Chapter 3

Water Supply & Distribution

Basics of Water Supply & Distribution

(A)Preliminary information

- Estimate the quantum of water required per day based on occupancy in proposed project and activities catered for.

Identify possible Source

- Surface Water (lake, River, Pond)
- Underground source (open well/bore/tube-well)
- Harvested Rainwater
- Recycled Water/Reclaimed water from sewage treatment works
- Desalinated Sea Water
- Brought out the Combination of Above

(B)Water Treatment

- Analysis of the available water is essential to decide the treatment process to render water suitable for consumption
- Depends on the quality of water and purpose for which it being treated

(C)Water Storage Tank

- Since continuous availability of water at adequate pressure cannot be ensured, it is essential to have storage facility.

Cotd.

If the distribution system proposed is by gravity from elevated tank, the combined capacity of low level and high level tank should be adequate for the duration of anticipated disruption in supply

The tank partition will have to be based on structural considerations, different qualities of water to be stored and water requirement for fire fighting.

Storage tank compartment containing potable and non potable water should have adequate sanitary separation.

Water storage tank shall be constructed in impervious material, protected against contamination and provided with locked water tight covers.

Any over flow or ventilation openings shall be down –facing and provided with corrosion resistant screening of not less than No 24 mesh to prevent the entry of insects and vermin.

Water storage tank shall not have direct connection to sewers.

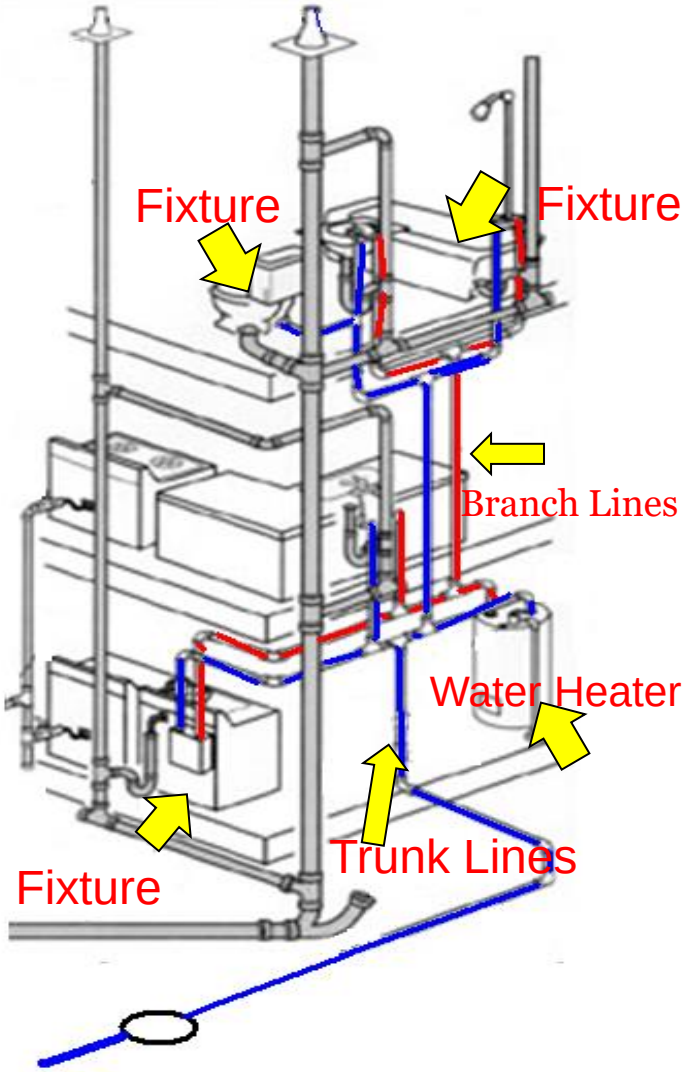
Contd.

- Unless permitted by the authority having Jurisdiction low level tank shall not be located below ground to avoid contamination by surface water or any other foreign materials.
- In unavoidable situations if the tank have to be located below ground the following minimum precaution have to be taken
  - ✓ *All inspection cover shall adequately raised above the surroundings ground level.*
  - ✓ *Submersible pump(s) shall be installed in suitable sump(s) at the floor of the tank for draining the contents of the tanks for cleaning in situations where draining of tank by gravity is not feasible.*
- Low level tank adjacent to the basement should share common wall with basement if the plant room is also situated. This will facilitate provision of pipe insert on the common wall.
- In an unavoidable condition if a common wall between water tank and plant room can not be provided the pipe connecting two structure could be sheared due to differential settlement.
- When the plant room and water storage tanks(s) are located adjacent to each other, the floor level of plant should be lower than the base of the tanks to allow for flooded suction pipe.
- Provision shall be made for over flow (minimum one size larger than the inlet pipe) to be discharged into safe and visible location.
- Adequate care shall be taken to prevent back flow or back siphonage.
- An audible visual alarm or alternatively warning pipe may be installed to prevent wastage of water through large over flow pipe.

Water Supply System

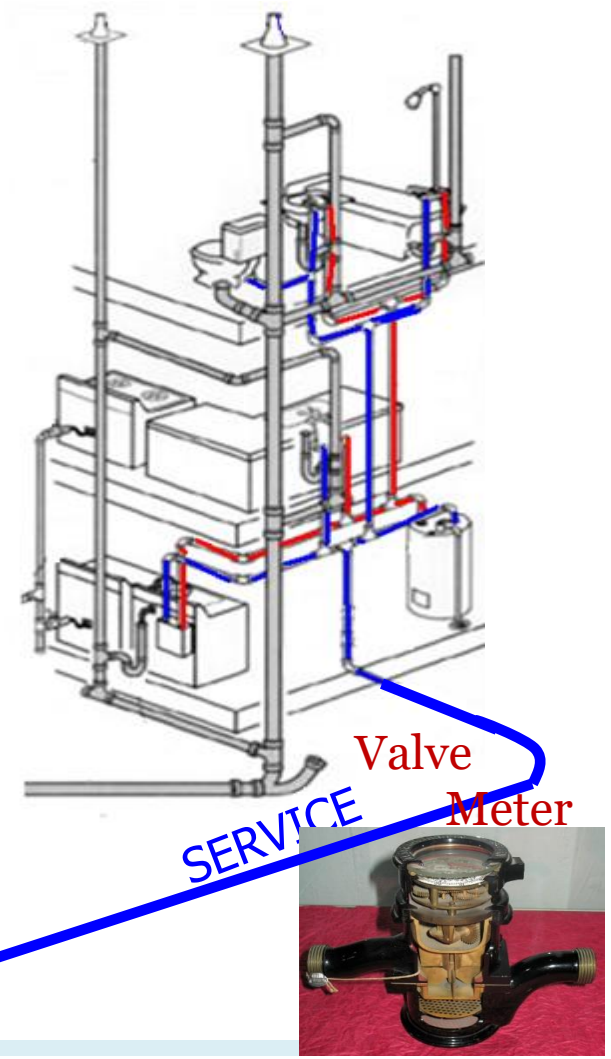
Network of pipes that transport hot and cold potable water under pressure

- Fixture – A device that uses water (sink, toilet, dishwasher, etc.)
- Water Heater – Large insulated tanks that heat cold water to be distributed in the hot water supply lines
- Trunk Lines – Hot or cold water pipes that serve many fixtures
- Branch Lines – Hot or cold water pipes that serve only one or two fixtures



Water Supply System

- Water Main – Supply pipe installed and maintained by a public entity and on public property
- Water Service – Pipe from the water main to the building supply pipes
- Meter – Measures the amount of water transported through water service
- Valve – A fitting used to control water flow (located next to the meter)



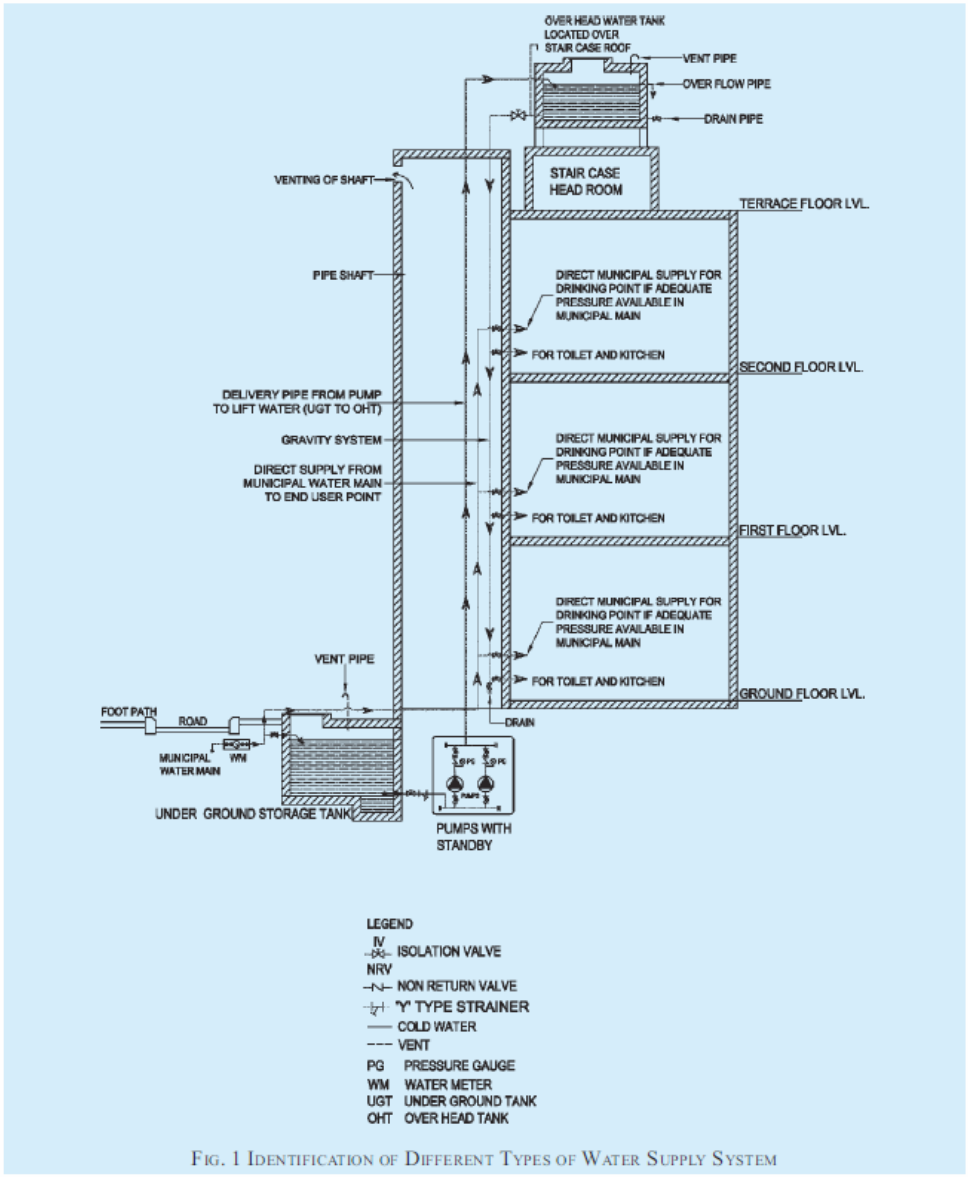


FIG. 1 IDENTIFICATION OF DIFFERENT TYPES OF WATER SUPPLY SYSTEM

Source: National Building Code of India 2016 (NBC 2016)

2.1.53 *Residual Head* — The head available at any particular point in the distribution system.

2.1.54 *Residual Pressure* — The pressure available at the fixture after allowance is made for pressure drop due to friction loss and head in the system during maximum demand periods.

2.1.55 *Saddle* — A purpose made fitting, so shaped as to fit over a hole cut in a sewer or drain used to form connections.

2.1.56 *Service Pipe* — Pipe that runs between the distribution main in the street and the riser in case of a multi-storeyed building or the water meter in the case of an individual house and is subject to water pressure from such main.

2.1.57 *Static Pressure* — The pressure exerted by a fluid that is not moving or flowing.

2.1.58 *Stop-Cock* — A cock fitted in a pipe line for controlling the flow of water.

2.1.59 *Stop Tap* — Stop tap includes stop-cock, stop valve or any other device for stopping the flow of water in a line or system of pipes at will.

2.1.60 *Storage Tank* — A container used for storage of water which is connected to the water main or tube-well by means of supply pipe.

2.1.61 *Studio Apartment*— An apartment unit consisting of a single room and a bathroom, the single room functioning as living room, bedroom and kitchen.

2.1.62 *Subsoil Water*— Water occurring naturally in the subsoil.

2.1.63 *Subsoil Water Drain*

a) A drain intended to collect and carry away subsoil water.

b) A drain intended to disperse into the subsoil from a septic tank.

2.1.64 *Sub-Zero Temperature Regions* — Regions where temperatures fall below 0°C and freezing conditions occur.

2.1.65 *Supply Pipe* — So much of any service pipe as is not a communication pipe.

2.1.66 *Supports* — Hangers and anchors or devices for supporting and securing pipe and fittings to walls, ceilings, floors or structural members.

2.1.67 *Surface Water* — Natural water from the ground surface, paved areas and roofs.

2.1.68 *Surface Water Drain* — A drain conveying surface water including storm water.

2.1.69 Thermostatic/Pressure Balancing Valve. Mixing valve that senses outlet temperature and incoming hot and cold water pressure and compensates for fluctuations for stabilization.

Source: National Building Code of India 2016 (NBC 2016)

2.1.70 *Vertical Pipe* – Any pipe or fitting which is installed in a vertical position or which makes an angle or not more than 45° with the vertical.

2.1.71 *Warning Pipe* — An overflow pipe so fixed that its outlet, whether inside or outside a building, is in a conspicuous position where the discharge of any water there from can be readily seen.

2.1.72 *Wash-Out Valve* — A device located at the bottom of the tank for the purpose of draining a tank for cleaning, maintenance, etc.

2.1.73 *Water Hammer Arrestor* — A device designed to provide protection against hydraulic shock in the building water supply system.

2.1.74 *Water Main (Street Main)* — A pipe laid by the water undertakers for the purpose of giving a general supply of water as distinct from a supply to individual consumers and includes any apparatus used in connection with such a pipe.

2.1.75 *Water Outlet* — A water outlet, as used in connection with the water distributing system, is the discharge opening for the water: (a) to a fitting; (b) to atmospheric pressure (except into an open tank which is part of the water supply system); and (c) to any water-operated device or equipment requiring water to operate.

2.1.76 *Water Supply System* — Water supply system of a building or premises consists of the water service pipe, the water distribution pipes, and the necessary connecting pipes, fittings, control valves, and all appurtenances in or adjacent to the building or premises.

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2.1.77 *Waterworks* — Waterworks for public water supply include a lake, river, spring, well, pump with or without motor and accessories, reservoir, cistern, tank, duct whether covered or open, sluice, water main, pipe, culvert, engine and any machinery, land, building or a thing used for storage, treatment and supply of water.

Source: National Building Code of India 2016 (NBC 2016)

Water Supply Requirements for Buildings

- The total quantity of water per day is estimated based on the proposed occupancy and activities catered.
- Designer has to identify all the possible sources for augmenting the shortfall in water supply.
- The analysis of available water is done to decide the treatment for consumption and treatment process depends on the quality of water and the purpose for which it is used
- Projection of population for each building shall be made on the basis of its usage. Population for each type of building shall be estimated on the basis of information obtained from the users.
- Alternatively, population may be worked on the following basis, for different type of buildings:

a) *Residential buildings:*

Accommodation	*Population Requirements*
1 bedroom dwelling unit	4
2 bedroom dwelling unit	5
3 bedroom dwelling unit	6
4 bedroom dwelling unit and above	7

- ❑ The above figures consider a domestic house - hold including support personnel, wherever applicable.
- ❑ For plotted development, the population may be arrived at after due consideration of the expected number and type of domestic household units.
- ❑ Dwelling unit under EWS category shall have population requirement of 4 and studio apartment shall have population requirement of 2

b) *Other than residential buildings:*

Occupancy	*Population Requirement*
Offices	1 person per 10 m^2 of floor area (*see* Note 1)
Schools	Strength of school + Teaching and non-teaching staff
Hostels	Number of beds + 4.5 x (warden's residence) + staff
Hotels	Number of beds + Staff + Requirement of restaurant seats
Hospitals	Number of beds + Staff + Patient attendants (generally population density per bed in secondary care hospital is 5, tertiary care is 7 and quaternary care is 9)
Mercantile	1 person per 3 m^2 of street floor and sales basement areas + 1 person per 6 m^2 of upper sale floors (Total population may be segregated into 10 percent for fixed and 90 percent for floating/visitors)
Traffic terminal stations	Average number of users per day (Total annual passenger traffic/365) + Staff + Vendors

- Wherever there are multiple work shifts, the number of users within a 24 h period may be considered as per actuals.
- Population of 5 to 15 percent, depending on the usage of building, shall be considered for visitors and floating population likely to use the buildings facilities

Source: National Building Code of India 2016 (NBC 2016)

Table 1 Water Requirements for Buildings Other than Residences

(*Clause* 4.1.2)

Sl No.	Type of Building	Domestic Per Day litre	Flushing Per Day litre	Total Consumption Per Day litre
(1)	(2)	(3)	(4)	(5)
i)	Factories including canteen where bath rooms are required to be provided	30 per head	15 per head	45 per head
ii)	Factories including canteen where no bath rooms are required to be provided	20 per head	10 per head	30 per head
iii)	Hospital (excluding laundry and kitchen) (*see* Note 2):			
	a) Number of beds not exceeding 100	230 per head	110 per head	340 per head
	b) Number of beds exceeding 100	300 per head	150 per head	450 per head
	c) Out patient department (OPD)	10 per head	5 per head	15 per head
iv)	Nurses' homes and medical quarters	90 per head	45 per head	135 per head
v)	Hostels	90 per head	45 per head	135 per head
vi)	Hotel (up to 3 star) excluding laundry, kitchen, staff and water bodies	120 per head	60 per head	180 per head
vii)	Hotel (4 star and above) excluding laundry, kitchen, staff and water bodies	260 per head	60 per head	320 per head
viii)	Offices (including canteen)	25 per head	20 per head	45 per head
ix)	Restaurants and food court including water requirement for kitchen:			
	a) Restaurants	55 per seat	15 per seat	70 per seat
	b) Food court	25 per seat	10 per seat	35 per seat
x)	Clubhouse	25 per head	20 per head	45 per head
xi)	Stadiums	4 per head	6 per head	10 per head
xii)	Cinemas, concert halls and theatres and multiplex	5 per seat	10 per seat	15 per seat
xiii)	Schools/Educational institutions:			
	a) Without boarding facilities	25 per head	20 per head	45 per head
	b) With boarding facilities	90 per head	45 per head	135 per head
xiv)	Shopping and retail (mall)			

Source: National Building Code of India 2016 (NBC 2016)

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xiv)	Shopping and retail (mall)			
	a) Staff	25 per head	20 per head	45 per head
	b) Visitors	5 per head	10 per head	15 per head
xv)	Traffic terminal stations (*see* Notes 3 and 4)			
	a) Airports	40 per head	30 per head	70 per head
	b) Railway stations (Junctions) with bathing facility	40 per head	30 per head	70 per head
	c) Railway stations (Junctions) without bathing facility	30 per head	15 per head	45 per head
	d) Railway Stations (Intermediate) with bathing facility	25 per head	20 per head	45 per head
	e) Railway Stations (Intermediate) without bathing facility	15 per head	10 per head	25 per head
	f) Interstate bus terminals	25 per head	20 per head	45 per head
	g) Intrastate Bus Terminals/Metro Stations	10 per head	5 per head	15 per head

NOTES

1 For calculating water demand for visitors, consumption of 15 litre per head per day may be taken.

2 The water demand includes requirement of patients, attendants, visitors and staff. Additional water demand for kitchen, laundry and clinical water shall be computed as per actual requirements.

3 The number of persons shall be determined by average number of passengers handled by stations, with due considerations given to the staff and vendors who are using these facilities.

4 Consideration should be given for seasonal average peak requirements.

5 The hospitals may be categorized as Category A (25 to 50 beds), Category B (51 to 100 beds), Category C (101 to 300 beds), Category D (301 to 500) and Category E (501 to 750 beds).

Source: (NBC 2016)

4.7.3.1 Design of consumer.s pipes based on fixture units The design of the consumers. pipes or the supply pipe to the fixtures is based on,

a) the number and kind of fixtures installed;

b) the fixture unit flow rate; and

c) the probable simultaneous use of these fixtures.

The rates at which water is desirably drawn into different types of fixtures are known. These rates become whole numbers of small size when they are expressed in fixture unit. The water supply fixture units (WSFU) for different sanitary appliances or groups of appliances

4.7.3.3 The maximum flow rate and flush volumes shall be as given below:

Plumbing Fixtures/Fittings	*Maximum Flow Rate*
Water closets	6 litre/flush
Urinals	3.8 litre/flush
Lavatory, metered faucet (Public)	1 litre/use
Lavatory, faucet (Private)	8 litre/min
Sink, faucet	8 litre/min
Bidet, hand held spray	8 litre/min
Shower head	10 litre/min

NOTE — The maximum flow rates of plumbing fixtures and fittings provided are at the pressure of 0.42 N/mm ^{2}. Water closet with dual flush cistern and urinals with reduced flush volumes are recommended. Further, users/ designers are encouraged to use low flow fixtures.

Source: (NBC 2016)

Table 2 Water Supply Fixture Units (WSFU) for Different Fixtures with Minimum Pipe Sizes

(*Clause* 4.7.3.1)

Sl No.	Type of Fixture	Application		Minimum Pipe Size mm
		Private	Public	
(1)	(2)	(3)	(4)	(6)
i)	Bathtub	4	–	15
ii)	Ablution faucet/Bidet	1	1	15
iii)	Clothes washer	4	4 (*see* Note 7)	15
iv)	Dishwasher	1.5	1.5	15
v)	Drinking fountain	–	0.5 (0.75)	15
vi)	Hose bib	2.5	2.5	15
vii)	Wash basin (with metered faucet)	1	1	15
viii)	Wash basin (with standard faucet)	1.5	1.5 (2)	15
ix)	Service sink	1.5	3	15
x)	Kitchen sink	2	4	15
xi)	Surgical sink	–	2	15
xii)	Scrub station in hospital (per outlet)	–	3	15
xiii)	Shower	2	3	15
xiv)	Bathroom group (flush tank)	5	6	20
xv)	Bathroom group (flush valve)	8	10	25/32
xvi)	Urinal (flush valve)	3	5 (6)	20
xvii)	Urinal (flush tank)	2	2 (3)	15
xviii)	Urinal (sensor operated)	2	2 (3)	15
xix)	Water closet (flush valve)	6	8 (10)	25/32
xx)	Water closet (flush tank)	2	3 (5)	15
xxi)	Combination fixture (faucet)	3	–	15
xxii)	Laundry trays (faucet)	3	–	15

NOTES

1 The above table is based on Hunter's method.

2 Hunter's method of estimating load in plumbing systems is based on assigning a fixture unit (FU) weight to the plumbing fixtures and then converting these to equivalent litre per minute, based on the theory of probability of usage and based on the observation that all fixtures are not used simultaneously.

3 The fixture unit concept is a method of calculating maximum probable water demand within large buildings based on theory of probability. The method is based on assigning a fixture unit (FU) value to each type of fixture based on its rate of water consumption, on the length of time it is normally in use and on the average period between successive uses.

4 The values of probable demand will not change in respect of systems with flush valves and flush tanks for fixture units more than 1 000.

5 The fixtures or appliances which are not included in the above table may be sized referring to fixtures having similar flow rate and frequency of usage.

6 The minimum supply branch pipe sizes for individual fixtures are nominal sizes.

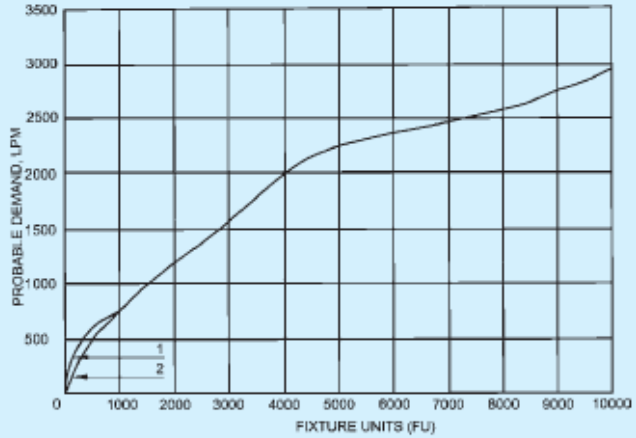
7 The clothes washer for public does not include large washer extractors, and in such cases the pipe sizing shall be determined as per manufacturer's recommendations.

8 For more information on bathroom groups, reference may be made to specialist literature.

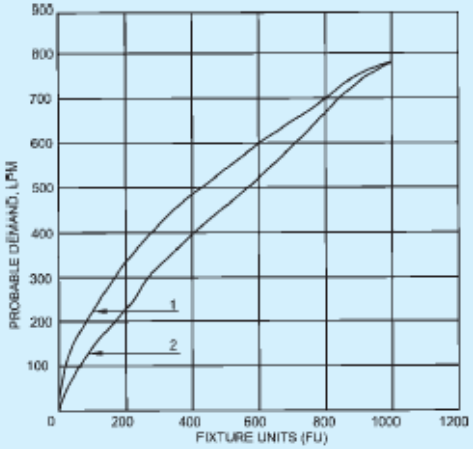
9 The fixture units listed in the above table represent the load for cold water service. The separate cold and hot water fixture unit value for fixtures having both hot and cold water connections may each be taken as three quarter of the listed total value of fixture.

10 A shower head over a bath tub does not increase the fixture unit value.

Source: (NBC 2016)



2A GRAPH FOR PROBABLE DEMAND UP TO 10 000 FU



2B GRAPH FOR PROBABLE DEMAND UP TO 1 000 FU

Curve 1 — System With Flush Valves
Curve 2 — System With Flush Tanks

FIG. 2 GRAPH FOR PROBABLE DEMAND

Source: (NBC 2016)

Probable simultaneous demand

4.7.3.2 The possibility that all water supply taps in any system in domestic and commercial use will draw water at the same time is extremely remote. Designing the water mains for the gross flow will result in bigger and uneconomical pipe mains and may not be necessary. A probability study made by Hunter suggests the relationship shown in Fig. 2 and Table 3. In the absence of similar studies in India, the curves based on Hunter's study may be followed. In making use of these curves, special allowances are made as follows:

Demands for service sinks are ignored in calculating the total fixture demand.

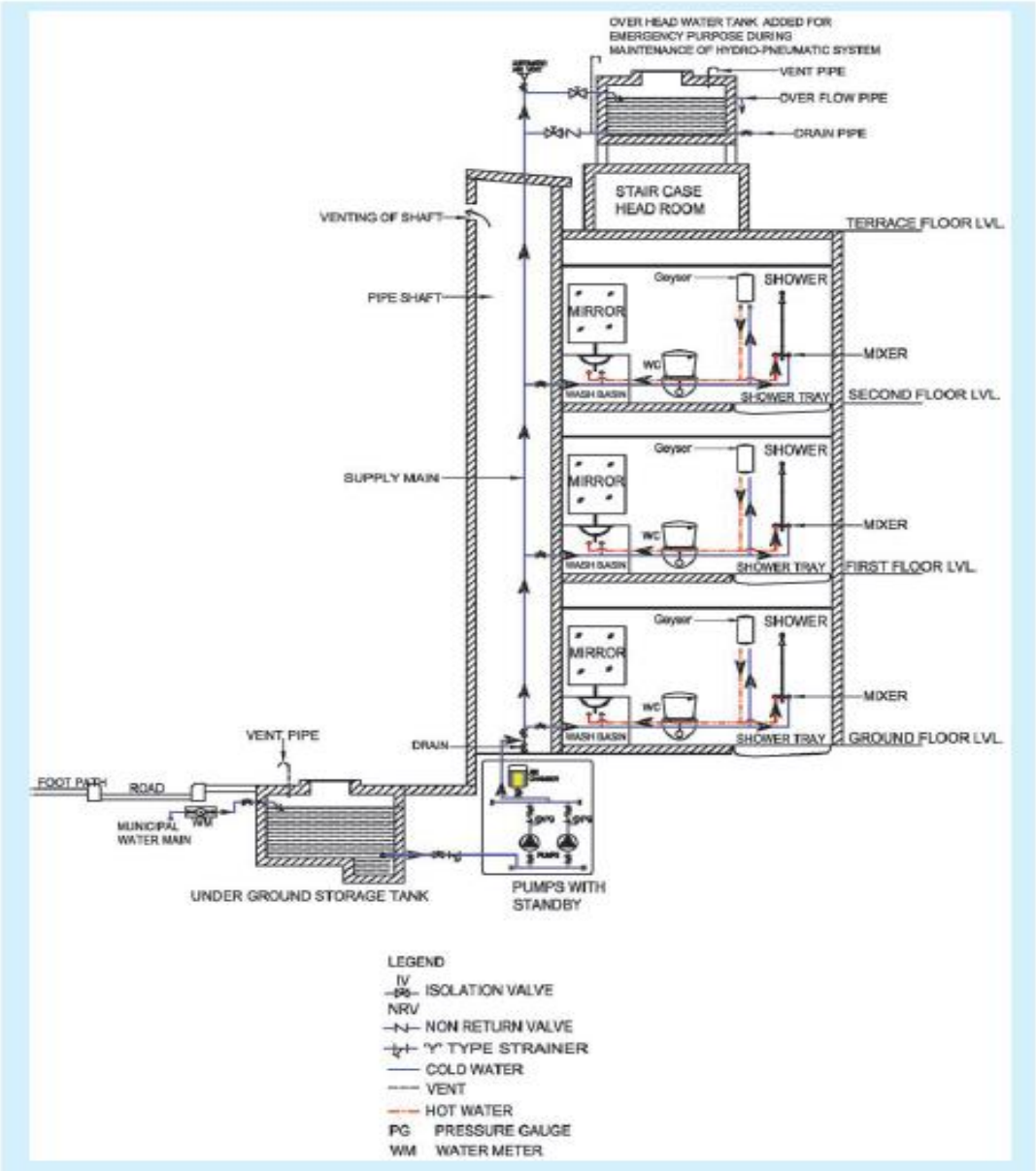
Demands of supply outlets such as hose connections and air conditioners through which water flows more or less continuously over a considerable length of time shall be added to the probable flow rather than the fixture demand.

Fixtures supplied with both hot and cold water exert reduced demands upon main hot water and cold water branches (not fixture branches

Table 3 Probable Simultaneous Demand
(*Clause* 4.7.3.2)

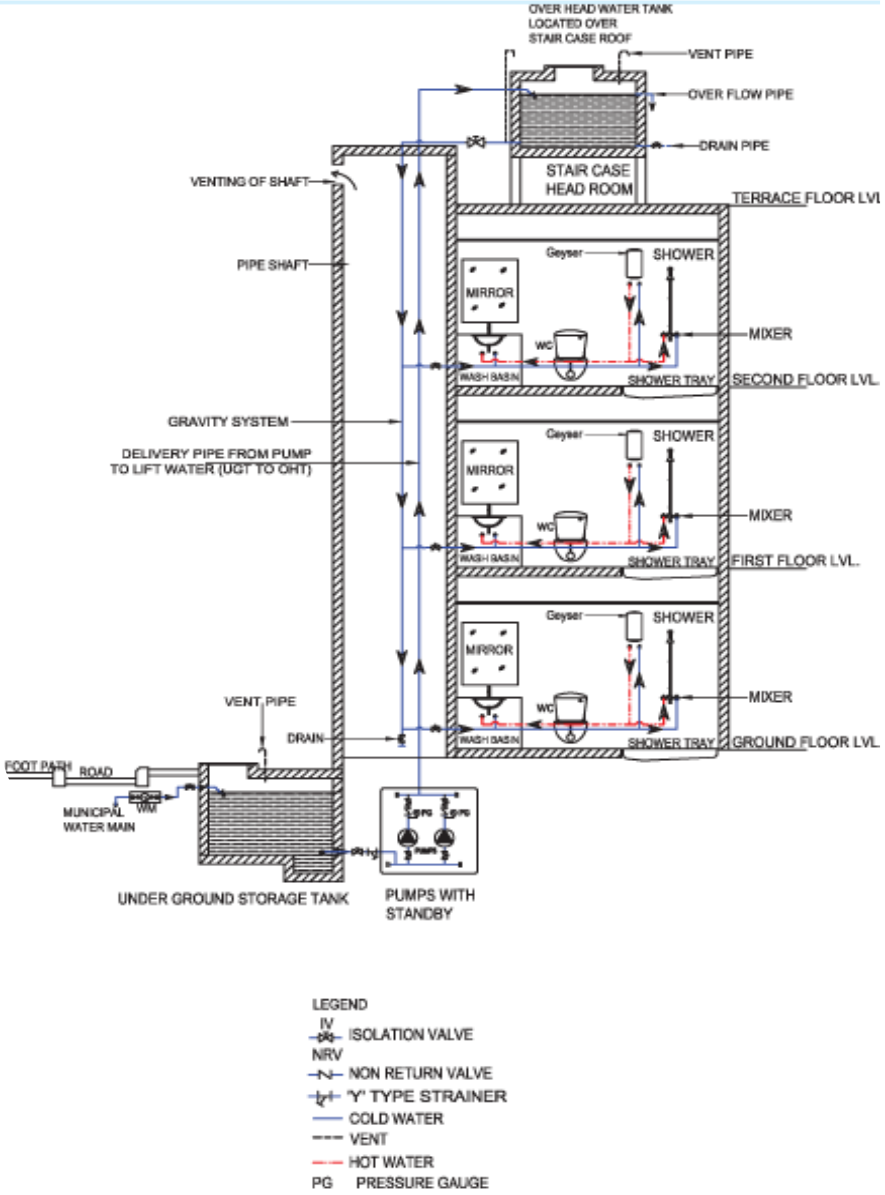
Sl No.	Demand in Fixture Units	Demand with Flush Tanks litre/min	Demand with Flush Valves litre/min
(1)	(2)	(3)	(4)
i)	1	0	—
ii)	2	3.8	—
iii)	3	11.4	—
iv)	4	15.1	—
v)	5	22.7	—
vi)	6	25.5	—
vii)	8	28.1	—
viii)	10	30.3	102.20
ix)	20	53.0	132.48
x)	30	75.7	155.19
xi)	40	94.6	177.90
xii)	50	109.8	196.82
xiii)	60	121.1	208.18
xiv)	70	132.5	223.32
xv)	80	143.8	234.67
xvi)	90	155.2	246.03
xvii)	100	166.5	257.38
xviii)	140	200.6	295.23
xix)	180	230.9	329.30
xx)	200	246.0	348.22
xxi)	250	283.9	382.29
xxii)	300	321.7	416.35
xxiii)	400	397.4	476.91
xxiv)	500	473.1	537.47
xxv)	750	643.5	673.73
xxvi)	1 000	787.3	787.28
xxvii)	1 250	908.4	908.40
xxviii)	1 500	1 010.6	1 010.60
xxix)	1 750	1 112.8	1 112.79
xxx)	2 000	1 215.0	1 214.99
xxxi)	2 500	1 419.4	1 419.38
xxxii)	3 000	1 635.1	1 635.12
xxxiii)	3 500	1 811.1	1 811.12
xxxiv)	4 000	1 987.1	1 987.13
xxxv)	4 500	2 115.8	2 115.82
xxxvi)	5 000	2 244.5	2 244.51
xxxvii)	5 500	2 312.6	2 312.64
xxxviii)	6 000	2 380.8	2 380.77
xxxix)	6 500	2 411.0	2 411.05
xl)	7 000	2 479.2	2 479.18
xli)	7 500	2 547.3	2 547.31
xlii)	8 000	2 615.4	2 615.44
xliii)	8 500	2 683.6	2 683.57
xliv)	9 000	2 751.7	2 751.70

HYDRO-PNEUMATIC SYSTEM



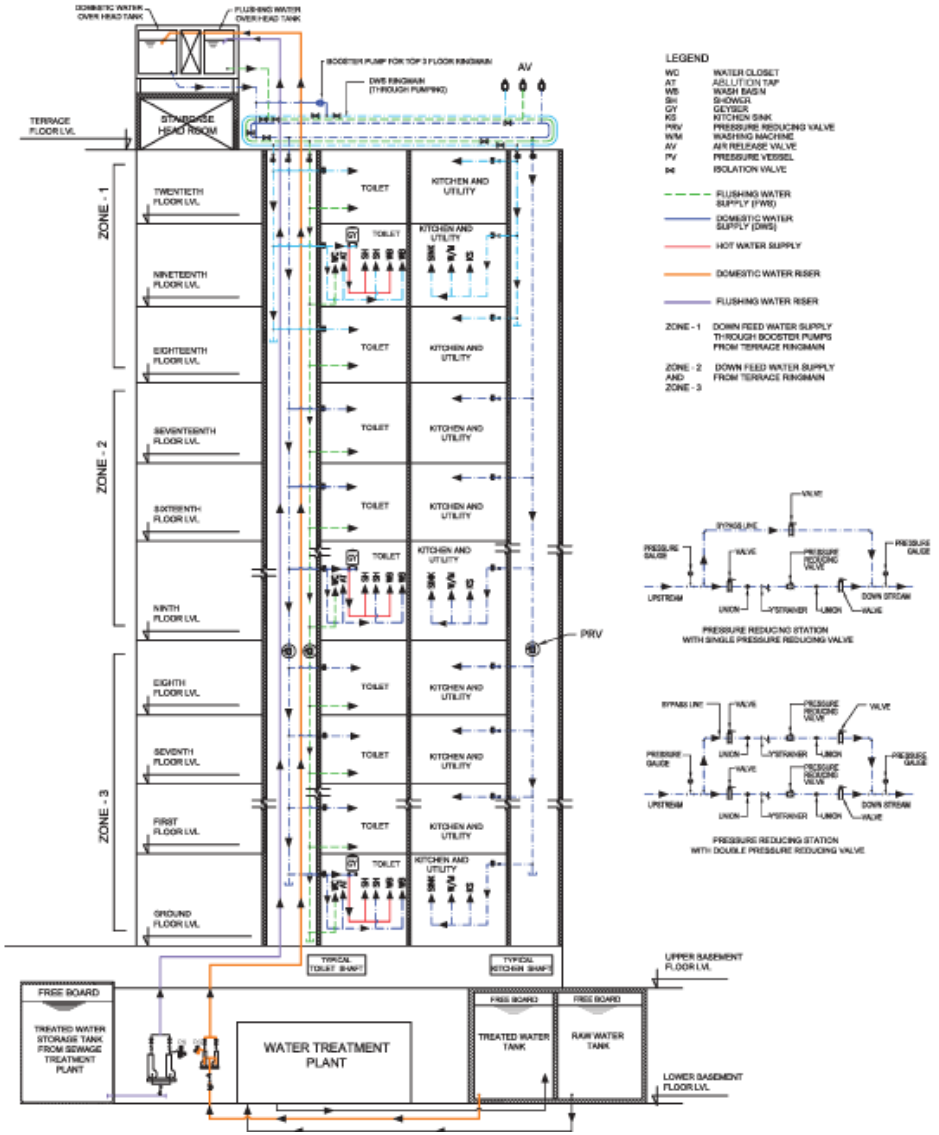
OVER HEAD TANK DISTRIBUTION

- Pump operation to be by level controller or air vessel/pressure switch at motorized valve at OHT.
- Hot water supply to be planned as per requirement by provision of geyser and hot water piping.
- Flushing water supply from WC to planned in case of availability of recycled waste water.
- For large and commercial buildings, water supply to be based on zone-based distribution for domestic and flushing water supply.
- Presentation of layout and location of fixtures/appliances are only typical in nature.



THE DISTRIBUTION SYSTEM IN RESPECT OF GRAVITY SYSTEMFOR A MULTI-STOREYED BUILDING

- Appurtenance, such as PRV should be planned in main piping network or branch piping, as required, to restrain pressure to upper limits.
- Zoning of water distribution network may be adopted for 7 to 9 floors.
- Maximum permissible velocity is 2.4m/s.
- Requirements for storage and usage of fire water shall be as per Part 4 .Fire and Life Safety. of the Code.

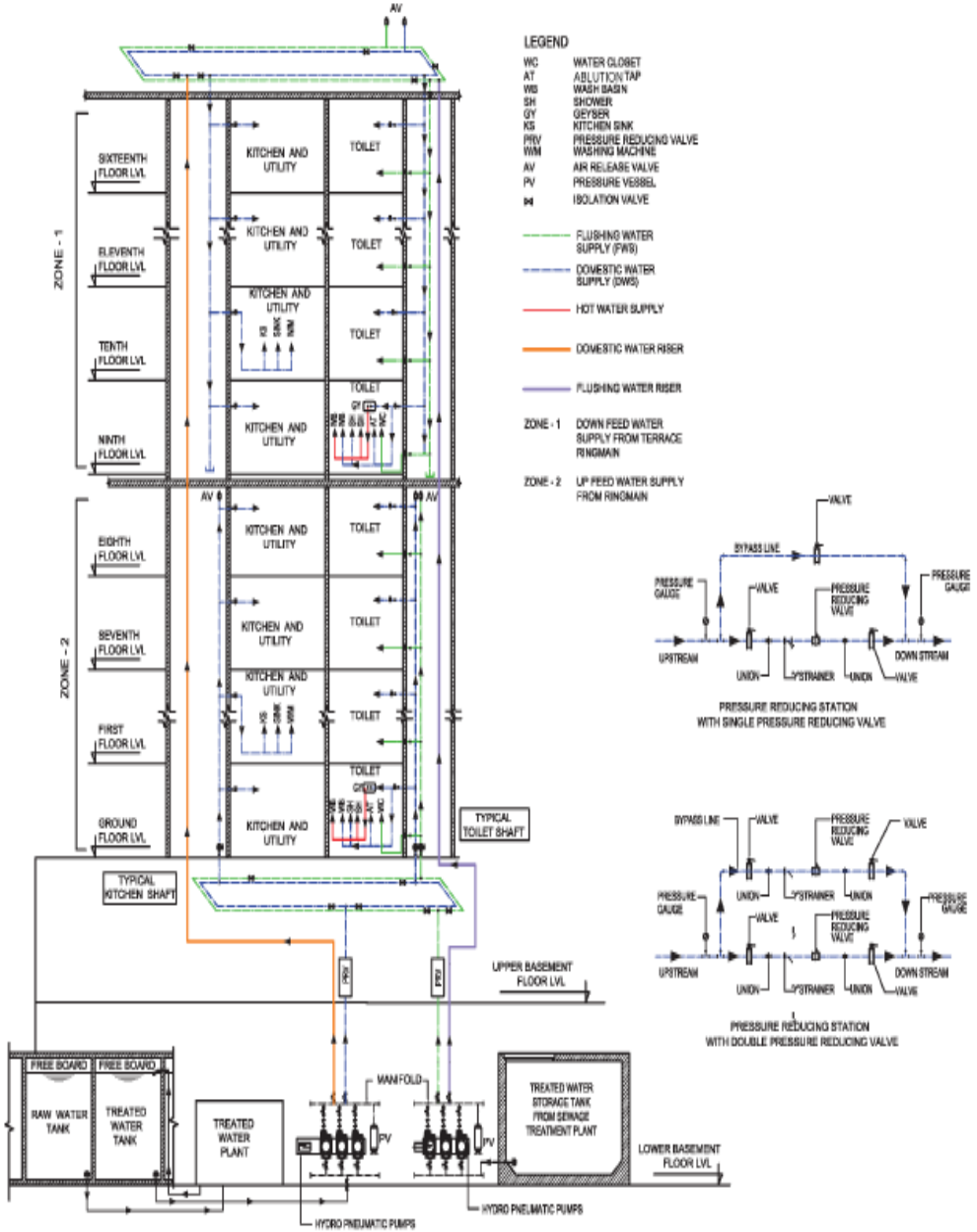


DISTRIBUTION SYSTEM IN RESPECT OF HYDRO-PNEUMATIC SYSTEM FOR A MULTI-STOREYED BUILDING

1 The given example is for 16 storeyed building with concept of upfeed and down feed ringmains. The choice of ringmain is on designer proposal. For taller building, zones and ringmains shall be planned to meet maximum and minimum pressure requirements.

Appurtenance, such as PRV should be planned in main piping network or branch piping, as required, to restrain pressure to upper limits.

2 Requirements for storage and usage for fire water shall be as per Part 4 .Fire and Life Safety. of the Code.



Water Supply and Distribution Systems

Hot and Cold Water Required.

- Except where not deemed necessary for safety or sanitation by the Authority Having Jurisdiction, each plumbing fixture shall be provided with an adequate supply of potable running water, piped thereto in an approved manner, so arranged as to keep it in a clean and sanitary condition without danger of backflow or cross-connection.
- Water closets and urinals shall be flushed by means of an approved flush tank or flushometer valve (flush valve). Where permitted by the Authority Having Jurisdiction, alternative water sources such as reclaimed water of approved quality may be used for flushing of water closets, urinals and for trap seal primer.
- Exception: Listed fixtures that do not require water for their operation and are not connected to the water supply. In occupancies where plumbing fixtures are installed for private use," hot water may be required for bathing, washing laundry, cooking, dishwashing or cleaning In occupancies where plumbing fixtures are installed for public use, hot water be required for bathing and washing purposes. This requirement shall not supersede the requirements for individual temperature control limitation for lavatories, bidets, bathtubs, whirlpool bathtubs and shower control valves.

Table 4 Rate of Hot Water Flow
(*Clause* 4.14.4)

Sl No.	Fixtures	Rate of Flow litre/min
(1)	(2)	(3)
i)	Kitchen sink	5
ii)	Wash basin	5
iii)	Shower (spray type)	6.5

Table 5 Maximum Permissible Lengths of Hot Water Draw-Off Pipes
(*Clause* 4.14.12.2.3)

Sl No.	Largest Internal Diameter of Pipe	Length m
(1)	(2)	(3)
i)	Not exceeding 20 mm	12
ii)	Exceeding 20 mm but not exceeding 25 mm	7.5
iii)	Exceeding 25 mm	3.0

NOTE — In the case of a composite pipe of different diameters, the largest diameter is to be taken into consideration for the purpose of this table.

For safety and sanitation reasons, each plumbing fixture that requires water for its operation shall be provided with potable water to wash the side walls of the fixture and to replenish the trap seal. The exception to this requirement is for reclaimed water systems that may be installed for flushing of water closets, urinals and for trap seal primers.

Fixtures such as floor drains, receptors, floor sinks, in-cinerators, chemical-treated toilets, composting toilets and non water urinals do not require water for their operation and are not provided with the water supply. Non water urinals may be installed where approved by the Authority Having Jurisdiction.

Drainage system going dry in the absence of adequate water
required for self-cleansing velocity and thereby causing un-sanitary conditions. The situation holds more relevance in rctrofit /refurbishment installations since the existing drains designed for fixtures using water may not be suitable for non- water urinals.

Contd.

- Stringent venting requirement on the drainage piping system calls for high levels of water seal to avoid trap seal loss.
- One of the popular models of non-water urinals is dependent on a cartridge, replacement of which is recommended after a certain number of usages. It is impractical to keep track of number of usages, especially in a large installation with a number of urinals with varying frequency of usage. such as in a public washroom. Substantial replacement cost of the cartridge is also a concern.
- Other versions of non-water urinals use proprietary liquid seals to prevent foul odours from drainage system entering the living spaces. Emptying of, say, a bucket of water into the urinal bowl will negate the artificially created liquid seal.
- Cleaning of the bowls has to be done manually at regular intervals without use of water but with proprietary cleaning agents, much to the dislike of the maintenance personnel.
- Non-water urinals are known to cause frequent blockage of the drainage system due to the encrustation of the urine crystals.
- Installation calls for a high level of accuracy and skill, m the case of non-water urinals using floating liquid, since an incorrect installation can negate the liquid seal and cause unsanitary conditions in wash room.
- Plumbing codes stipulate installation of fixture(s) using water upstream of non-water urinals. These requirements are often overlooked.
- The UIPC-I calls for provision of a water connection at each location where a non-water urinal is installed. This is due to the apprehension of malfunctioning of the non-water urinals and eventual need for its replacement with a water-using urinal.
- The Ministry of Environment and Forest (MoEF) regulations in India call for usage of treated effluent from onsite treatment plants for flushing. In such situations, usage of non- water urinals with a higher capital cost may not be justified.

Identification of Potable and Nonpotable Water Systems.

Minimum length of colour field and size of lettering		
Out side diameter of the pipe or covering	Minimum length colour field	Minimum size of letters
mm	mm	mm
15 to 32	200	12.5
40 to 50	200	20
65 to 150	300	32
200 to 250	600	64
over 250	800	89

POTABLE WATER

CAUTION: NON PORTABLE WATER DO NOT DRINK

CAUTION:RECLAIMED WATER DO NOT DRINK

Unacceptable connections

- No Installation of potable water supply piping or part thereof shall be made in such a manner that it will be possible for used, uncleaned, polluted or contaminated water, mixtures , or substances to enter any portion of such piping.
- The source may include any tank, receptor, equipment, or plumbing fixture. The cause may back-siphonage, suction, or other cause either during normal use and operation thereof, or when any such source is flooded or subject to pressure exceeding the operating pressure in the hot or cold water piping.

Contd.

- Cross Contamination-

No person shall make a connection or allow one to exist between pipes or conduits carrying domestic water by public or private water service system; and any pipe conduit of fixtures, containing or carrying water from any other source or containing or carrying water that has been used for any purpose whatever or any piping carrying chemical, chemical liquid gasses whatsoever unless an approved back flow device is provided. Each point of use shall be separately protected when potential cross contamination of individual unit exist.

- Back flow prevention

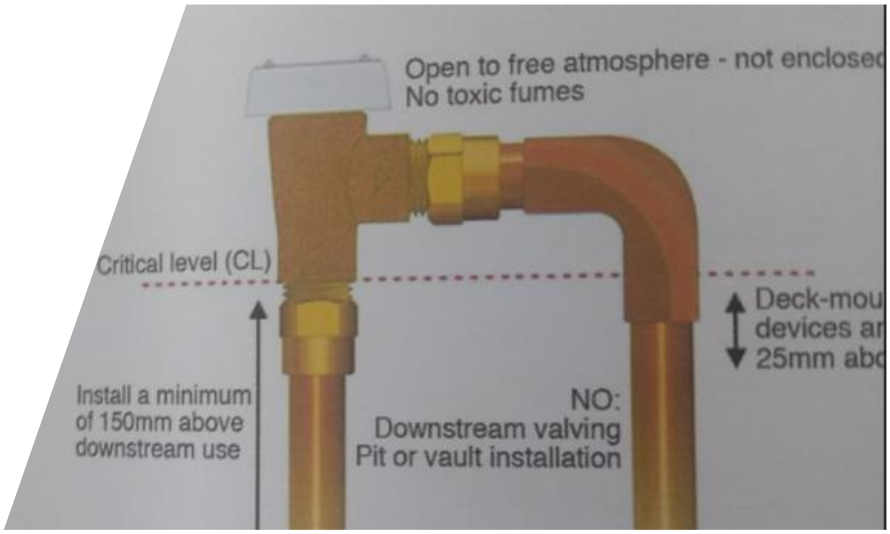
No installation of a fixture device or an arrangement of piping system that may cost a cross connection shall be allowed unless it is protected by a back flow prevention method. Maintenance or repair of the piping system shall not cause cross connection.

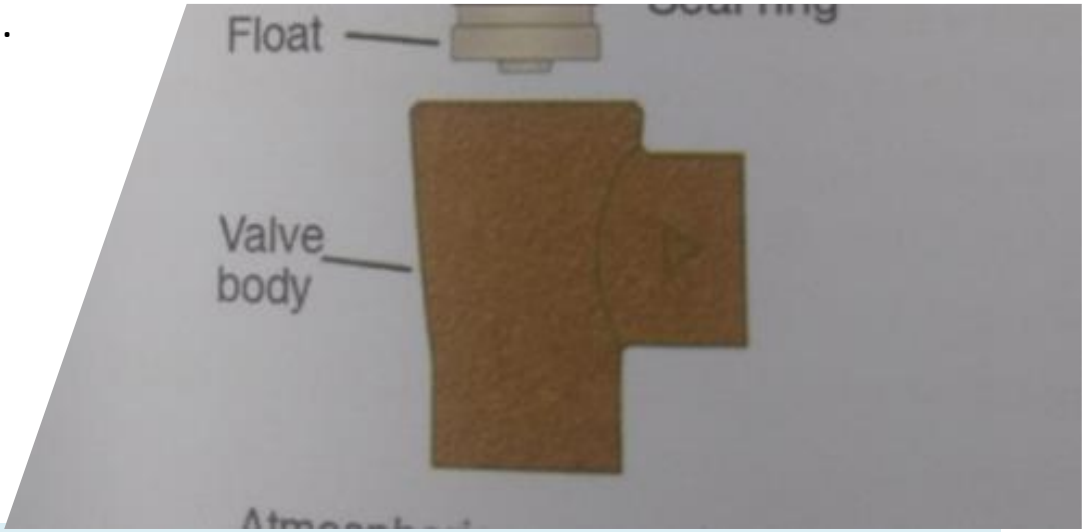
- Private Water Supply

No water piping supplied by any private water supply system shall be connected to any other source of water supply without the approval of authority having Jurisdiction

Atmospheric Vacuum Breaker(AVP)

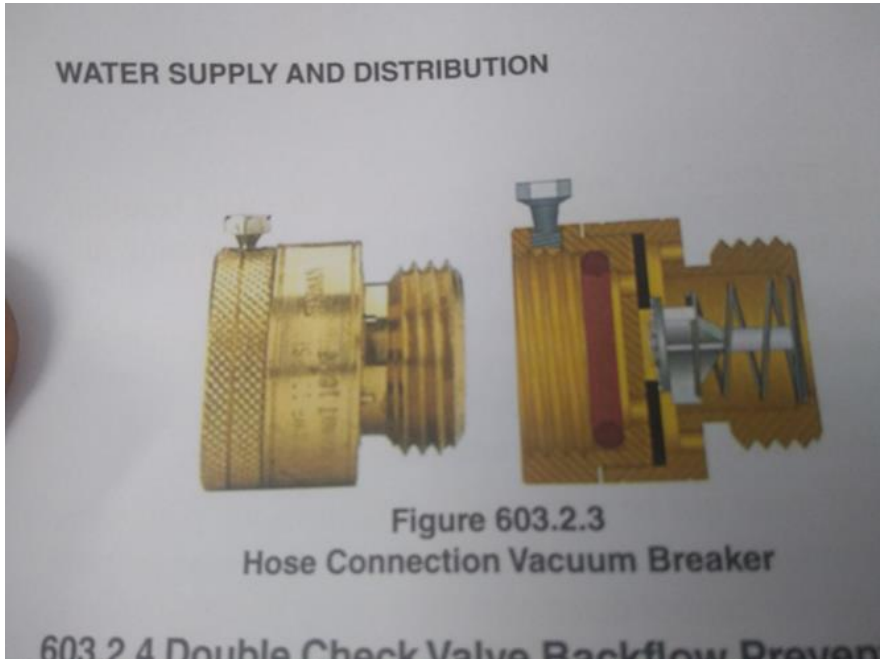
- The purpose of the vacuum breaker is to stop back siphonage. The atmospheric vacuum breaker(AVB) consist of valve that allows air into piping system for the purpose of stooping and downstream siphon.





Hose Connection Backflow Preventer

A hose connection backflow preventer consist of two independent check valves with an independent atmospheric vent between and means of field testing and draining



Parallel Water Distribution

A parallel water distribution system usually refers to plastic pipe systems. Usually refers to plastic pipe system. Usually PEX or PEX-AL-PEX systems that use manifold in system. There are two types of manifold system.

The “home run “system utilizes a centrally located manifold to individually distribute supply lines to each fixture.

The “remote manifold system” system utilized a trunk or main which service several small manifold that in turn service a group individual fixture.

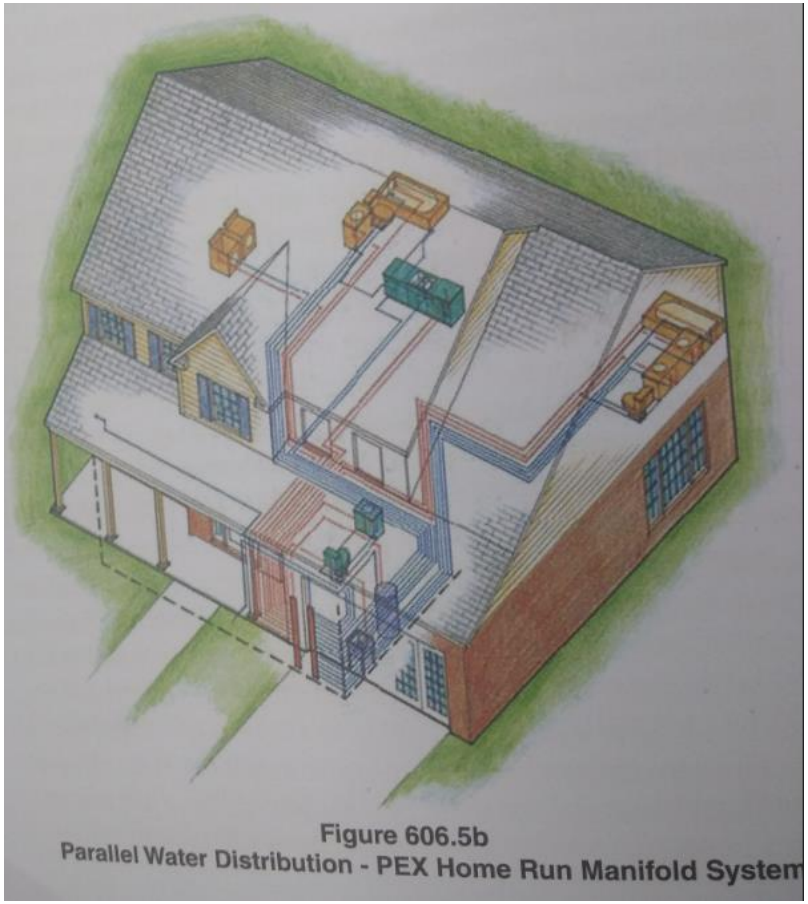


Figure 606.5b
Parallel Water Distribution - PEX Home Run Manifold System

Pressure Reducing Valves

- Pressure regulating or reducing valves are modulating valves which have high level of flow resistance and consequent pressure drop through them even when fully open. Therefor pipe sizing downstream of the pressure regulator must be based on ”Worst Case” pressure loss during a maximum demand water flow.

For Example a water system has a pressure 6.5 Bar . A pressure regulator will install and set at 4.0 Bar (4.0kg/cm2-40 m Water column) .

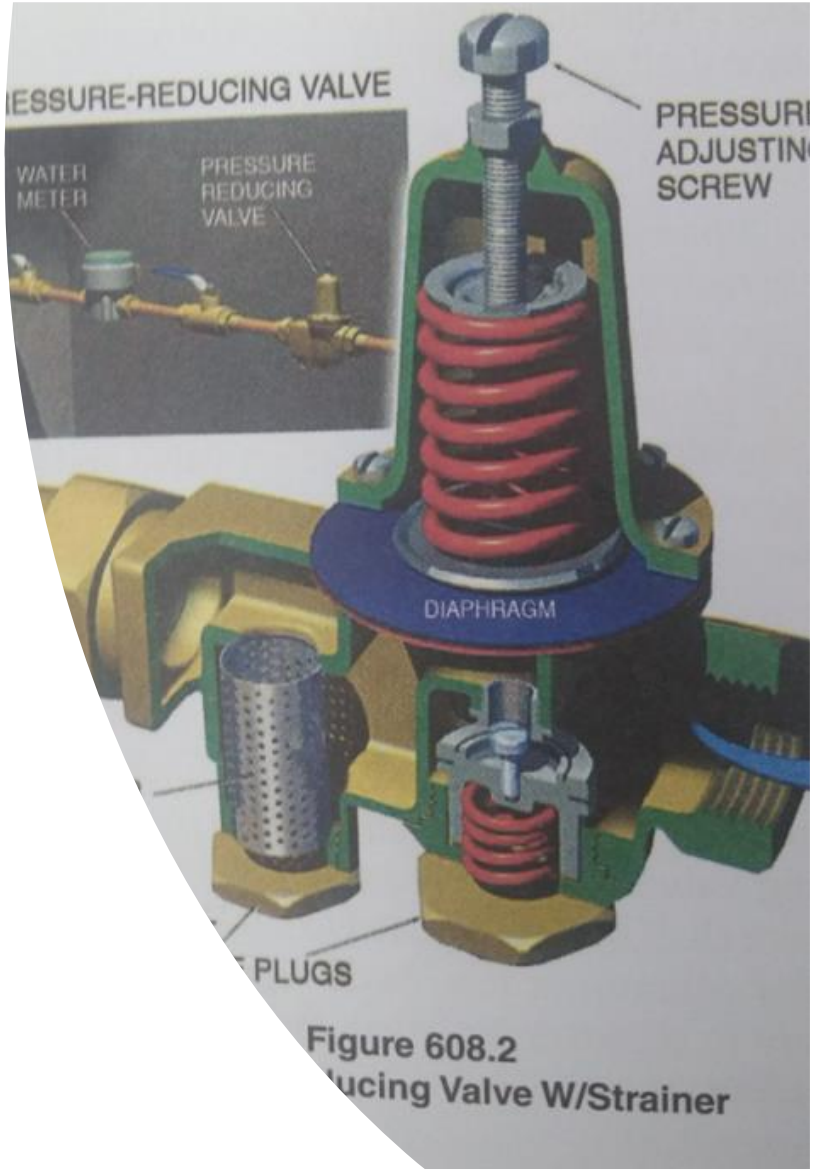
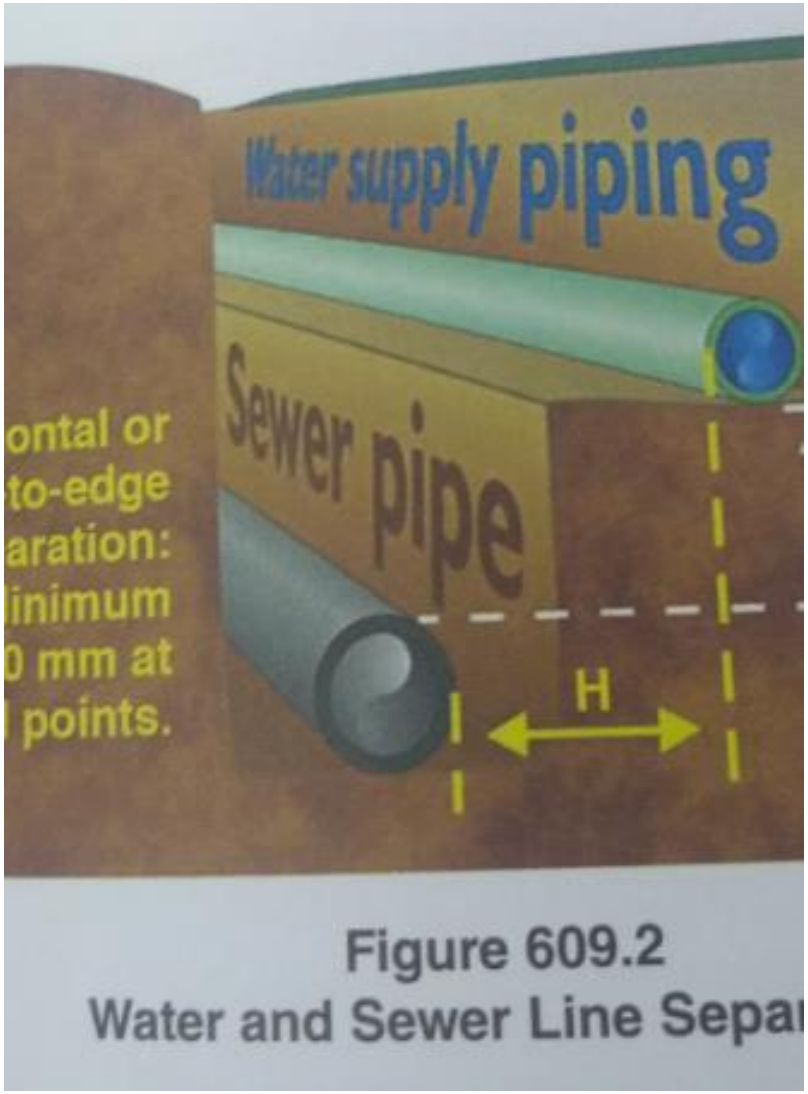


Figure 608.2
ucing Valve W/Strainer

Water and Sewer line separation

- Water pipe crossing sewer drainage piping constructed of clay or material that are not approved for use building shall be laid not less than 300 mm above the sewer or drain pipe.



Water hammer and Air chamber air cushion depletion

Building water supply system where quick acting valve are installed shall provided with water hammer arresters to absorb high pressure resulting from quick closing of the valves.

An air chamber or crapped stand pipe was an effective solution to controlling water hammer. However within a air chamber nothing separate the air from the water . It only takes few short weeks before the air is absorbed into water, leaving air chamber water logged and completely in effective against water hammer.

Figure 609.10.1a
Air Chamber Air Cushion Depletion

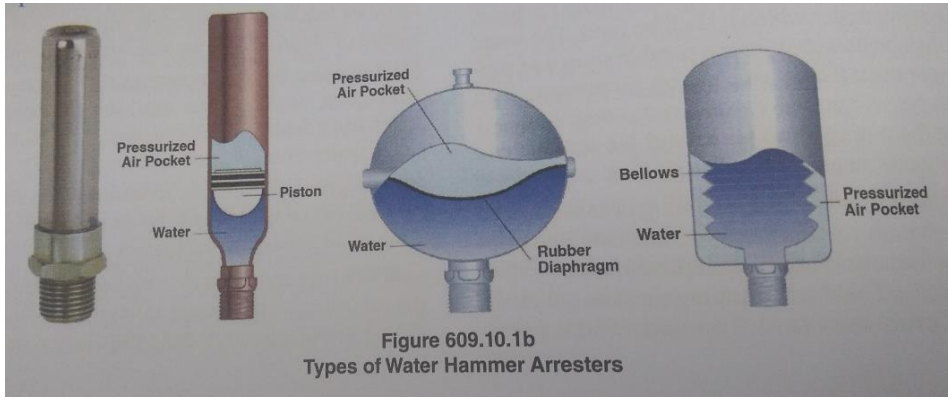


Figure 609.10.1b
Types of Water Hammer Arresters

Conclusion

Presently, water is the world's scarcest natural resource. It is no longer affordable to overdesign plumbing systems if the industry advocates sustainable use of water.

In the context of water conservation, which should be the primary goal in the global water-stressed scenario, designers are giving importance to using low-water-use (demand) fixtures. Merely recommending the use of low-water-flow fixture cannot address the issue of water conservation.

Thank you

- Any Questions?

Compiled by Technical Committee - IPA