, septic tanks, soak pits, oil tanks or under car-parking areas to avoid all kind of contamination due to seepage or leakage.The minimum clearance distance as 5.0 meter.

2.2.6 The overflow water level in the underground tanks should be above the surrounding ground level to prevent the surface water from entering the tanks through overflows.

2.2.7 The top slab, the walls and the base should all be designed to take the possible load of traffic, natural pressure of soil from sides and bulging pressure from the base when empty, and the water pressure when full.

2.3 Overhead Storage.

2.3.1 In areas of chronic shortage or intermittent supply, overhead storage is also required for domestic use and flushing purposes and to ensure constant supply. The minimum overhead storage shall be in accordance to ;

Table-A 2

Type of Building	***Unit***	***Unit storage***
1. Apartments (Domestic use)	Residence	360 lit
2. Auditoriums	WC	500lit
3. Hospitals	Urinal	150 lit
	WC	300 lit
4. Cold Storage	Urinal	75 lit
	WC/Urinal	300
5. Buildings more than 4 Stories (Commercial & Industrial)	Residental	360 lit

Recommended		
i) Dwelling Units	Resident	360 lit
ii) Hostels	,,	360 lit
iii) Hotels	,,	135 lit
iv) Commercial Building without canteen	Head	50 lit
v) Commercial Building with canteens	Head	70lit
vi) Restaurants	Meal	12lit
vii) Day Schools	Head	12 lit
viii) Boarding Schools	Resident	90 lit
ix) Nurse's Hostels and Medical quarter	Resident	135 lit
Flushing Purpose		
i) For tenants having common convenience	WC	500 lit
ii) For residential premises other than (i)	WC	270 lit
	Additional WC in the same flat	180 lit
iii) For factories and workshops	WC	500 lit
	Urinal seat	180 lit
iv) For cinema halls, public	WC	500 lit
Assembly halls etc.	urinal seat	350lit

2.3.2 If placed on terraces the tank bottom should be clear off the terrace level to avoid overloading the structural slab, leakages and to make easy for future maintenance work. In tall buildings, security rail or wall on the top slab must be provided for safety of maintenance staff.

2.3.3 Lightning arresters must be provided as per the recommended practice on top of tanks in high rise buildings.

2.3.4 Tanks fabricated from galvanized or mild steel sheets should be protected against corrosion from water by painting both on the inside and outside with suitable paints.

3 Distribution System and Pipe Work:

The piping systems to distribute the water within the building through the different fixtures must be designed to provide uniform flows and pressure in all areas and floors within certain practical limitations.

3.1 The sizes of pipes depend on

a) the maximum rate of discharge required;

b) the length of pipes;

c) the head loss due to friction in that length and

d) the roughness of the interior surface of the pipe.

Several empirical formulae are used to determine the size of pipe. The Hazen Williams formula and charts based on the same may be used without any risk of inaccuracy in view of the fact that the pipes normally to be used for water supply are of smaller sizes.

As per Hazen William's formula
$V= 0.849\ CR^{0.63}\ S^{0.54}$
Where V= velocity of water in m/sec
C= Coefficient of roughness of the pipe
R= hydraulic means depth / radius
= D/4 of circular pipes flowing D= diameter
S= Slope of hydraulic gradient (pressure loss /length of pipe)
And Q = Discharge in cu.m./second = VxA
A = cross-sectional area of pipe in square m. = $\pi\ d^2/4$

In dead systems, Cobbrok-white equation is more justified

3.2 Plumbing shall be designed and adjusted to use minimum quantity of water in consistent with performance and cleaning. There should be at least a residual head of 0.018 N/mm^2 (1.81kg./cm^2) at the consumer's tap.

3.3 All premises intended for human habitation/occupancy or use shall be provided with supply of pure and wholesome water without any hazard of backflow or back-siphoning.

3.4 All pipe work shall be designed, laid or fixed and maintained as to remain completely water tight, thereby avoiding wastage, damage to property and the risk of any contamination.

3.5 Change in diameter and in direction shall preferably be gradual rather than abrupt to avoid undue loss of head. No bend or curve in piping shall be made which is likely to materially diminish or alter the cross-section.

3.6 The cover for the water main shall be at least 1.20 M. under National Highways,other roads 1.0m and 0.90M in the case of footpaths. This cover shall be measured from the top of the pipe to the surface of the ground.

3.7 The service pipe shall pass into or beneath the buildings at a depth of not less that 75 cm below the outside ground level.

3.8 The underground water service pipes and building sewer or drain shall be kept at a sufficient distances apart so as to prevent contamination of water. Water service pipes shall not be run or laid in the same trench as the drainage pipe. Where this is unavoidable, the following conditions shall be fulfilled;

a) the bottom of water service pipe at all points, shall be at least 30cm above the top of the sewer line at the highest point.

b) the number of joints in the water pipe shall be kept to a minimum.

3.9 Distribution pipes shall be made of any of the following materials like galvanized iron (GI Pipe) of medium class only.

3.10 Testing of the distribution system & fittings:
After the pipe work is completed and the fittings are all installed, it shall be carefully charged with water so that all air is expelled from the system. The entire system shall there be hydraulically tested to a pressure of 0.5 N /mm^2 (5kgf /cm^2) or twice the working pressure whichever in greater for a period of at least half an hour after steady state is reached. The entire installation shall be inspected visually for leakages, and sweating. All defects found shall be rectified by removing and remarking the particular section. Caulking of threads, hammering and welding of leak joint shall not be allowed.

3.11 Disinfection of the distribution system and storage tanks :

The storage tanks and pipes shall first be filled with water and thoroughly flushed out. The storage tank shall be filled with water again and a disinfecting chemical containing chlorine added gradually while the tanks are being filled to ensure thorough mixing.

4. Fire Fighting Provision.

Water is the most common fire extinguishing agent because it has the ideal properties for extinguishing the most common fires, it is available in plenty and is very cheap.

4.1 Shortage of water and intermittent public water supply has led to the need to have captive water storage tanks exclusively for fire fighting operation.

4.2 For water supply for wet riser system a storage tank should be available with arrangement for replenishment of water supply through public supply mains or by an alternate source of supply at the rate of about 1000 ltr/minute. Where this is not possible the capacity of the static tank will have to be increased. The storage should last for 90-120 minutes at a nominal pumping rate of 2400 ltr/minute. Storage available from swimming pools, ornamental pools are considered as supplementary and are not acceptable as replacement for fire storage tank.

4.3 Some categories of public buildings like Hotels, Boarding Houses, Restaurants, Schools and buildings used for educational and training purposes, Hospitals and Nursing Homes, Buildings for devotional congregations such as Temples, Mosques, Churches etc., Public Halls, Museums, Public libraries, Record rooms. Commercial offices, Banks, Government offices, Club houses, Retail shops, Emporia & Stores, Theatres, Cinemas and places of entertainment etc., which have generally low fire loads but higher personnel hazards, require to be provided with portables appliances where the total area of the floors exceeds 1000 sq. meters so that the whole of the floor is protected. It should be insured that no part of the floor is more than 6 metres from the hose nozzle when the hose reel in fully extended. There should be constant supply of water not less than 23 litres per minute through a nozzle of not less than 6.5 mm size for half an hour when upto 3 hose reels are operated. The hose shall be of reinforced rubber lining having a bore of 12/20-mm diameter. This water supply should be independent of domestic supply connections. A pressure of at least 3 kg/cm2 should be available at the highest hydrant outlet.

4.4 Hydrant System :

4.4.1 Dry Risers, so called because they contain no water in the pipes, are installed within a building with a landing valve in the staircase lobby. They terminate at the street level in the form of a fire brigade connection. The connection enables the five brigades to connect the fire brigade connection either to street fire hydrant directly or to a fire brigade pumper and charge the dry riser with water.

4.4.2 Wet risers are fixed pipe installations within a building and permanently charged with water under pressure from available water source.

4.4.3 Hydrant station is provided to serve an area of 926- 1000 sq.m. It is advisable of place it in fire-protected areas near each fire escape staircase or lobby so that it can be located easily.

Each hydrant station comprises,

a) a first aid, hose reel with 20mm diameter rubber hose about 30-36 m long with a 63 mm diameter landing valve.

b) two 15m x 63 mm. Reinforced rubber lined hoses with couplings and a branch pipe with a 12 mm nozzle for use by fire service personnel.

4.4.4 Fire pumps : To enable the water to reach the topmost floor, it is necessary to provide pumping sets connected to the fire tank or city public supply mains when permitted. The pump delivery is connected to the piping system of the hydrant or sprinkler system. Pumps are electrically driven and each system provided with a stand by pump. Pumps for fire hydrant systems and sprinkler system are separated and independent of each other, though common pumps having appropriate discharging capacity are used in many parts of the world.

4.4.5 Standby pumps : Where power supply in not dependable, standby pumps with diesel engine are provided to conduct fire fighting operations.

4.4.6 The typical fire-fighting installation requirement should be as given in the table below.

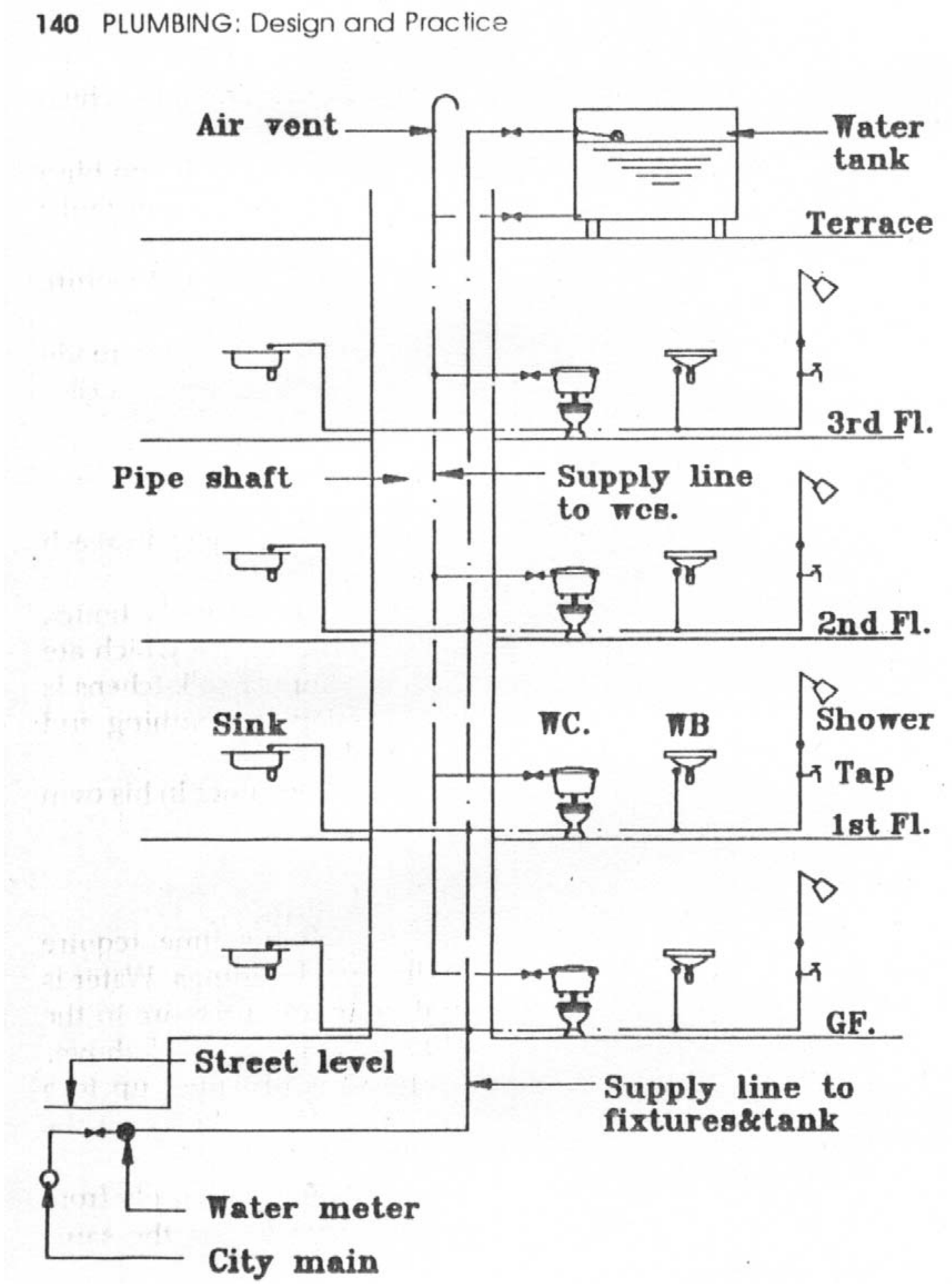
Table- A 3

Sn		Requirement				
		Water supply			Pump capacity	
	Type of building occupancy	Type of installation	Underground static tank	Terrace tank	Near underground tank	At the terrace level
1	Residential building a) lodging or room houses dormitories & hotels. (No provision is needed for dormitories housing less than 25 person .					
	*upto 15 mtr. In height.	Nil	50000 ltr.	Nil	Nil	Nil
	* above 15 m. height but not exceeding 24 m.	One wet riser cum down comer per 1000 m.sq. floor area. The riser shall be fully automatic in operation.	100000 ltr.	Nil	2400 lit/min at pressure not less than 0.3 N/mm.sq. (3kg./cm.sq) at the topmost hydrant	Nil

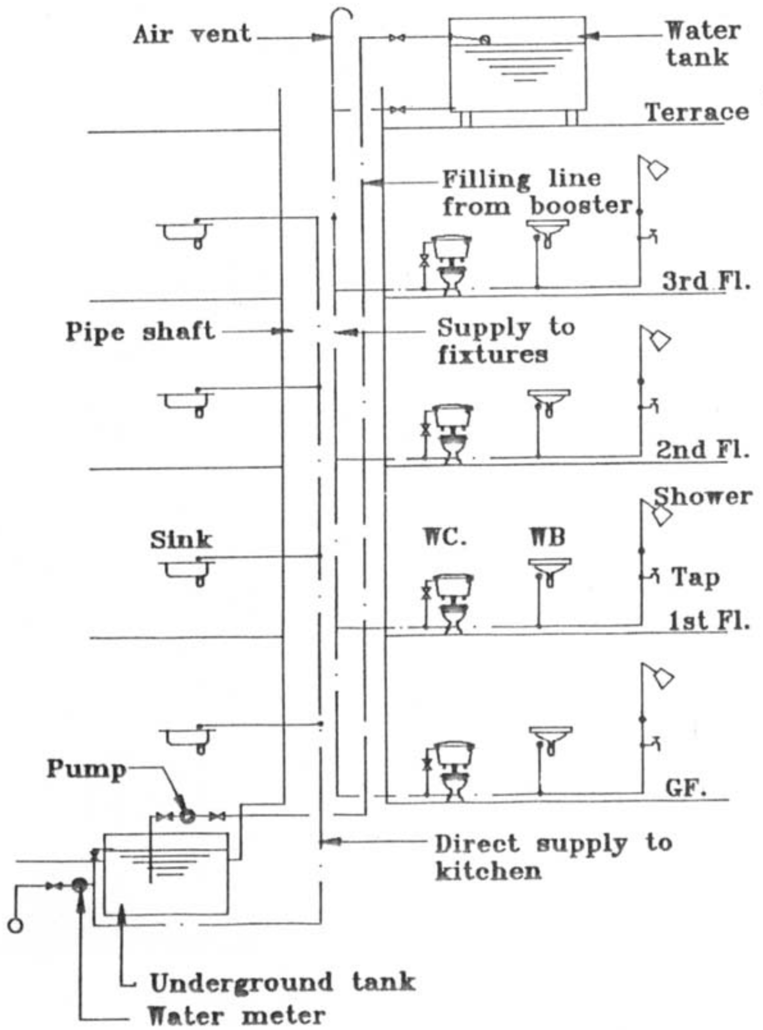
2	One or two family private dwelling & apartment houses (flat) i) Upto 15 m. height ii) Above 15 m. height but not exceeding 24 m.	Nil One wet riser cum down comer with a provision of fire service inlet at only ground level per 1000 m.sq. floor area.	Nil 50000Ltr.	Nil Nil	2400 lit/min at pressure not less than 0.3 N/mm.sq. (3kg./cm.sq) at the topmost hydrant	Nil Nil
3	Educational & Institutional building i) Up to 15 m. height ii) Above 15 m. in height but not exceeding 24 m.	Nil One wet riser cum down comer per 1000-m. sq. floor area.	50000 ltr 50000 ltr	Nil Nil	Nil 2400 lit/min at pressure not less than 0.3 N/mm.sq. (3kg./cm.sq) at the topmost hydrant	Nil Nil
4	Storage & Hazardous. Buildings. i) Upto 15 m. height	One wet riser com down comer per 1000 m. sq. floor area. The riser shall be fully automatic in operation.	100000 ltr	Nil.	1800 ltr/minute at pressure not less than 0.3 N/mm.sq. (3kg./cm.sq.) at the topmost hydrant.	Nil.
	ii) Above 15 m. in height but not exceeding 24 m.	One wet riser com down comer per 100 m. sq. floor area. The riser shall be fully automatic in operation.	100000 ltr	NIL	2400 ltr/minute at pressure not less than 0.3 N/mm.sq. (3kg./cm.sq.) at the toppest hydrant.	Nil

Note : a) A minimum of two hydrants shall be provided in the courtyard.
b) A wet riser cum down comer is an arrangement for fire fighting with in a building by means of vertical riser mains not less than 100 mm. Dai (Internal dia) with hydrant outlet on each floor and landing connected to overhead tank with proper non return valve.
c) The terrace tank & pump need not be provided if automatic pump at ground level can be maintained satisfactorily.
d) The size of riser shall be as under

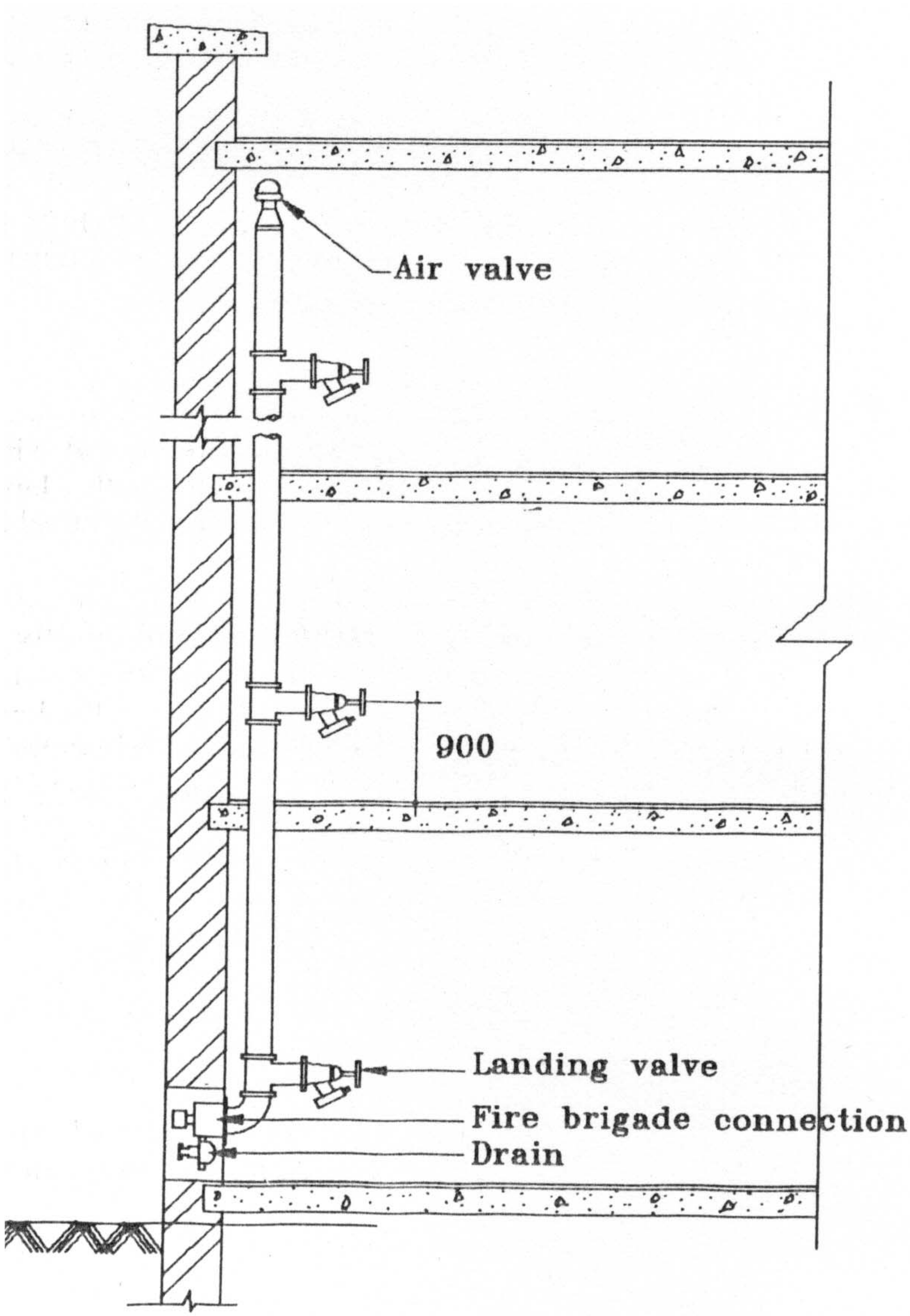
i) Apartment buildings upto 45 m. height---100 mm. with single two hydrant outlets and hose reel on each floor.
ii) Non apartment buildings up to 24 m. height---100 mm. with single hydrant outlet and hose reel on each floor.



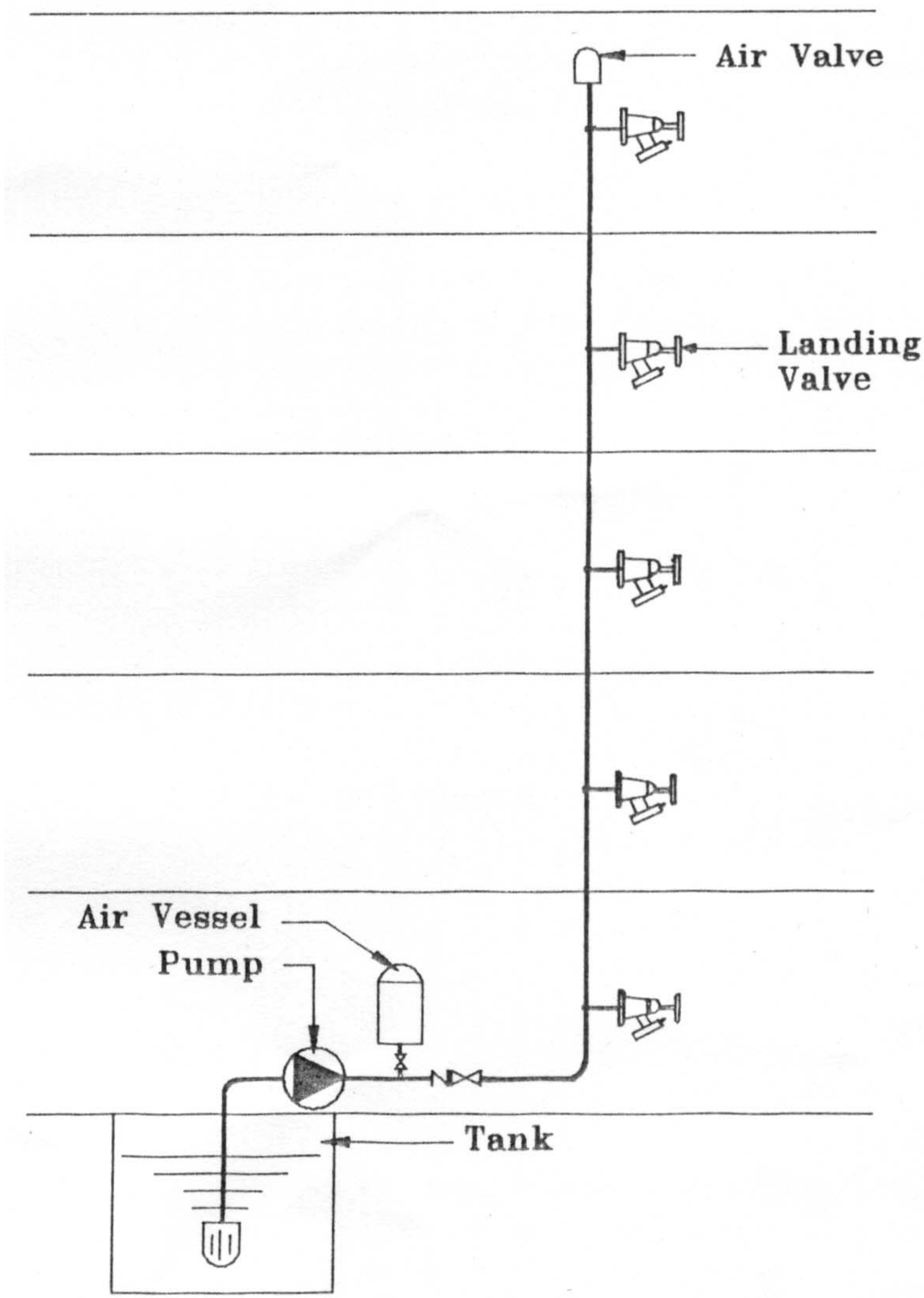
Direct O.H. Tank Supply
Illustration A1



Supply Through Underground Tank
Illustration A2



Dry Riser/Fire Fighting Installation
Illustration A3



Wet Riser/Fire Fighting Installation
Illustration A4

B) Waste Water Disposal :

Scope: This section covers general guidelines for different sanitation provisions in buildings. The aim shall be to provide a system of self cleansing conditions for conveyance of foul waste and surface water and for the removal of such wastes to a sewer or a outer outlet without risk of nuisance and hazard to health .

1 **Collection Systems** : The system to be adopted will depend on the type and planning of the building in which it is to be installed and will be one of the following :

1.1 **Two Pipe System** – A discharge pipe system comprising two independent discharge pipes one of which conveys soil excreta directly to the drain, the other conveying waste water to the drain through a trapped gully. The system may also require ventilating pipes.

1.2 **One Pipe System –** The plumbing system in which the waste connection from sinks, baths and wash basins and soil pipe branches are all collected into one main pipe connected directly to the drainage system. Gully traps and waste pipe are completely dispensed with but all the traps of water closets, basins etc. are completely ventilated to preserve the water seal.

1.2.1 Single Stack System – Single stack system eliminates the anti-siphonage pipe in the one pipe system. To be effective single stack system must be used in buildings having normal domestic flow. It is not suitable in building where short term high flows are generated in buildings. eg: schools, workshops, sports building. Where used, the toilets fixtures must be grouped together around a shaft to provide short and easy connections. As far as possible the fixture layout should be repetetive vertically. A long radius bend should be provided at the foot of each stack and the ground floor connection made directly to the manhole.

1.3 All fixtures should be provided with a water seal trap to prevent foul gases, insects and vermin of the main sewer from entering the building. The depth of water seal traps for different fixtures shall be as follows :

Water closet -50mm.
Floor trap - 50mm

1.4 All pipes are to be adequately sized and sloped for effective disposal of waste. Branches and stacks which receive discharge from WC pan should not be less than 100mm except where the outlet from siphonic WC is 80mm in which case a branch pipe of 80mm may be used; for outlet of the floor trap 75mm dia may be used.

1.5 All piping system is to be fully ventilated to allow for the removal of foul gases. Access to the atmosphere also maintains an equilibrium in the system, thereby avoiding negative pressure and retardation of flow in the pipes.

1.6 No connections and cross connections are to be made between the water supplies and the drainage system in order to avoid all possibilities of back flow and contamination.

1.7 Vertical stacks must continue to roof level as vent pipes without diminishing in diameter.

1.8 Bends and junctions should be smooth and rounded with access doors or clean out plugs wherever necessary.

1.9 Pipes used must be strong enough to withstand the internal pressure of the liquid carried and the external pressures to which it may be subjected particularly if buried.

1.10 Toilet layouts must be planned so that they are grouped together in an orderly manner, then allowing easy and direct connection from fixture to vertical stacks or manholes.

1.11 There should be at least one water tap and arrangement for drainage in the vicinity of each water closet or group of water closets in all buildings.

1.12 Each family dwelling unit on premises or any other structure for human occupancy abutting on a sewer or with a private sewage disposal system shall have at least one water closet and one kitchen type sink. It is desirable that a bath or shower should be installed to meet the basic requirement of sanitation and personal hygiene.

1.13 Where only one water closet is provided in a dwelling, the bath and water closet shall be separately accommodated.

1.14 Dwellings without individual conviniences shall have the following fitments.

a) One water tap with drainage arrangement in each tenement;
b) One water closet and one bath for every two tenements;
c) Water taps in common bathrooms and common water closets.

1.15 The requirements for fitments for drainage and sanitation in the case of buildings other than residences shall be in accordance with Table 1 to 13

1.16 A soil pipe conveying to a drain any solid or liquid, shall be circular and shall have a minimum diameter of 100mm.

TABLE B1 - OFFICE BUILDINGS

(Including Buildings higher than 4 Storey)

S.No	FITMENTS	FOR MALE PERSONNEL	FOR FEMALE PERSONNEL
1	2	3	4
I)	Water-closets	1 for every 25 persons of part thereof	1 for every 15 persons of part thereof
ii)	Ablution taps	1 in each water-closet,	1 in each water-closet
		1 water tap with draining arrangement shall be provided for every 50 person or part thereof in the vicinity of water-closet and urinals	
iii)	Urinals	Nil, up to 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons From 101 to 200 persons add at the Rate of 3 percent From over 200 persons add at the rate of 2.5 percent.	
iv)	Wash basins	1 for every 25 persons of part thereof	
v)	Drinking water fountains	1 for every 100 persons with a minimum of one on each floor	
vi)	Cleaner's sinks	1 per floor, Min, preferably in or adjacent to sanitary rooms	

This may include adequate number of water-closets of European style, where desired.

Table B2 - Factories

S.No	FITMENTS	FOR MALE PERSONNEL	FOR FEMALE PERSONNEL
1	2	3	4
i)	Water-closets	1 for 1-15 persons 2 for 21-45 persons 3 for 36-65 persons 4 for 66-100 persons	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
		From 101 to 200 persons, add at the rate of 3 percent	From 101 to 200 persons, add at the rate of 5 percent
		For over 200 persons, add at the rate of 2.5 percent	For over 200 persons, add at the rate of 4 percent
ii)	Ablution	1 in each water-closet	1 in each water-closet
		1 water tap with draining arrangements shall be provided for every 50 persons or part thereof in the vicinity of water-closets and urinals	
iii)	Urinals	Nil, up to 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons From 101 to 200 persons add at the Rate of 3 percent For over 200 persons add at the rate of 2.5 percent.	
iv)	Washing taps draining arrangements with	1 for every 25 persons or part thereof	
v)	Drinking water fountains	1 for every 100 persons with a minimum of one on each floor	
vi)	Bath (preferably showers)	As required for particular trades of occupations	

Note 1 for many trades of a dirty or dangerous character, more extensive provisions are required by law.

Note 2 Crèches, where provided, shall be fitted with water-closets (one for 10 persons or part thereof) and wash basins (one for 15 persons or part thereof) and drinking water tap with draining arrangements (one for every 50 persons or part thereof).

- Some of the water-closets may be of European style, if desired.

TABLE B 3 – AUDITORIUMS, CINEMAS, CONCERT HALLS AND THEATRES

S.No	FITMENTS	FOR MALE PUBLIC	FOR FEMALE PUBLIC	FOR MALE STAFF	FOR FEMALE STAFF
1	2	3	4	5	6
I)	Water-losets	1 per 100 persons up to 400 personsfor over 400 persons ad at the rate of 1 per 250 persons or part thereof	3 per 100 persons up to 200 persons for over 200 persons add at the rate of 2 per 100 persons or part thereof	1 for 1-15 persons 2 for 16.-35 persons	1 for 1-12 persons 2 for 13-25 persons
ii)	Ablution taps	1 in each water-closet	1 in each water-closet	2 in each water-closet	3 in each water-closet
		1 water tap with draining arrangements shall be provlded for every 50 persons or part thereof in the vicinity of water-closets and urinals.			
iii)	Urinals	1 for 25 persons or part thereof		Nil, up to 6 persons 1 for 7-20 persons 2 for 21-45 persons	
iv)	Wash basins	1 for every 200 persons or part thereof	1 for every 200 persons or part thereof	1 for 1-15 persons 2 for 16-35 persons	1 for 1-12 persons, 2 for 13-25 persons
v)	Drinking water fountain		1 per 100 persons or part thereof		

Note 1 Some of the water-closets may be of European styles, if desired.

Note 2 It may be assumed that two-third of the number are males and one-third females.

TABLE B 4 - ART GALLERIES, LIBARIES AND MUSEUMS

S.No	FITMENTS	FOR MALE PUBLIC	FOR FEMALE PUBLIC	FOR MALE STAFF	FOR FEMALE STAFF
i)	I) Water-closets	1 per 200 persons up to 400 persons For over 400 persons add at the rate of 1 per 250 persons or part thereof	1 per 100 persons up to 200 persons For over 200 persons, add at the rate of 1 per 159 persons or part thereof	1 for 1-15 persons 2 for 16.35 persons	1 for 1-12 persons 2 for 13-25 persons
ii)	Ablution taps	1 in each water-closet	1 in each water-closet	1 in each water-closet	1 in each water-closet
		1 water tap withdraining arrangements shall be provided for every 50 persons or part thereof in the vicinity of water-losets and urinals			
iii)	Urinals	1 per 50 persons		Nil, up to 6 persons 1 for 7-20 persons 2 for 21-45 persons	
iv)	Wash basins	1 for every 200 persons or part thereof. For over 200 persons, add at the rate of 1 per 250 persons or part thereof.	2 for every 200 persons or part thereof. For over 200 persons, add at the rate of 1 per 150 persons or part thereof.	1 for 1-15 persons 2 for 16-35 persons	1 for 1-12 persons 2 for 13-25 persons
v)	Cleaner's sinks		1 per floor, Min		
vi)	Drinking water fountain		1 per 100 persons or part thereof		

Note : 1 some of the water-closets may be of European style, if desired.

Note : 2 It may be assumed that two-third of the number are males and one-third females.

TABLE B 5 - HOSPITAL INDOOR PATIENT WARDS

S.No.	Fitments	For Males and Females
1	2	3
i)	i) Water-closets	1 for every 8 beds or part thereof
ii)	Ablution taps	1 in each water-closet plus one water tap with draining arrangements in the vicinity of water-closets and urinals for every 50 beds or part thereof.
iii)	Wash basins	2 up to 30 beds; add 1 for every additional 30 beds or part thereof
iv)	Baths	1 bath with shower for every 8 beds or part thereof
v)	Bedpan washing sinks	1 for each ward
vi)	Cleaner's sinks	1 for each ward
vii)	Kitchen sinks and dish washers (where kitchen is provided)	1 for each ward

Note : 1 Some of the water-closets may be of European style, if desired.

Note : Additional and special fitments for specific needs of hospitals may be provided.

TABLE B 6 - HOSPITALS, OUTDOOR PATIENTS WARDS

S.No	FITMENTS	FOR MALE	FOR FEMALE
1	2	3	4
i)	Water-closets	1 for every 100 persons or part thereof	2 for every 100 persons or part thereof
ii)	Ablution taps	1 in each water-closet 1 water tap with draining arrangements shall be provided for every 50 persons or part thereof in the vicinity of water-closets and urinals	2 in each water-closet
iii)	Urinals	1 for every 50 persons or part thereof	
iv)	Wash basins	1 for every 100 persons or part thereof	2 for every 100 persons or part thereof
v)	Drinking water fountain	1 per 500 persons or part thereof	

Note : 1 Some of the water-closets may be of European style, if desired.

Note : Additional and special fitments for specifick needs of hospitals may be provided.

TABLE B7 - HOSPITALS (ADMINISTRATIVE BUILDINGS, MEDICAL STAFF AND QUARTERS AND NURSES' HOMES

St No	Fitments	For Administrative Buildings		For Medical Staff Quarters (hostel type)		For Nurses' Homes (hostel type)
		For male personnel	For Female Personnel	For Male Staff	For Female Staff	
1	2	3	4	5	6	7
I)	Water-closets	1 for every 25 persons or part thereof	1 for every 15 persons or part thereof	1 for 4 persons	1 for 4 persons	1 for 4 persons or part thereof
ii)	Ablution taps	1 in eachwater-closets	1 in eachwater-closets	1 in eachwater-closets	1 in eachwater-closets	5 in eachwater-closets
iii)	Urinals	Nil, up to 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 41-100 persons				

		From 101 to 200 persons,add at the rate of 2-5 percent				
		From 200 persons,add at the rate of 2-5 percent				
iv)	Wash basins	1 for every 25 persons or part thereof	1for every 25 persons or part thereof	1 for every 8persons or part thereof	1for every 8persons or part thereof	1 for every 8persons or part thereof
v)_	Bath (with shower)	-	-	1for every 4persons or part thereof	1for every 4persons or part thereof	1 for every 4-6 persons or part thereof
vi)	Drinking water fountains	1 por 100 persons or part thereof with a minimum of 1 on each floor				
viii)	Cleaner's sinks		1 per floor, Min			

Note : 1 Some of the water-closets may be of European style, if desired.

Note : 2 It may be assumed that two-thirds of the number are males and one-third females.

TABLE B8 – HOTELS
(Including Buildings more than 4-storey)

St No	Fitments	For Residental Public and Staff	For Public Rooms		For Non-Residential Staff	
			For male	For Females	For Male Staff	For Female Staff
1	2	3	4	5	6	7
I)	Water-closets	1 per 8 persons omitting occupants of the room with attached water-closets; minimum of 2 if both sexes are lodged	1 per 100 persons up to 400 persons For over 400, add at the rate of 1 per 250 persons or part thereof	2 per 100 persons up to 200 persons For over 200, add at the rate of 1 per 100 persons or part thereof	1 for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-100 persons	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
ii)	Ablution taps	1 in each water-closet	1in each water-closet	1in each water-closet	1 in each water-closet	1 in each water-closet
iii)	Urinals	-	1 per 50 persons or part thereof	-	Nil, up to 6 persons 1 for 7-20 persons 2 for 2-45 persons 3 for 46-70 persons 4 for 71-100 persons	
iv)	Wash basin	1 per 10 persons omitting the wash basins installed in the room suite	1 per water-closet and urinal provided	1 per water-closet provided	1 for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-100 persons	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
v)	Baths	1 per 10 persons omitting occupants of the room with bath in suite	-	-	-	-
vi)	Slop sinks	1 per 30 bedrooms; 1 per floor, Min	-	-	-	-

vii)	Kitchen sinks and dish washers	1 in each kitchen

Note : Some of the water-closets may be of European style, if desired.
Note 2 It maybe assumed that two-thirds of the number are males and one-third females.

TABLE B9 – RESTAURANTS (Including Buildings more than 4 storey)

St No	Fitments	For Male Public	For Female Public	For Male Staff	For Female Staff
1	2	3	4	5	6
I)	Water-closet	1 for 50 seats up to 200 seats For over 200 seats, add at the rate of 1 per 100 seats or part thereof	1 for 50 seats up to 200 seats For over 200 seats, add at the rate of 1 per 100 seats or part thereof	1 for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-100 persons	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
ii)	Ablution taps	1 in each water-closet	1in each water-closet	1in each water-closet	1 in each water-closet
		1 water tap with draining arrangements shall be provided for every 50 persons or part thereof in the vicinity of water-closets and urinals			
iii)	Urinals	1 per 50 persons or part thereof		Nil, up to 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons	
iv)	Wash basin	1 for every water-closet provided			
v)	Kitchen sinks and dish washers	1 in each kitchen			
vi	Slop and service sinks	1 in each Restaurant			

Note : Some of the water-closets may be of European style, if desired.
Note 2 It maybe assumed that two-thirds of the number are males and one-third females.

TABLE B10 - SCHOOLS AND EDUCATIONAL INSTITUTIONS

St No	Fitments	Nursery Schools	Educational Institutions (Non-Residential)		Educational Institutions (Residential)	
			For Boys	For Girls	For Boys	For Girls
1		2	3	4	5	6 7
I)	Water-closets	1 per 15 pupils or part thereof	1 per 40 pupils or part thereof	1 per 25 pupils or part thereof	1 for every 8 pupils or part thereof	1 for every 6 pupils or part thereof
ii)	Ablution taps	1 in each water-closet	1in each water-closet	1in each water-closet	1 in each water-closet	1 in each water-closet
		1 water tap with draining arrangements shall be provided for every 50 persons or part thereof in the vicinityof water-closets and urinals				
iii)	Urinals	-	1 per 20 pupils or part thereof		1 for every 25 pupils or part thereof	-
iv)	Wash basins	1 for every 15 pupils or part thereof	1 per 60 Min 2	1 per 40 Min 2	1 for every 8 pupils or part thereof	1 for every 6 pupils or part thereof
v)	Baths	1 bath-sink per 40 pupils or part thereof			1 for every 8 pupils or part thereof	1 for every 6 pupils or part thereof
vi)	Drinking water fountains	1 for every 50 pupils or part thereof	1 for every 50 pupils or part thereof	1for every 50 pupils or part thereof	1 for every 50 pupils or part thereof	1 for every 50 pupils or part thereof
vii)	Cleaner's sink			1 per floor, Min		

For teaching staff, the schedule of fitments to be provided shall be the same as in the case of office buildings

Note : Some of the water-closets may be of European style, if desired.

TABLE B 11- HOSTELS

S.No	Fitments	For Residents and Residential Staff		For Non-Residential Staff		Rooms Wherein Outsiders Are Received	
		For Males	For Females	For Males	For Females	For Males	For Females
1	2	3	4	5	6	7	8
I)	Water-closets	1 for every 8 person or part thereof	1for every 6 person or part thereof	1for 1-15 persons 2 for 16-35 persons 3 for 36-45 persons 4 for 66-100 persons	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 per 100 persons up to 400 persons For over 400 persons, and at the rate of 1 for 250 persons or part thereof	2 per 100 persons up to 200 persons For over200 persons, and at the rate of 1 for 100 persons or part thereof
ii)	Ablution taps	1 in each water-closet	1in each water-closet	1in each water-closet	1 in each water-closet	1 in each water-closet	
		1 water tap with draining arrangements shall be provided for every 50 persons or part thereof in the vicinity of water-closets and urinals					
iii)	Urinals	1 per 25 persons or part thereof		Nil, up to 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons		1 per 50 persons or part thereof	
iv)	Wash basins	1 per 8 persons or part thereof	1 per 6 persons or part thereof	1for 1-15 persons 2 for 16-35 persons 3 for 36-65 persons 4 for 66-100 persons	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 per each water-closet and urinal provided	1 in each water-closet provided
v)	Baths	1 per 8 persons or part thereof	1 per 6 persons or part thereof				
vi)	Cleaner's sink			1 per floor, Min			

Note : Some of the water-closets may be of European style, if desired.

TABLE B12 – WAREHOUSES, FRUIT AND VEGETABLE MARKETS

S. No	FiTMENTS	Reqiore,emts
1	2	3
I)	Urinals	Not less than 2 for every 50 persons
ii)	Water-closets	2, Min, and an additional 1 for every 50 persons
iii)	Ablution taps	2, Min, and an additional tap for every 50 persons
iv)	Bathing places	suitable numbers with bathing platforms

Note : 1 For layout for regulated market yards for fruit and vegetables, reference may be made for females.
Note : 2 Separate and adequate provision of water-closets shall be made for females.
Note : 3 Adequate washing places for fruit and vegetables shall be provided.

Some of the water-closets may be of European style, if desired.

In this section where reference is made to accepted standards, in relation to material specification, testing or other information, the appropriate document listed at the end of this section may be used as a guide to the interpretation of the term.

TABLE B13 - SANITARY REQUIREMENTS FOR LARGE STATIONS AND AIRPORTS

St. No	Place	WC For Males	WC For Females	Urinals For Males only
1	2	3	4	5
I)	Junction stations, intermediate stations and bus stations	3 for first 1 000 persons and 1 for every subsequent 1000 persons	4 for first 1000 persons and 1 for every additional 1000 persons	4 for first 1000 persons and 1 for every additional 1000 persons
ii)	Terminal stations and bus terminals	4 for first 1000 persons and 1 for every subsequent 1000 or part thereof.	5 for first 1000 persons and 1 for every subsequent 2000 or part thereof.	6 for first 1000 persons and 1 for every additional 1000 persons or thereof.
iii)	Domestic airports Min	2*	4*	2*
	for 200 persons	5	8	6
	for 400 persons	9	15	12
	for 600 persons	12	20	16
	for 800 persons	16	26	20
	for 1000 persons	18	29	22
iv)	International airports			
	for 200 persons	6	10	8
	for 600 persons	12	10	16
	for 1000 persons	18	29	12

Note : Separate provision shall be made for staff and workers at these traffic terminal stations,
*At lease one Indian style water-closet shall be provided in each toilet, Assume 60 males to 40 females inany area.

2 Disposal of Sewage/Waste Water and Pipe Work :

2.1 Where public sanitary sewers are available, the sewage / waste water from a building /premises can be disposed into public sewer with the approval of the concerned authority. The connection to the public sewerage system should be made by connecting the building /premises manhole to the service manhole of the public sewerage system.In this the case level of the public sewers must be lower than that of the building drains .

2.2 Where public sanitary sewerage is not available, then the sewage of the building or premises, shall be done through septic tanks or stabilization ponds or any method approved by the concerned authority.

2.3 The pipes used for disposal /conveyance of sewage /waste water can be either Salt Glazed Stoneware Pipe, Cement Concrete Pipe (Plain or reinforced) Cast Iron pipe, Galvanized Iron Pipe , Asbestos Cement Pipe , Lead Pipe , PVC or HDPE Pipe . The jointing of those pipes will be either spigot and socket type or collar type .

2.4 **Gradients** : The discharge of water through a domestic - drain is intermittent and limited in quantity and therefore, small accumulations of solid matter are liable to form in the drain between the building and the public sewer. Gradients shall be sufficient to prevent such temporary accumulations building up and blocking the drains.

2.4.1 The sewer pipes are normally designed to take the peak simultaneous flow flowing half full.Thus the gradient should be maintainced such that the flow velocity at the minimum flow situation also remains at a minimum self cleansing velocity of 0.75m/sec, and the maximum velocity at time of peak flow does not exceed 2.4m/sec. (Whereby there is adverse effects on the pipe material.)

Table - B14

Different Diameter Pipes Giving A Velocity of 0.75m/sec. and corresponding discharge .

S. No	Diameter (mm)	Gradient	Discharge (cum/min)
1	100	1 in 57	0.18
2	150	1 in 100	0.42
3	200	1 in 145	0.73
4	230	1 in 175	0.93
5	250	1 in 195	1.10
6	300	1 in 250	1.70

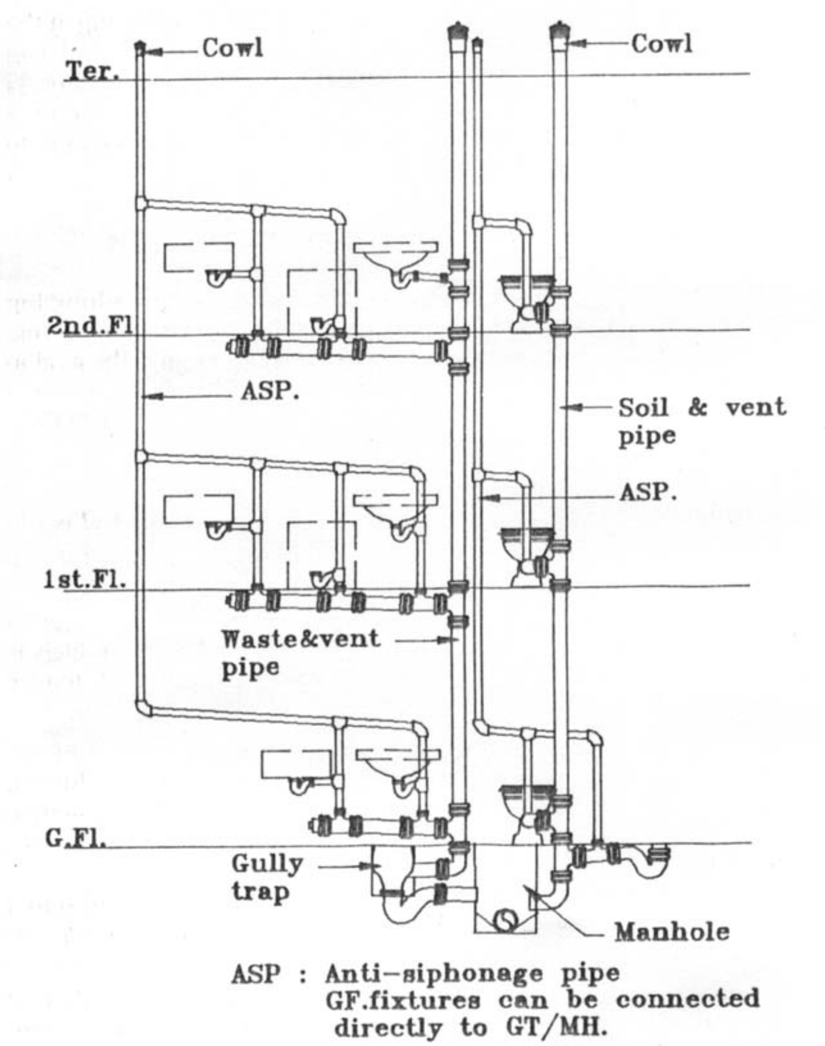
Table – B15

Different Diameter Pipes Giving AVelocity of 2.4m/sec and corresponding discharge.

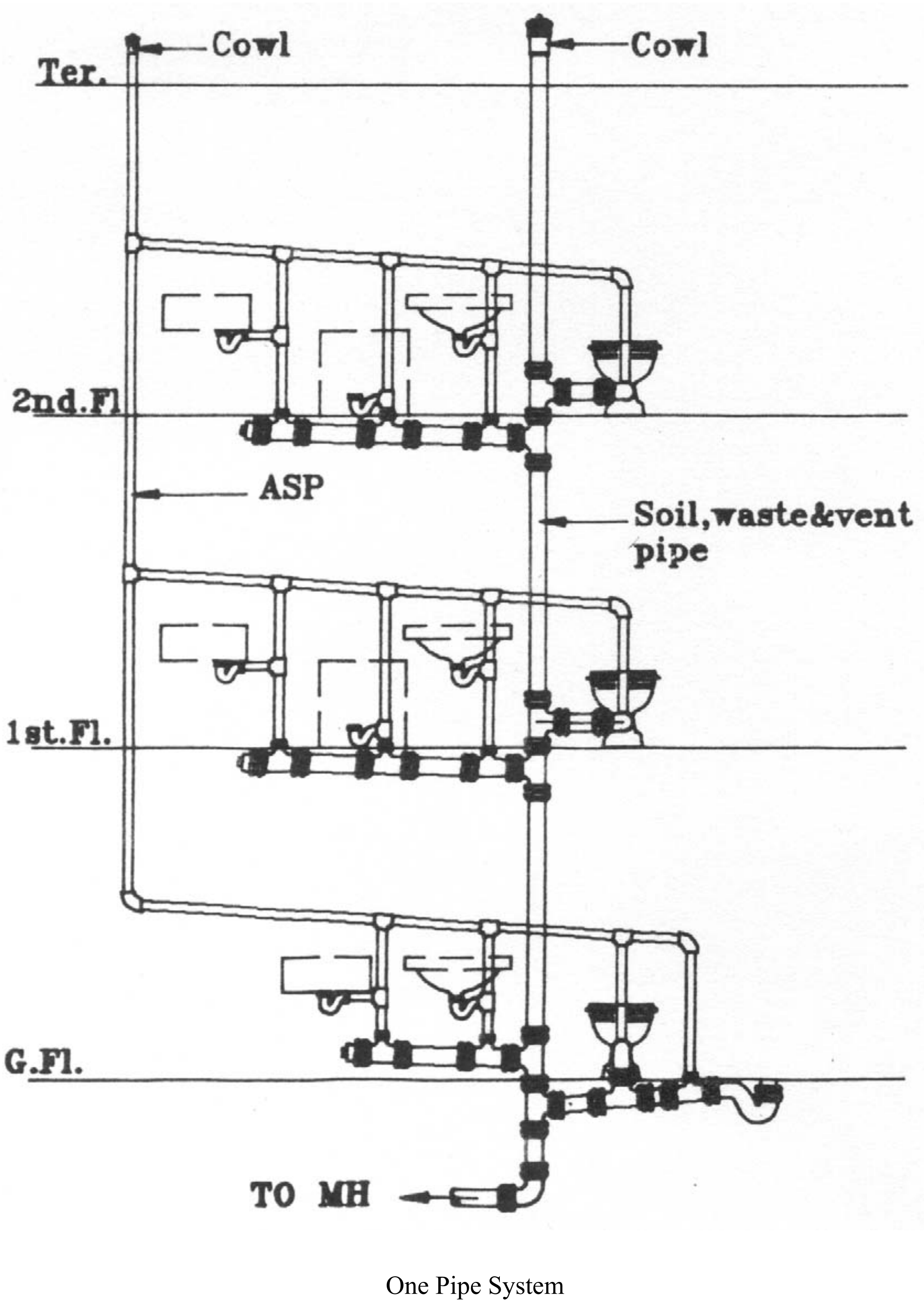
S. No	Diameter (mm)	Gradient	Discharge (cum/min)
1	100	1 in 5.6	0.59
2	150	1 in 9.7	1.32
3	200	1 in 14	2.40
4	230	1 in 17	2.98
5	250	1 in 19	3.60
6	300	1 in 24.5	5.30

(Based on Manning s formula with n = 0.015)

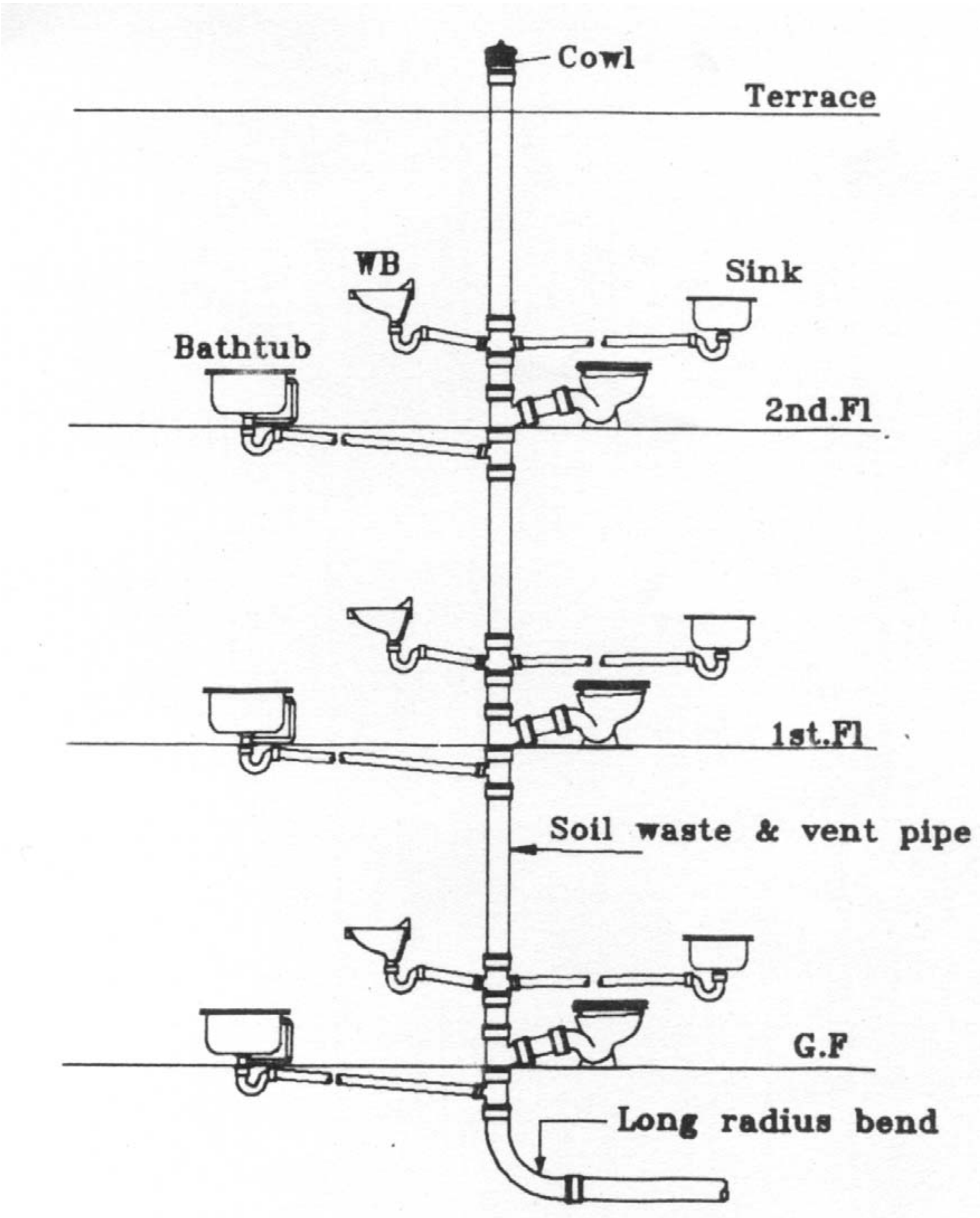
2.5 All sanitary appliances and fitments shall be carefully examined for defects before they are installed and also on the completion of the work .



Two Pipe System
Sewage/Waste Water Collection
Illustration B1



One Pipe System
Sewage/Waste Water Collection
Illustration B2



Single Stack System
Sewage/Waste Water Collection
Illustration B3

C) Rain Water Disposal.

Scope: This section covers general guidelines for provisions for disposal of rainwater in different buildings.

1 Rainwater falling on roofs, paved areas and other open area must be collected and disposed off efficiently and quickly. Provision should be made for a separate and independent storm water disposal system leading to the public storm-water drain or natural watercourse for individual buildings.

2 Provision should be made for the drainage of wastes/rain water from balconies and terrace in an efficient manner.

3 Sloping Roof: Apart from architectural considerations, the roof system of a building should take into account the annual frequency and intensity of rainfall also.

3.1 Roofs of single-storey buildings in isolated areas can be sloped in any direction and the rainwater allowed to fall on the ground to be drained naturally.

3.2 For large and tall buildings free fall of rainwater from the roofs is not advisable. It is necessary to catch the rainwater in roof gutters provided with downtake pipes at suitable locations.

4 For designing rain water/storm water disposal systems, the maximum intensity of rainfall should be used.

5 Catchment area: The plan area that contributes to the down takes/gutter should be taken as catchment area.

5.1 Catchment from vertical wall surface enclosing a terrace should also be taken into account. An area equal to 50% of the wall surface projecting above the terrace should be added to the roof area contributing to a rain water pipe.

5.2 If rain water of any other terrace at upper level is discharging the rain water to rain water pipe of the lower terrace, the area must be added to the terrace under design.

5.3 For sloping roofs, allowance is to be made for wind borne rain. It is advisable to take the actual roof area rather than the plan area for such situations.

5.4 Slopes in flat roofs are desirable to direct the flow to the outlet and drain off the water quickly in less than one or two minutes. Flow speed is generated by the hydraulic gradient between the far end and the free fall outlet.

5.4.1 Slopes to be provided depend on the quality and reliability of the water proofing, surface finishes and spacing of downtakes. Rough and absorbing surfaces require more slopes.

TABLE C1

Suggested slopes for flat roofs for different surface.

1.	Smooth surfaces (Polished stone, cement/terrazzo floor etc.)	0.5-0.75%
2.	Normal surfaces (Brick, rough stone/concrete blocks, tiles etc)	0.75-1.0%
3.	Rough surfaces (Gravel, cobbled etc)	1.5-2%

5.5 Design of rainwater/storm water disposal very much depend on the co-efficient of run-off. Co-efficient of run-off is the quantity of rainwater which finds it's way into the drainage system. Some water is lost in evaporation and absorption in soil or the floor surface by various means. Typical coefficient of run-off figures are as in Table below;

TABLE C2

Surface Type	Coefficient of Run-off
a) Terrace, Hard paved surface:	0.90-0.95
b) Paved surface, roads:	0.85-0.90
c) Gravel paths, loosely paved walks, rocky surface	0.70-0.85
d) Brick paved, compacted ground, turf:	0.50-0.70
e) General ground	0.50-0.60
f) Natural ground, sloping ground:	0.20-0.50

6 If proper streets drain is not available within 30m. of the boundary of the premises, a rain-water pipe may discharge directly into the kerb drain and shall be taken through a pipe outlet across the footpath, if any, with out obstructing the path.

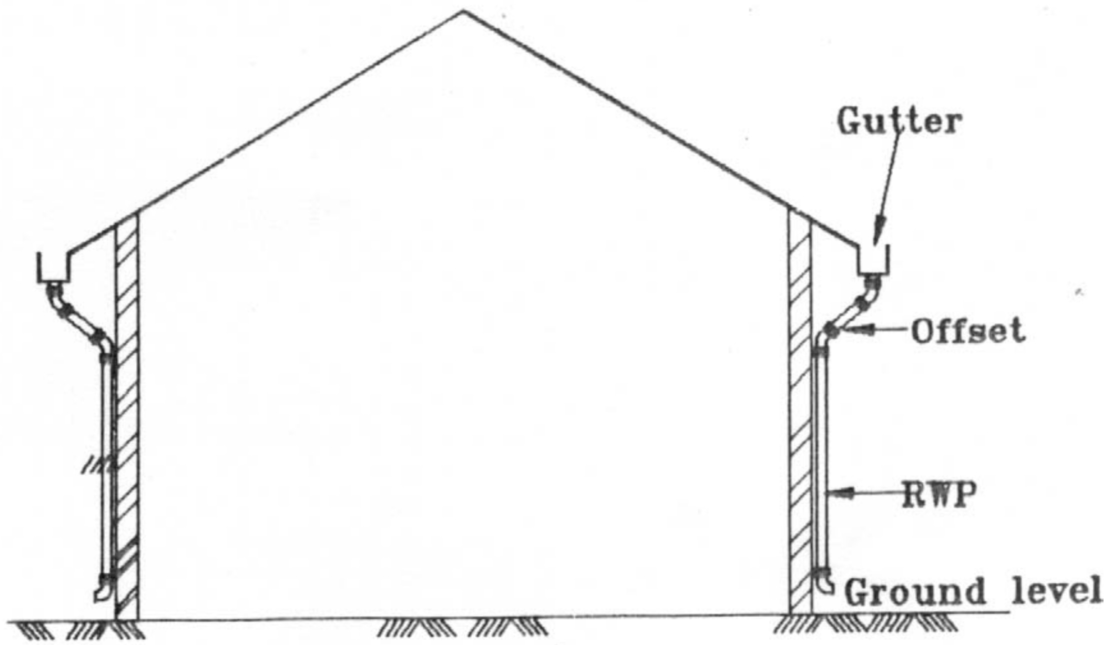
7 A rain-water pipe shall not discharge into or connect with any soil pipe or its ventilating pipe or any waste pipe or its ventilating pipe nor shall it discharge into a sewer unless specifically permitted to do so by the Authority, in which case such discharge into a sewer shall be intercepted by means of a gully trap.

8 Rainwater pipes shall be constructed of cast iron, PVC pipe asbestos cement, galvanized sheet or other equally suitable material and shall be securely fixed.

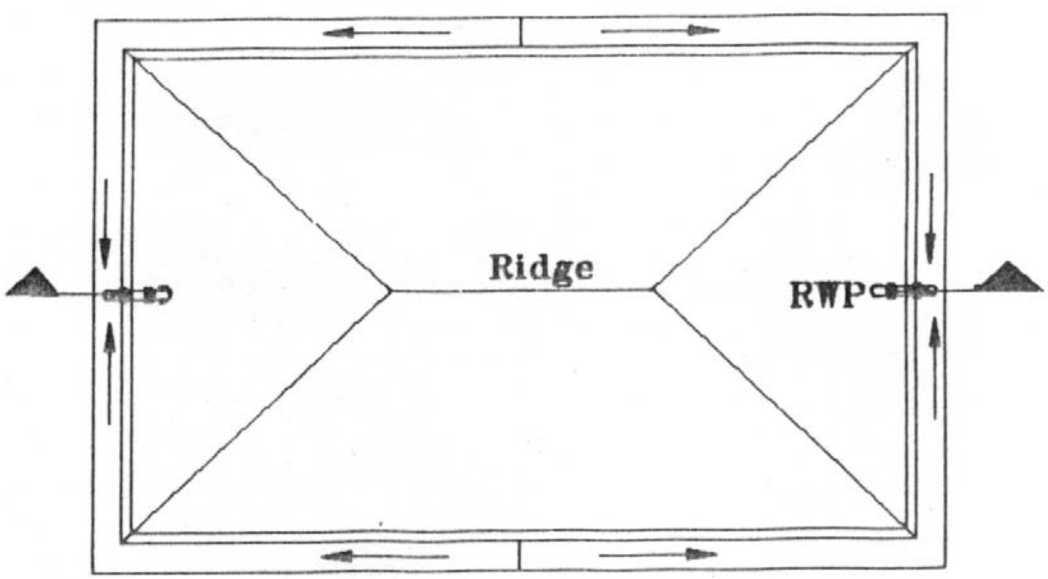
9 Rainwater pipes shall be normally sized on the basis of roof areas according to Table C3, a bell mouth inlet at the roof surface is found to give better drainage effect provided proper slopes are given to the roof surface. The spacing of pipes depends on the position of the windows and arch openings, but 6 m apart is a convenient distance. The strainer area shall be 11/2 to 2 times the area of pipe to which it connects.

TABLE C3 - SIZING OF RAINWATER PIPES FOR ROOF DRAINAGE

S.No	Dia of Pipe	Average rate of rainfall in mm/h					
1	2 (mm)	3	4	5	6	7	8
		50 mm	75 mm	100 mm	125 mm	150 mm	200 mm
Roof Area m^2							
i)	50	13.4	8.9	6.6	5.3	4.4	3.3
ii)	65	24.1	16.0	12.0	9.6	8.0	6.0
iii)	75	40.8	27.0	20.4	16.3	13.6	10.2
iv)	100	85.4	57.0	42.7	34.2	28.5	21.3
v)	125	-	-	80.5	64.3	53.5	40.0
vi)	150	-	-	-	-	83.6	62.7



SECTION



PLAN

Sloping Roof
Illustration C1