BUILDING SERVICES: WATER SUPPLY, PLUMBING AND DRAINAGE IN BUILDINGS

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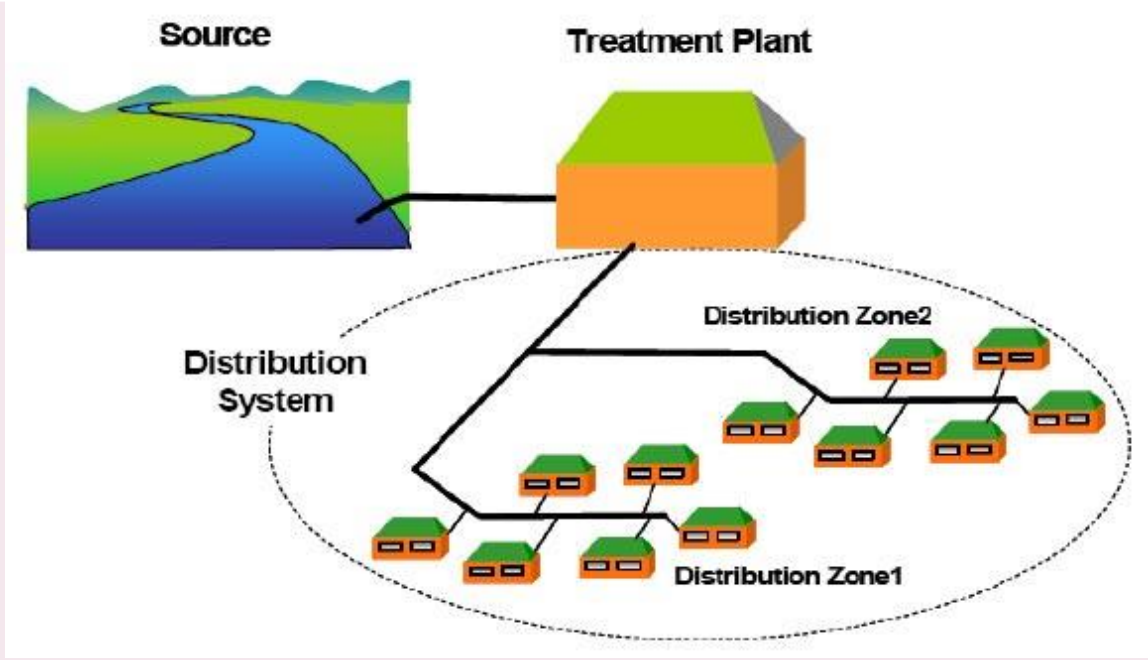
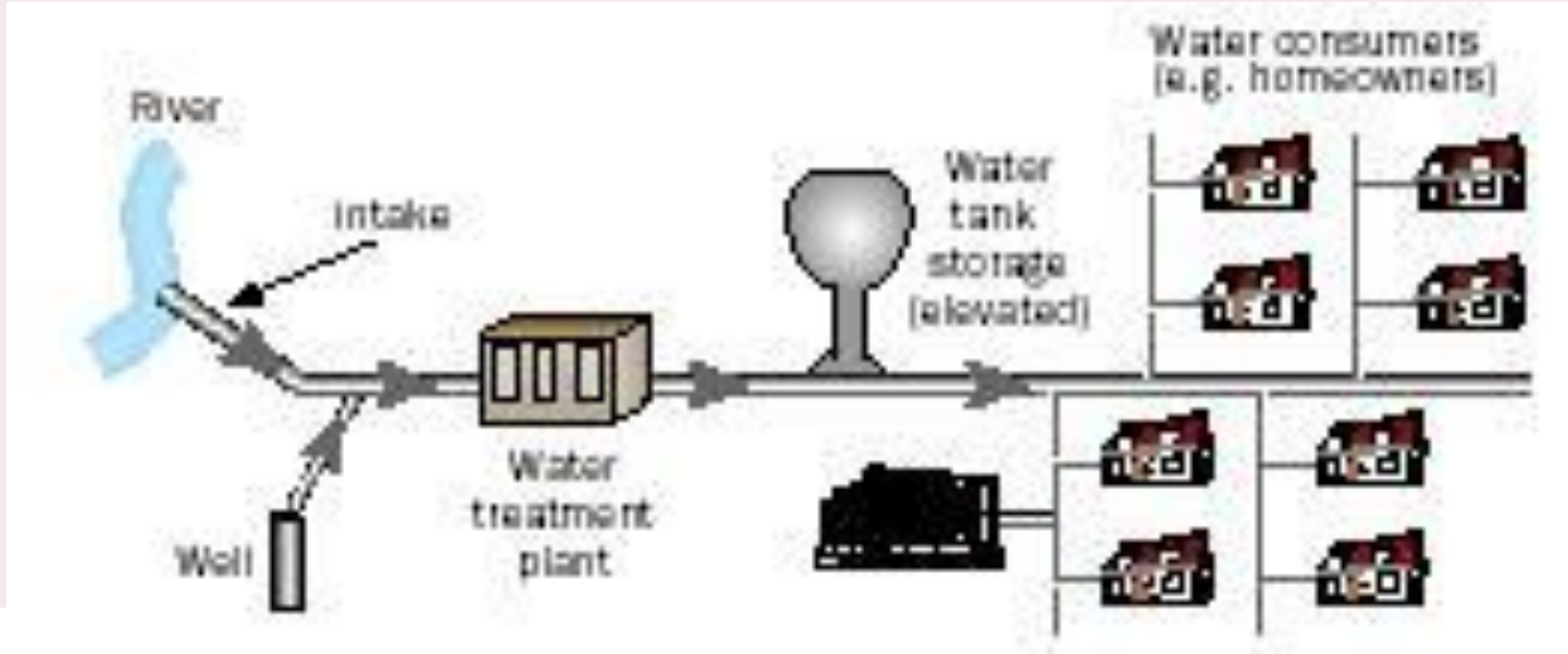

Source
Treatment Plant
Distribution System
Distribution Zone2
Distribution Zone1


Water consumers (e.g. homeowners)
River
intake
Water tank storage (elevated)
Well
Water treatment plant

TECHNICAL TERMS RELATED TO WATER SUPPLY AND PLUMBING

- **WATER MAIN:** The main water supply pipe vested in administrative authority for use of public or community

- **WATER SUPPLY SYSTEM:** System of connecting pipes, fittings, control valve and all accessories in or adjacent to building or premises.

- **WARNING PIPE:** An overflow pipe so fixed that its outlet is in an exposed position where discharge of water may be readily seen.

- **STORAGE TANK:** A tank for storage of water connected to water main by means of a supply pipe.

- **HOUSE PLUMBING:** The practice, materials and fixtures used in the installation, maintenance, extension and alteration of all piping, appliances and accessories n connection with house of premises.

- **PLUMBING SYSTEM:** System of water supply and distribution pipes, plumbing fixtures and taps, vent pipes, building drains and sewers including their connection

- **AVAILABLE HEAD:** head of water available from a water main at the plinth level of the building or premises.

- **BACK FLOW:** flow of water or their liquid, into the distribution pipes of a potable supply of water from any source or sources other than its intended source.

- **BACK SIPHONAGE:** The flowing back of used, contaminated or polluted water from a plumbing fixture or vessel into a water supply pipe due to lowering of pressure in such a pipe.

- **EFFECTIVE OPENING:** the minimum cross-sectional area at the point of water supply, expressed in terms of diameter of circle and if opening is not circular, the diameter of a circle of equivalent cross sectional area.

- **WASH OUT VALVE:** A device located at the bottom of the tank for the purpose of draining a tank for cleaning, maintenance etc.

- **RESIDUAL HEAD:** Pressure available at the tail end of distribution system

PURPOSE OF WATER STORAGE

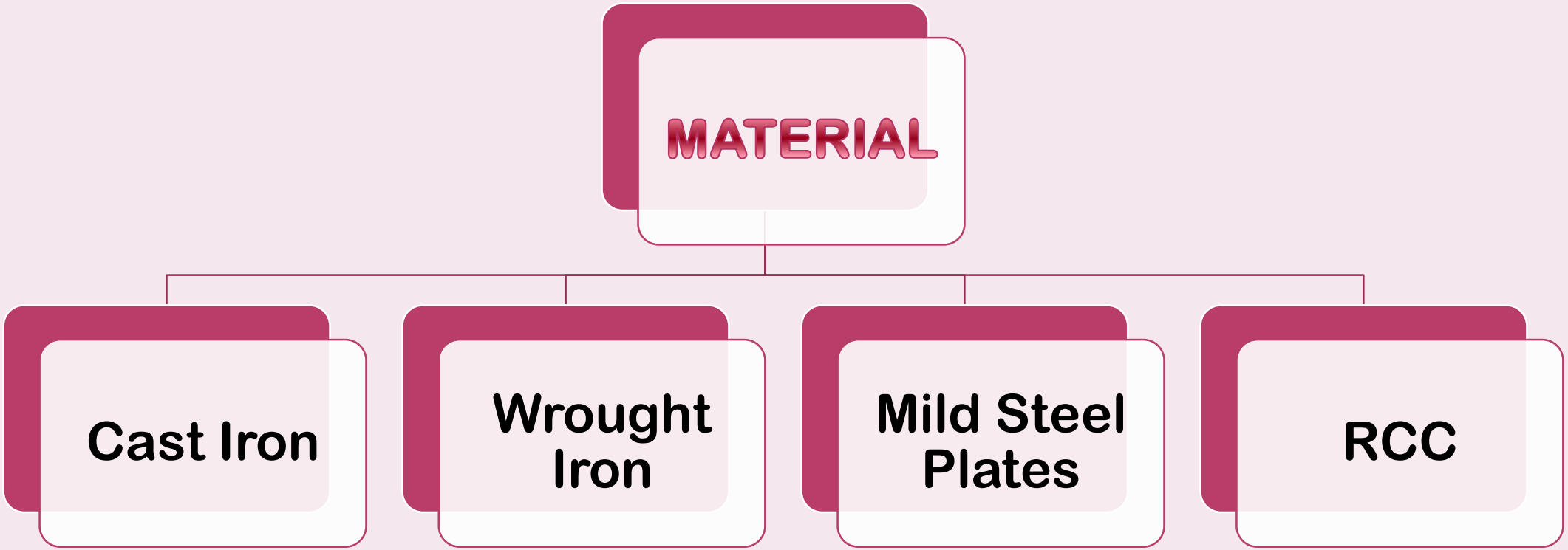
For supplying of water during non-supply hours

Reducing maximum rate of demand on water mains

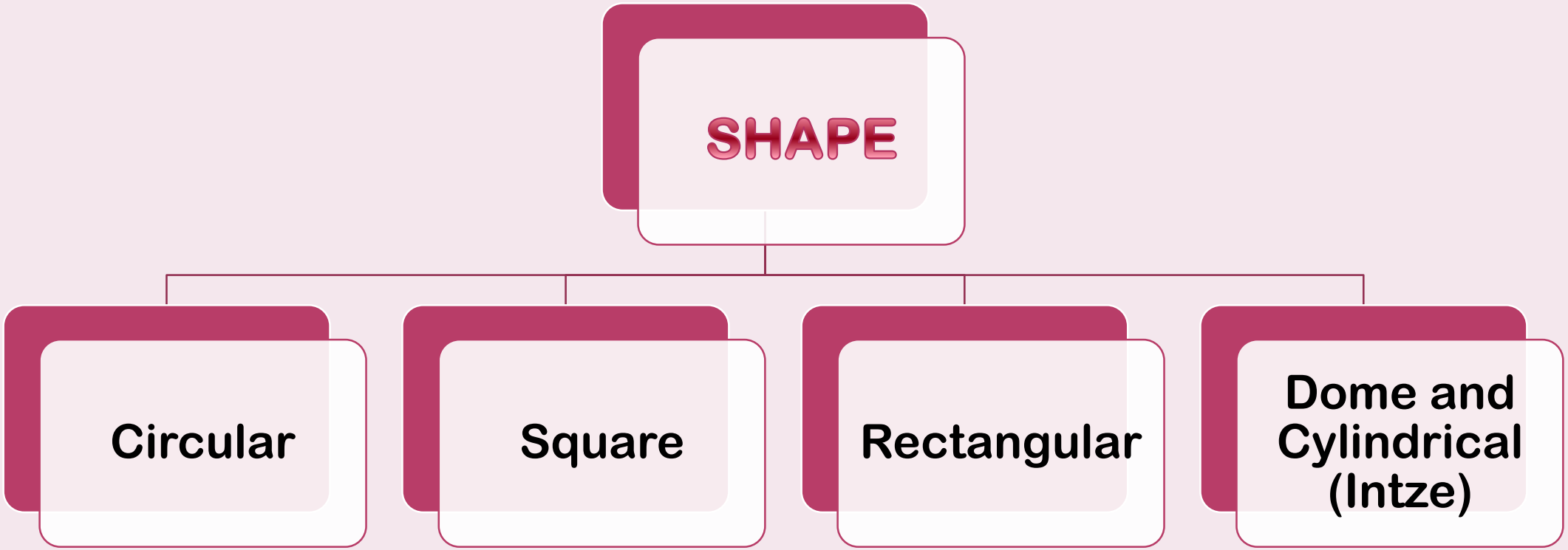
Storage of water during repair, damage etc, of the water mains

When available head is insufficient to supply water in each storey of multi0strorey building

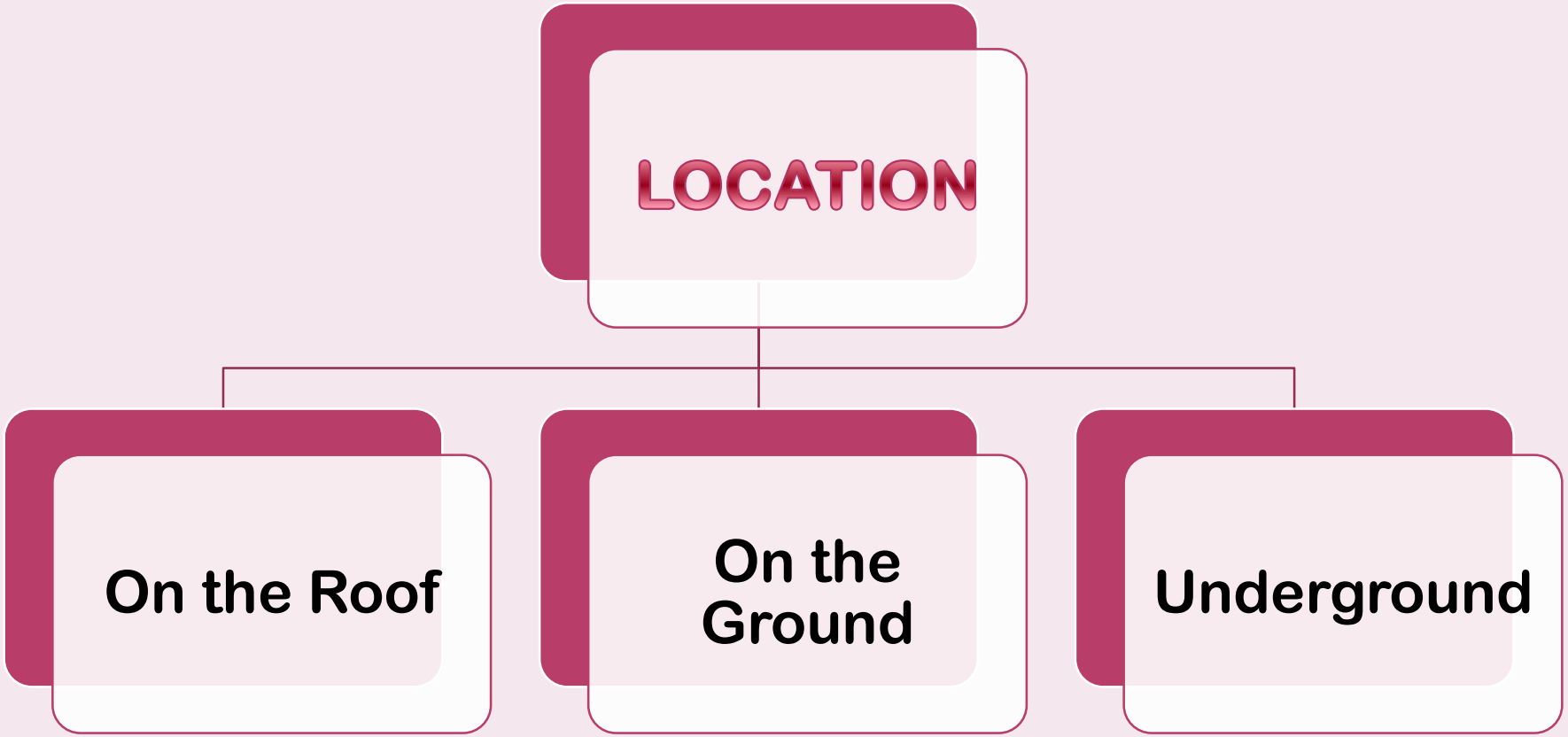
TYPES OF STORAGE TANKS



TYPES OF STORAGE TANKS



TYPES OF STORAGE TANKS



REQUIREMENTS OF STORAGE TANKS

- Water tight
- Provided with warning pipe such that discharge can be easily seen
- Provided with valve to control flow of water
- Provided with drain pipe near the bottom to clean the tank
- Provided with outlet pipe (a pipe with an opening which permits escape or release of water, etc)

CAPACITY OF STORAGE TANKS

- **FACTORS EFFECTING STORAGE CAPACITY ARE:**

Rate of supply of water from water works

Type of building: residential or public or industrial

Water supply continuous or intermittent

Frequency of replenishment of tanks during one day

Demand

CAPACITY OF STORAGE TANKS

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Demand

According to Indian Standard: 135 litre/head/day in residential buildings

IS CODES

- IS 2064 : 1993 - Code of practice for selection, installation and maintenance of sanitary appliances
- IS 2065 : 1993 - Code of Practice for Water Supply in Buildings
- IS 1172 : 1993 - Code of Basic Requirements for Water Supply, Drainage and Sanitation

IS 1172

4.1 Water Supply for Residences

A minimum of 70 to 100 litres per head per day may be considered adequate for domestic needs of urban communities, apart from non domestic needs as flushing requirements. As a general rule the following rates per capita per day may be considered minimum for domestic and non domestic needs:

1) For communities with population up to 20 000 and without flushing system
   a) water supply through standpost — 40 lphd (*Min*)
   b) water supply through house service connection — 70 to 100 lphd
2) For communities with population 20 000 to 100,000 together with full flushing system — 100 to 150 lphd
3) For communities with population above 100 000 together with full flushing system — 150 to 200 lphd

NOTE — The value of water supply given as 150 to 200 litres per head per day may be reduced to 135 litres per head per day for houses for Lower Income Groups (LIG) and Economically Weaker Section of Society (EWS), depending upon prevailing conditions.

4.1.1 Out of the 150 to 200 litres per head per day, 45 litres per head per day may be taken for flushing requirements and the remaining quantity for other domestic purposes.

Table 1 Water Requirements for Buildings Other than Residences

Sl No.	Type of Building	Consumption Per Day, litres
(1)	(2)	(3)
i)	Factories where bath rooms are required to be provided	45 per head
ii)	Factories where no bath rooms are required to be provided	30 per head
iii)	Hospital (including laundry):	
	a) Number of beds not exceeding 100	340 per head
	b) Number of beds exceeding 100	450 per head
iv)	Nurses' homes and medical quarters	135 per head
v)	Hostels	135 per head
vi)	Hotel	180 per head
vii)	Offices	45 per head
viii)	Restaurants	70 per seat
ix)	Cinemas, concert halls and theatres	15 per seat
x)	Schools:	
	a) Day schools	45 per head
	b) Boarding schools	135 per head

NOTE — For fire demand in buildings refer IS 9668 : 1981.

IS 1172

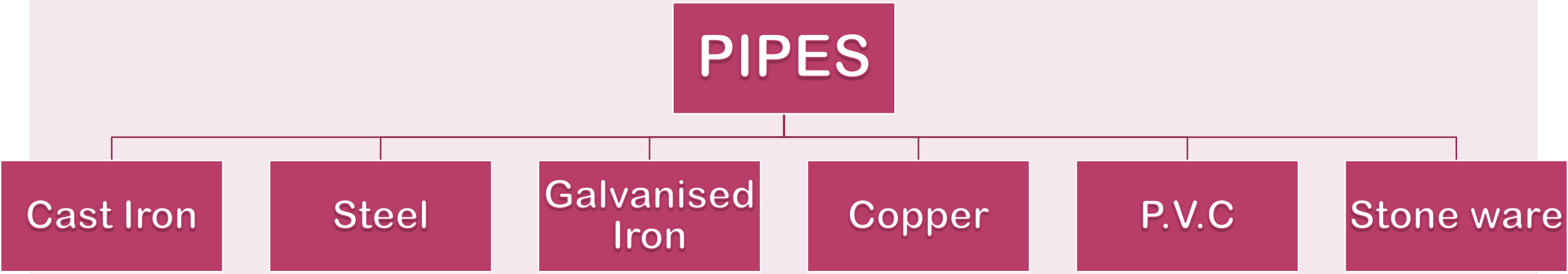
Nature of Station	*Where Bathing Facilities are Provided litres/capita*	*Where Bathing Facilities are not Provided litres/capita*
a) Railways, bus stations and sea ports		
i) Intermediate stations (excluding mail and express stops)	45	25
ii) Junction stations and intermediate stations where mail or express stoppage is provided	70	45
iii) Terminal stations	45	45
b) Airports		
International and domestic airports	70	70

NOTES

1 The number of persons shall be determined by average number of passengers handled by the station daily; due consideration may be given to the staff and vendors likely to use facilities.

2 Consideration should be given for seasonal average peak requirements.

PIPES


PIPES
Cast Iron
Steel
Galvanised Iron
Copper
P.V.C
Stone ware

CAST IRON PIPES

- Used in water distribution network

STEEL PIPES

- Used in water mains where water pressure is very high.
- Stronger and lighter in weight as compared to CI pipes
- Costly
- Effected by atmosphere easily
- Must be treated before use

GALVANISED IRON PIPES

- Made of wrought iron and coated with zinc
- Zinc coating prevents corrosion
- Used in plumbing services inside the building
- Easily connected by joints by making threads at pipe ends

COPPER PIPES

- Used for hot water supply installations
- Not common in India
- High tensile strenth
- Light and can be easily bent
- Costly
- Provide an environment that makes it very difficult for bacteria to grow

PVC PIPES

- For supply of cold water
- Light in weight
- Non corrosive
- No threading required

STONE WARE PIPES

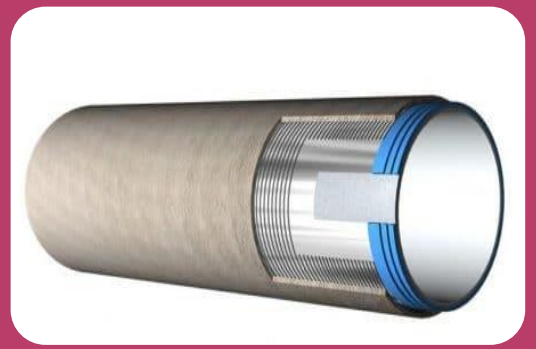
- They are ceramic pipes used for drainage
- Reasonably cheap to manufacture and easy to lay but are prone to cracking.
- Heavy
- Not used commonly

ASBESTOS PIPES

- Constructed from cement and **asbestos** fibers.
- Highly resistant to corrosion
- Was widely used in drainage systems and gas line

RCC PIPES

- Used for sewerage, drainage, culverts, Irrigation, water supply/ transportation
- leak proof
- easily repairable
- non-reactive to sewerage toxins.
- High grade Concrete Mix above M30 is considered ideal for RCC Hume Pipe manufacturing.



PRESTRESSED PIPES

- They have more strength than RCC pipes and economical compared to steel or cast iron pipes.
- To supply water for domestic needs
- Used as Pipe lines which carry sewage using gravity.
- Run-off or rainwater collecting pipe lines.

FIXING PIPES AND ACCESORIES

- Rainwater, soil and vent pipes can be either
  - **embedded** in the walls and floors or
  - **fixed** on walls and floors (for ease in repair and maintenance)

- When **embedded**: no fixing devices required
- When **fixed**: special brackets used with aluminum painted clips. Brackets fit around the pipes or accessory directly beneath the socket and have ears for securing the face of structure

- After fixing, all pipes and accessories are tested for water tightness

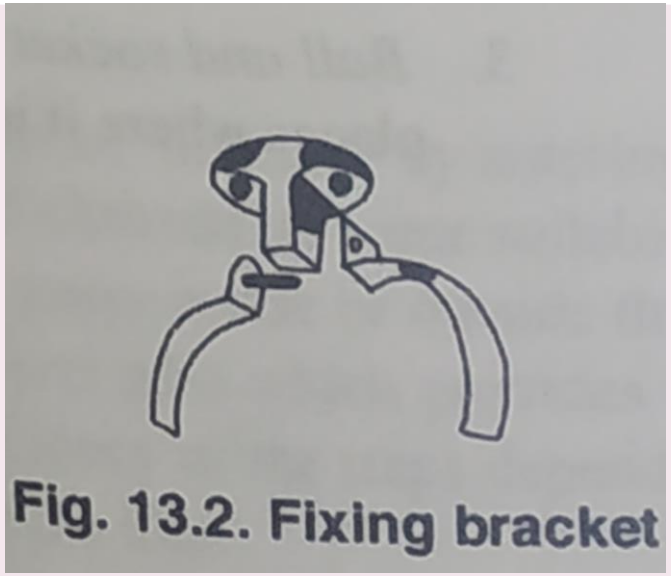


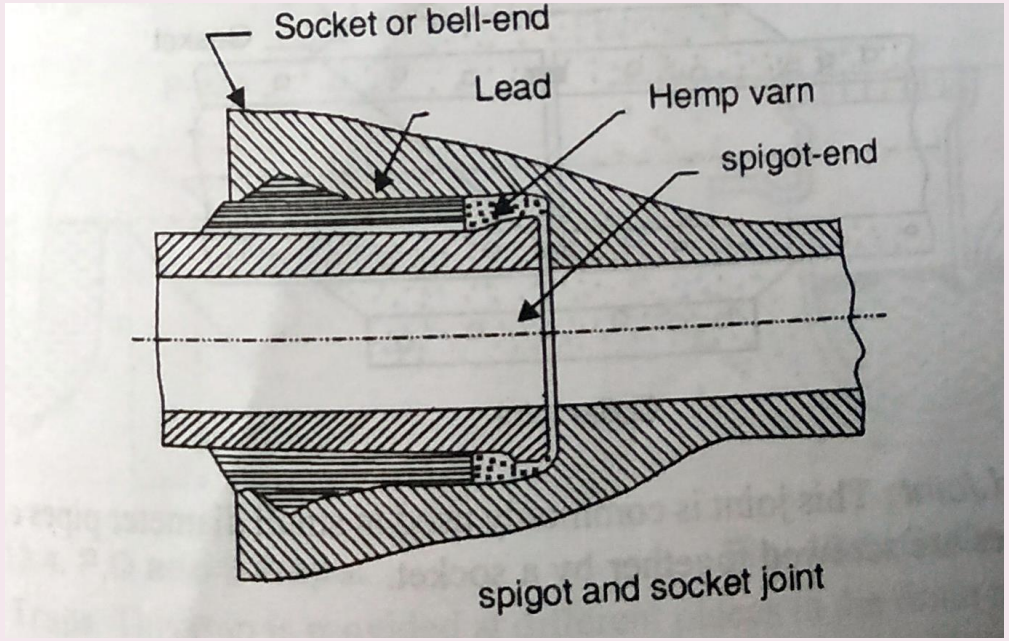
Fig. 13.2. Fixing bracket

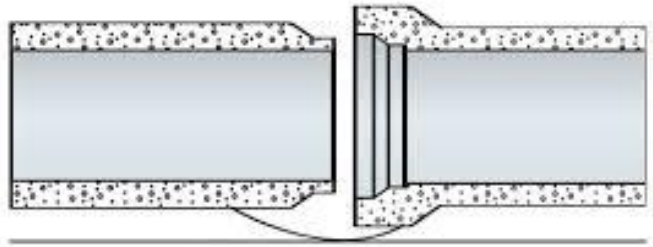
JOINTING PIPES

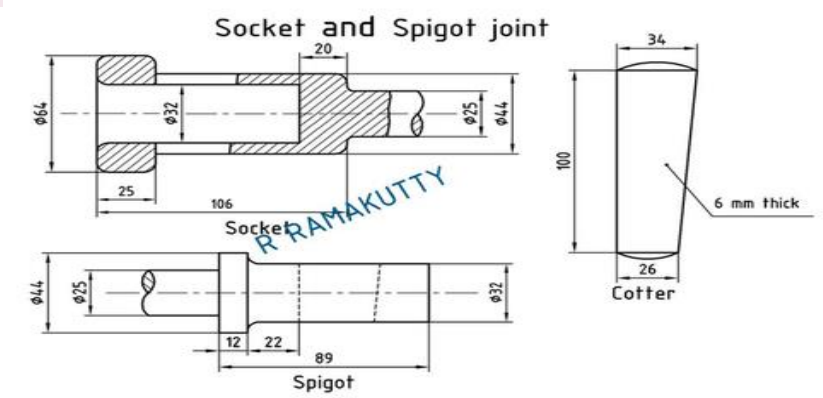
- After laying pipes in position, pipes are jointed together
- Different types of joints are used under different conditions.

TYPES OF JOINTS IN PIPES

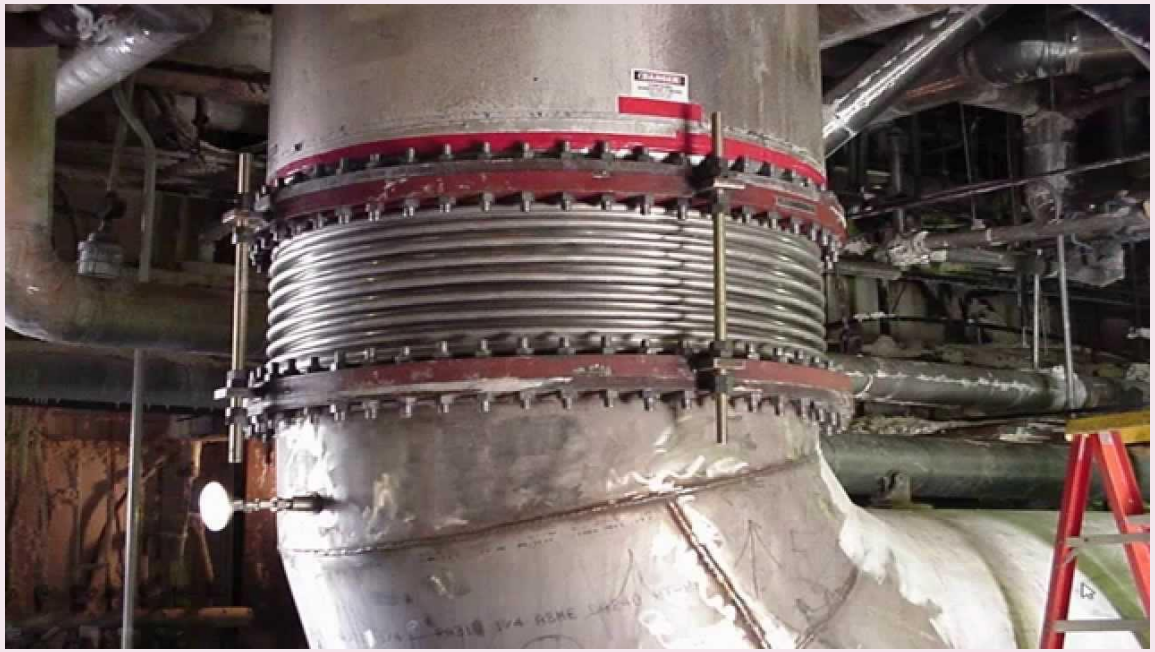
- **SPIGOT AND SOCKET JOINT:**
  - Cast Iron pipes are joined by this method
  - Enlarged end of pipe is called socket and plain end is called spigot.







- **EXPANSION JOINT:**
  - Used in very long pipes to allow provision for expansion of pipe



- **BALL AND SOCKET JOINT OR UNIVERSAL JOINT:**
  - Used in situations were it is apprehended that pipe line is likely to settle down

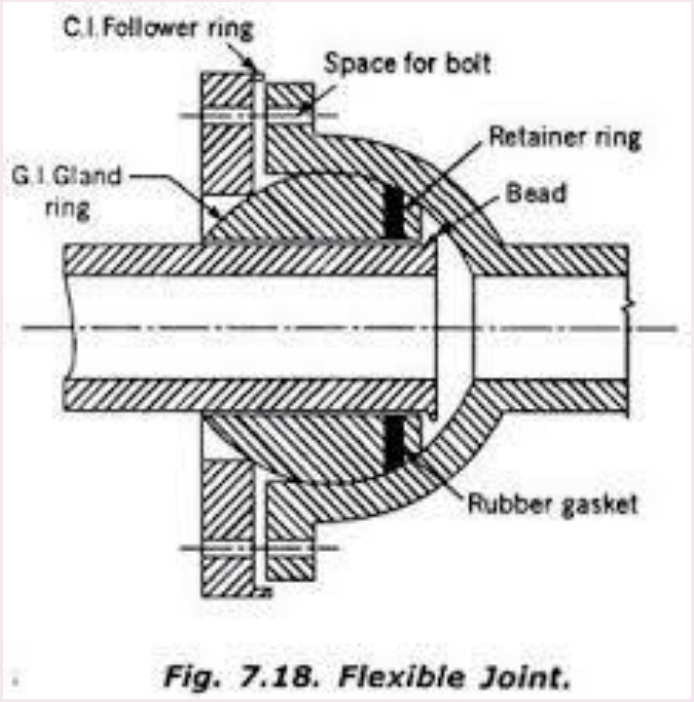
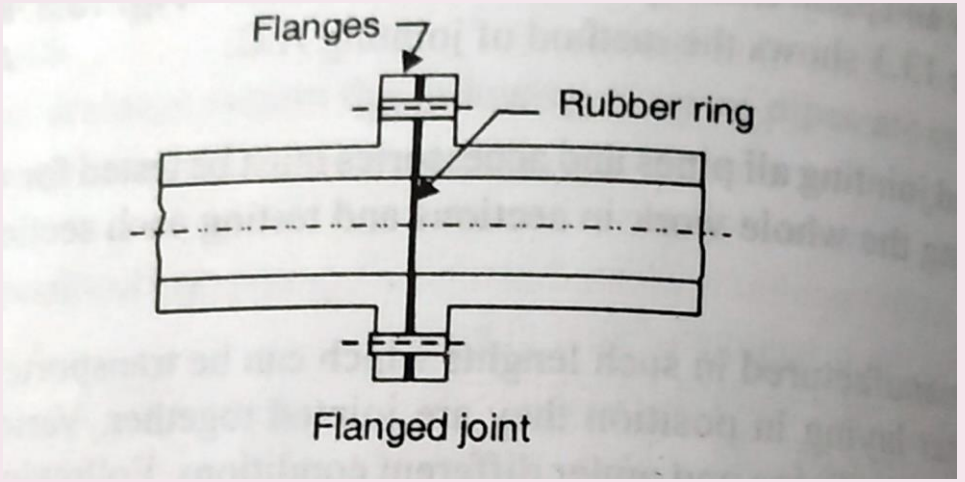
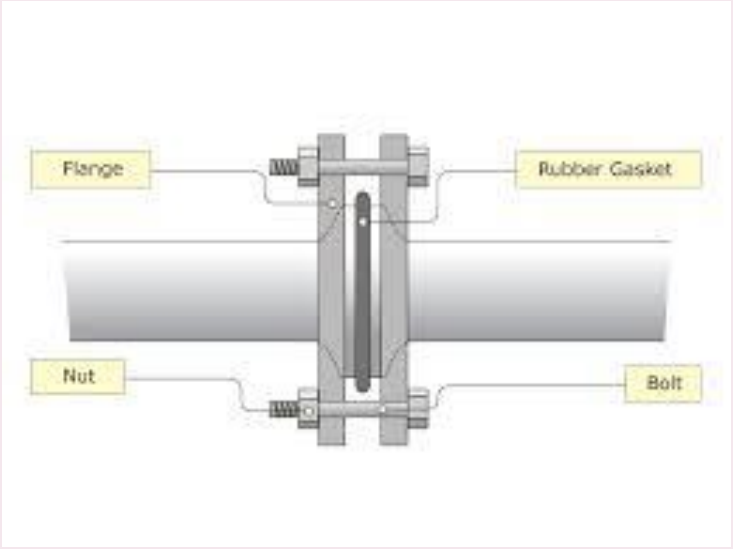
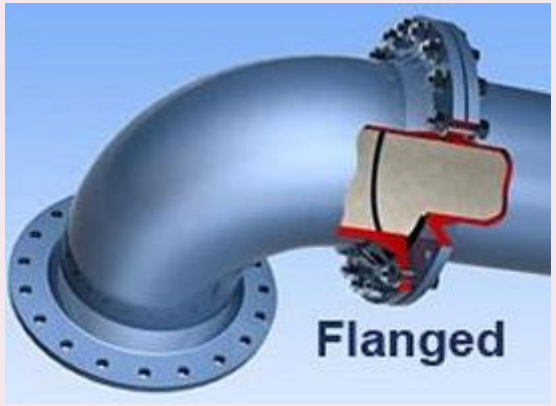


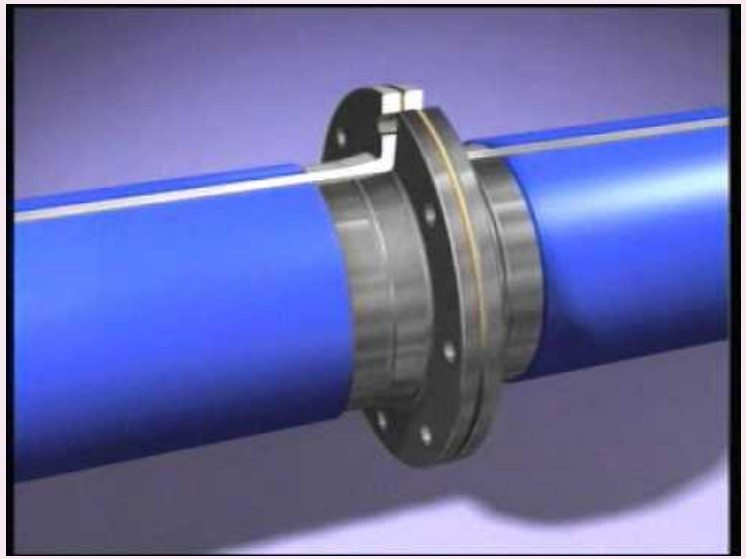
Fig. 7.18. Flexible Joint.

- **FLANGED JOINT:**
  - Used when pipes have flanges on the ends

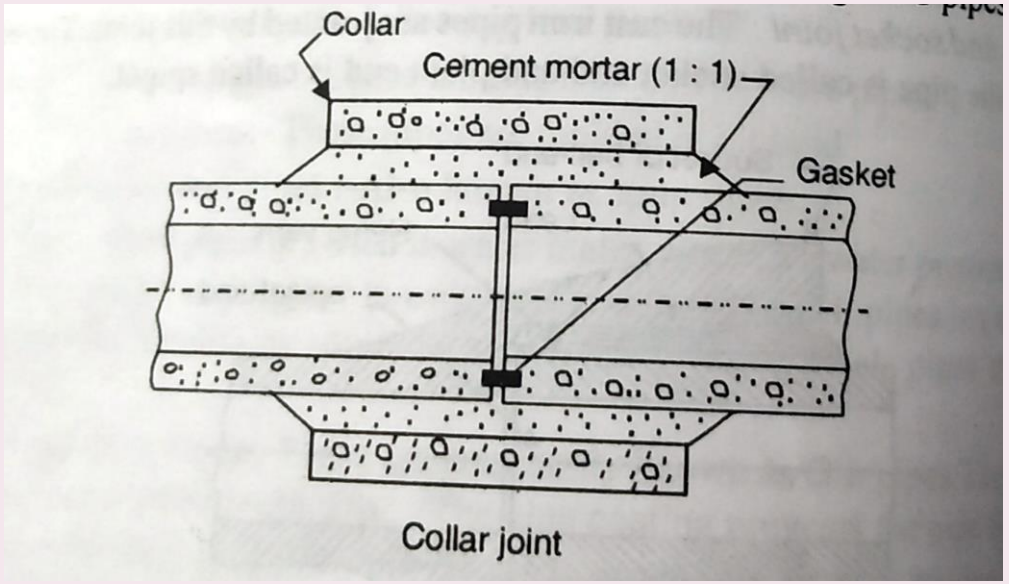




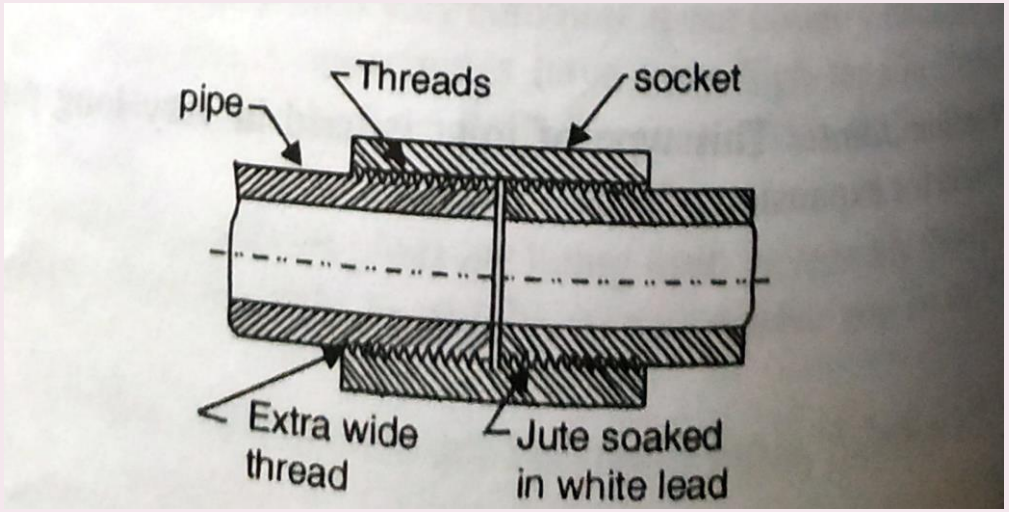




- **COLLAR JOINT:**
  - Used for connecting RCC pipes



- **SCREWED JOINT:**
  - Used in small diameter pipes.
  - Pipes are screwed together by a socket



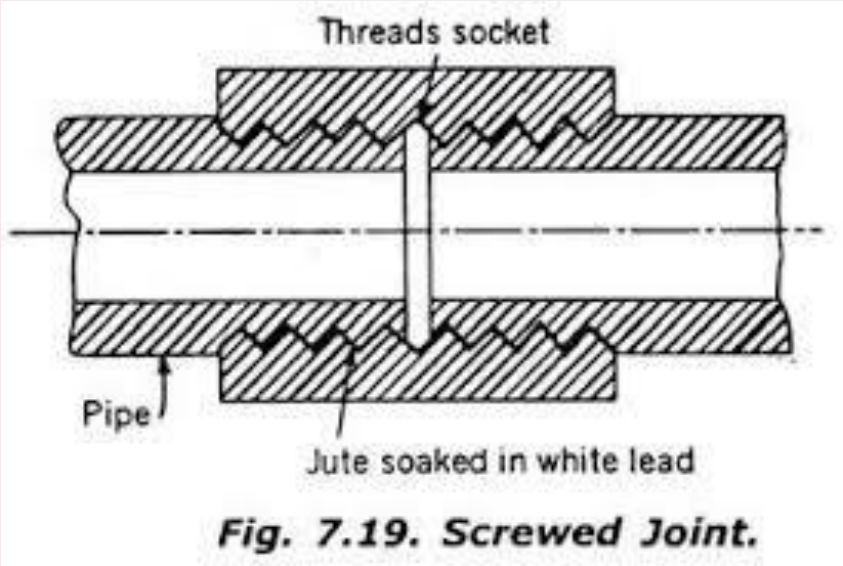
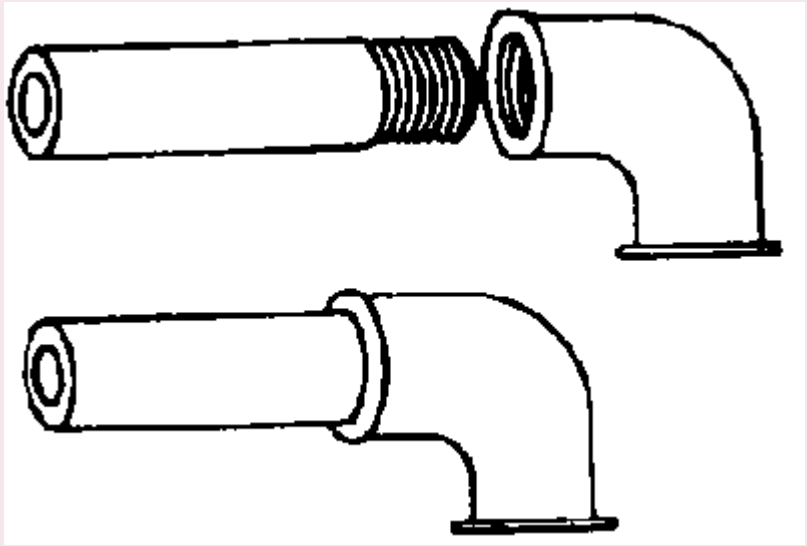


Fig. 7.19. Screwed Joint.



PIPE FITTINGS

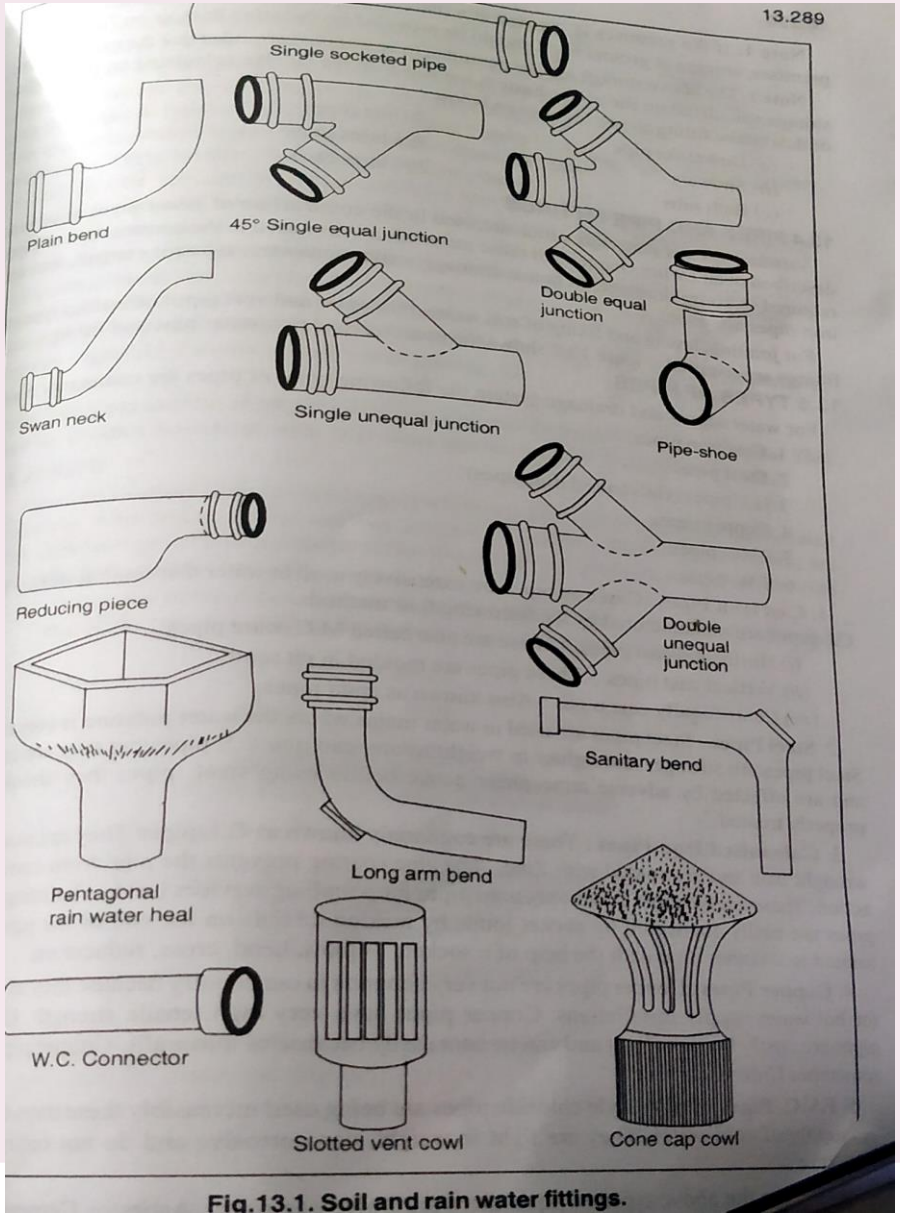
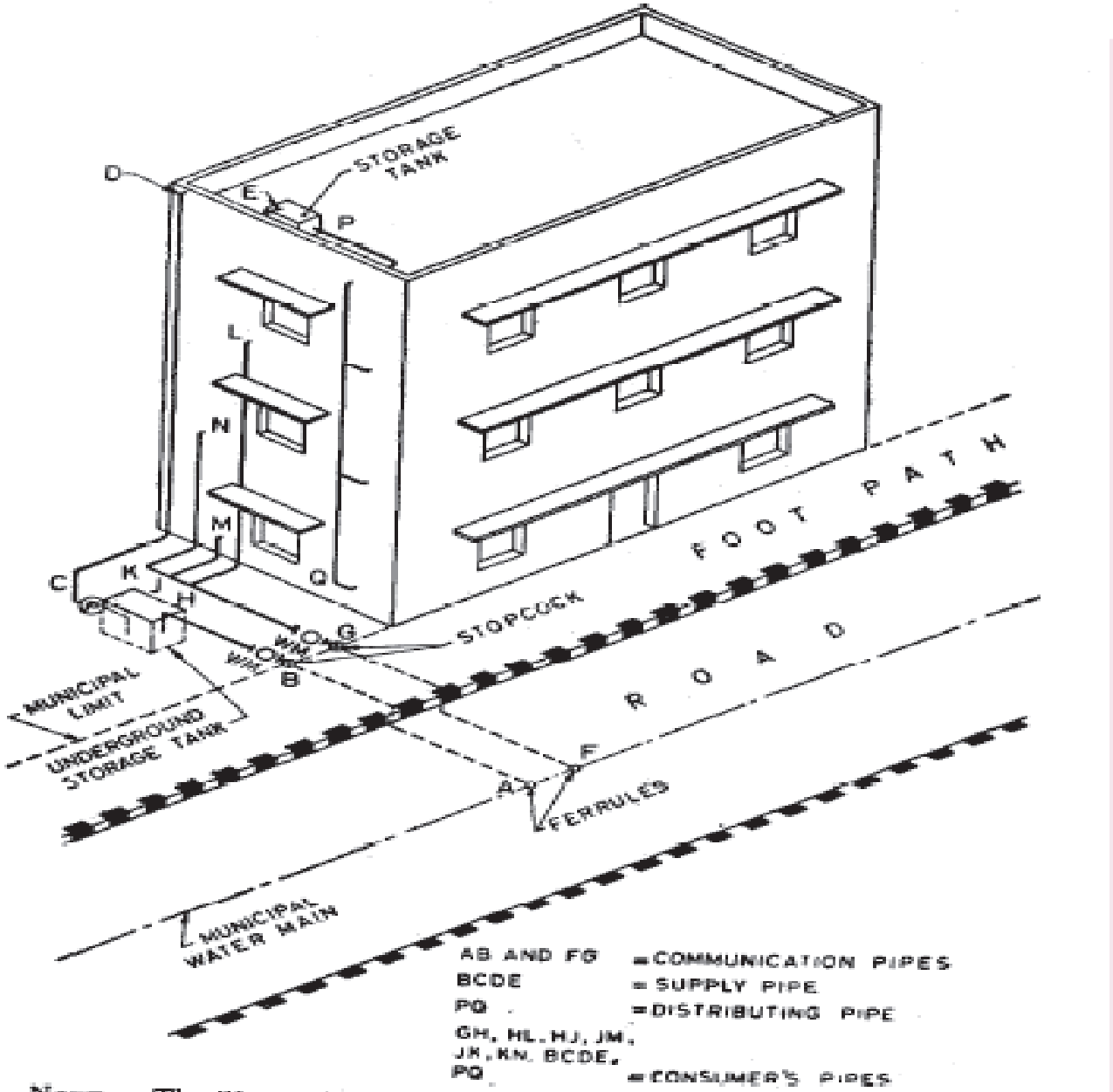


Fig.13.1. Soil and rain water fittings.

D-1.1 To indicate the class of its contents, each pipe shall be marked with the appropriate primary identification colour as per details given below:

Contents	*Identification Colour*
Water	Sea green
Steam	Silver grey
Air	Sky blue
Drainage and other wastes	Black
Gases	Canary yellow
Oils	Light brown
Acids and alkalis	Dark violet
Fire installations	Fire red



NOTE — The illustration is not intended to indicate recommended positions of underground storage tank (where provided), pipes, etc, and this will depend on local situations.

FIG. 1 TYPICAL SKETCH FOR IDENTIFICATION OF DIFFERENT TYPES OF WATER SUPPLY PIPES

SANITARY AND WATER SUPPLY FIXTURES

WASH BASINS

SINKS

VALVES,TAPS

GEYSOR

TRAPS

BATH TUBS

FLUSHING CISTERNS

WATER CLOSETS

WASH BASINS:

- Used for washing hands, face
- May be hung to wall with the help of brackets or may be supported on pedestals
- One or two taps provided in each wash basin
- Circular waste hole provided at bottom.
- Waste pipe connected to the drain through a trap.
- Nickel coated grating and plug with chain provided.

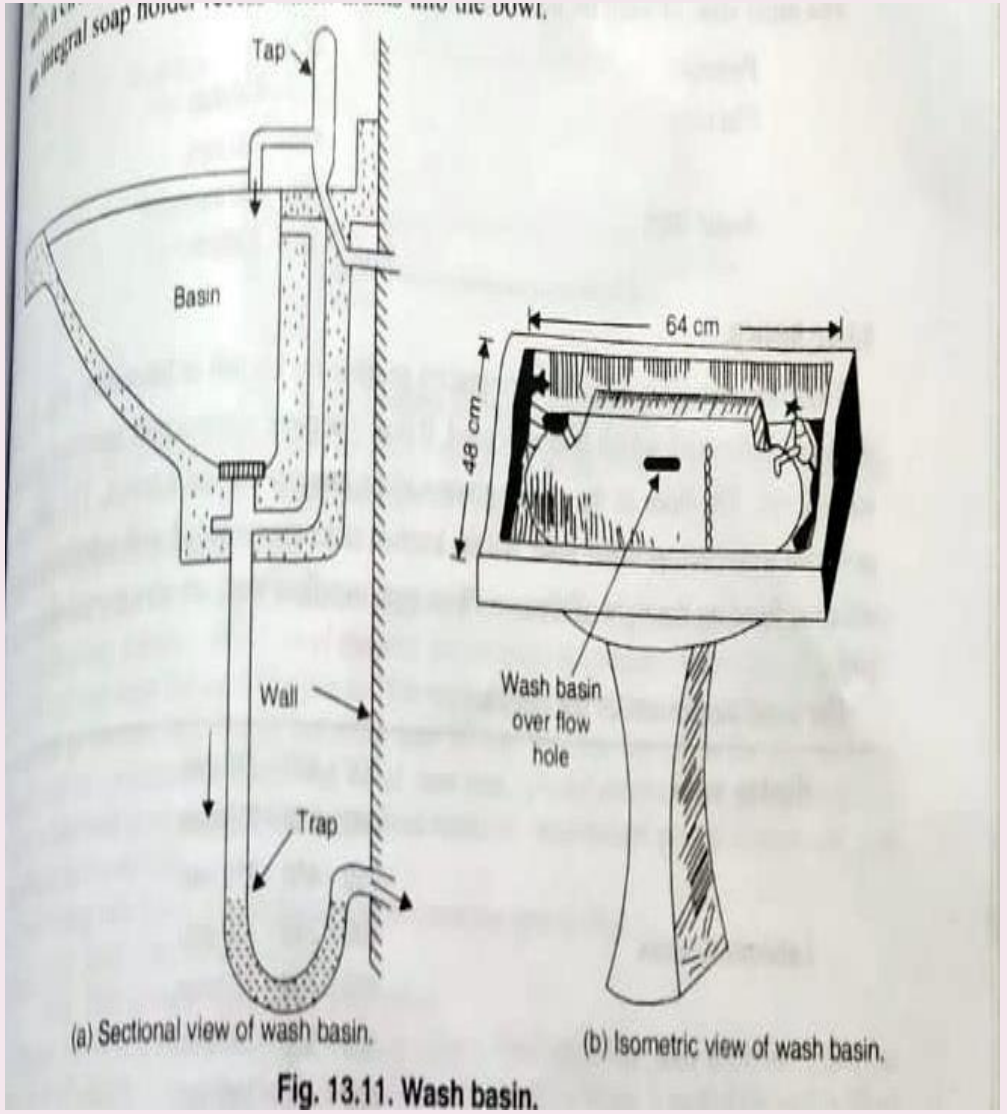


Fig. 13.11. Wash basin.

TYPES OF WASH BASINS:

On the basis of material

Fire clay	Stoneware	Earthen ware	Vitreous china	Steel	Aluminum

On the basis of Mounting/ Fixing

Flat Back
(mounted on walls)

Corner or Angle Back
(fixed at junction of two walls where space is limited)

On the basis of Support

Supported on pedestal

Hung on walls by brackets

On the basis of Shape

Rectangular	Square	Oblong	Circular	Quadrant

STANDARD AVAILABLE SIZES OF WASH BASINS:

WASH BASIN	SIZES
Rectangular type	630 x 510 mm 510 x 440 mm 580 x 430 mm 630 x 450 mm 560 x 430 mm 510 x 440 mm
Countertop Type	570 x 450 mm 450 x 380 mm
Circular Type	470 mm dia, 380 mm dia
Oval Type	550 x 460 mm 550 x 440 mm
Flat Back	630 x 450 mm 550 x 440 mm
Angle Back / Corner	600 x 480 mm 400 x 400 mm

•SINKS:

- Used for washing utensils, vegetables , other accessories in kitchens and laboratories.
- Floor of sink is given slope towards waste outlet.
- Kitchen sinks generally provided with drain boards which is fixed on the right side of user.

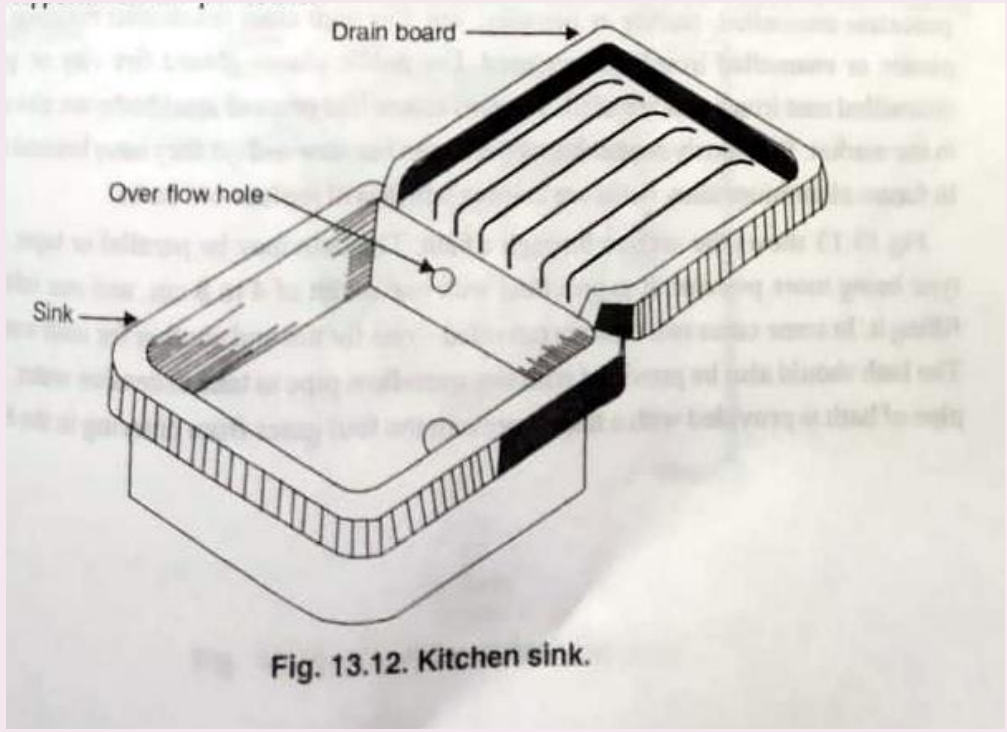


Fig. 13.12. Kitchen sink.

TYPES OF SINKS:

On the basis of Material

- Stainless Steel Sinks
- Porcelain-Enameled Cast Iron Sinks
- Fireclay Sinks
- Acrylic Kitchen Sinks
- Copper Kitchen Sinks
- Stone – Granite/ Composite/Marble Sinks



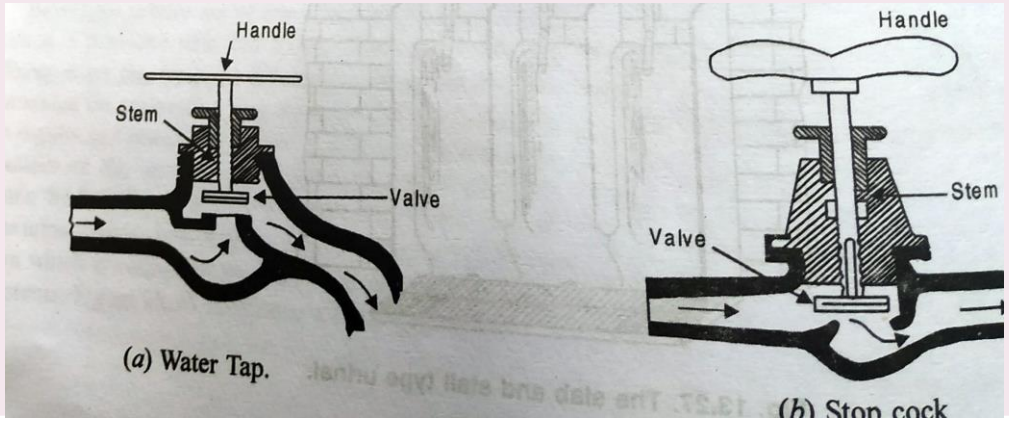



STANDARD AVAILABLE SIZES OF SINKS:

SINK	SIZES
Kitchen Sink	600 x 450 x 150 mm 600 x 450 x 250 mm 750 x 450 x 250 mm
Laboratory Sink	400 x 250 x 150 mm 450 x 300 x 150 mm 500 x 350 x 150 mm 600 x 400 x 200 mm

VALVES, TAPS:

- **BIB TAP:** valve used for controlling flow of water. Pipe connected to bib tap should have a min dia of 12 mm. For cold water fittings, leather or metal wishers. For hot water taps, fibre or asbestos washers used.



- **GLOBE VALVE:**
- Used in domestic water supply line for manually controlling flow of water.
- The valve is made of brass.
- Used in wash basins, kitchen sink, bathroom shower.
- It consists of a circular disc forced down by a screw against a circular seat. Circular disc is operated by a wheel.

- **FLOAT VALVE:**

- Used in storage tanks, flushing cistern for controlling flow of water.

- When the water level rises, float also rises and shuts off the supply of water automatically.

- **GATE VALVE:**

- Used to control flow of water or completely stopping the flow of water in a pipeline.

- Gate valve is mainly used for controlling discharge of water from a storage tank.

- **FERRULE:**

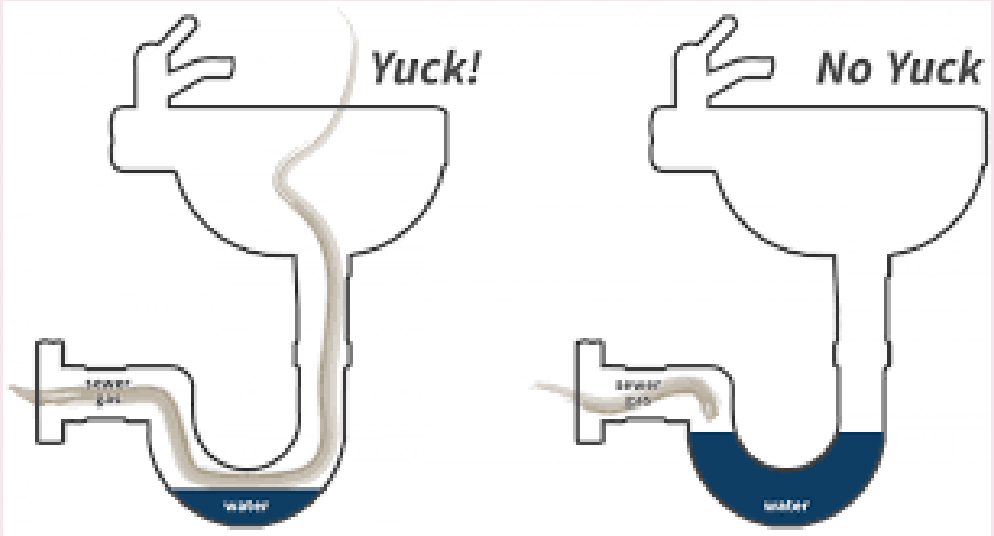
- Used in municipal water mains and domestic supply.
- It is fitted before the water meter.
- It is made of bronze or brass.
- Its size depends on size of water mains of domestic supply line
- Ferrule and water meter are connected by a goose neck (40-50 cm curved flexible pipe made of brass, copper or lead)

•GEYSOR:

- Electrical appliance used to supply hot water.
- Can be horizontal or vertical.
- Provided with pilot lights, safety cutouts and thermostats to ensure water is not over heated.
- Intake taken from storage tank.
- Fixed at a height not less than 2.25 m from floor level.
- May be concealed by providing false ceiling.
- Outlet connected to shower or bath tubs or taps.
- Pipes carrying hot water must have a min dia of 15 mm

•TRAPS:

- Devices used to stop the escape of foul gases produced in sewers, drains, waste-pipes inside the traps .
- They consist of a bent tube which provides a water seal between the atmosphere and sewer gas.
- Deeper the seal, more efficient will be the trap.



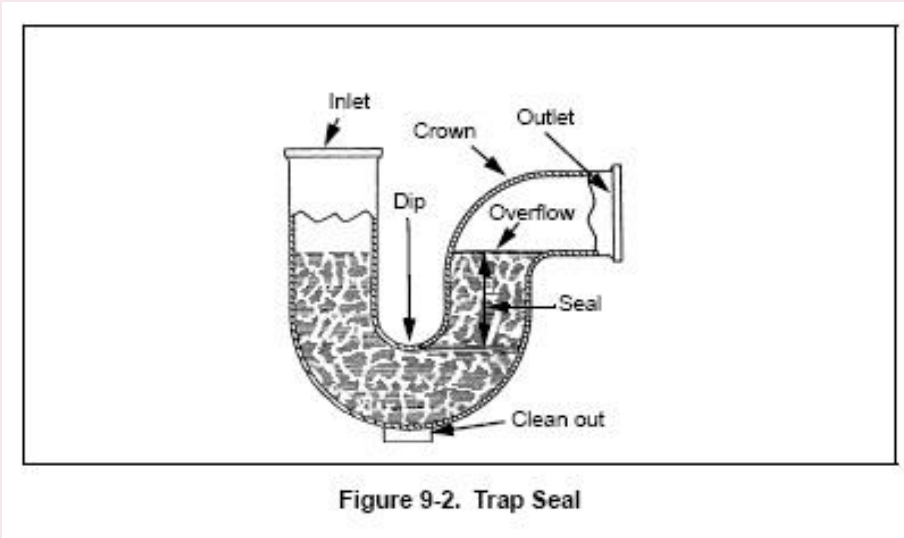
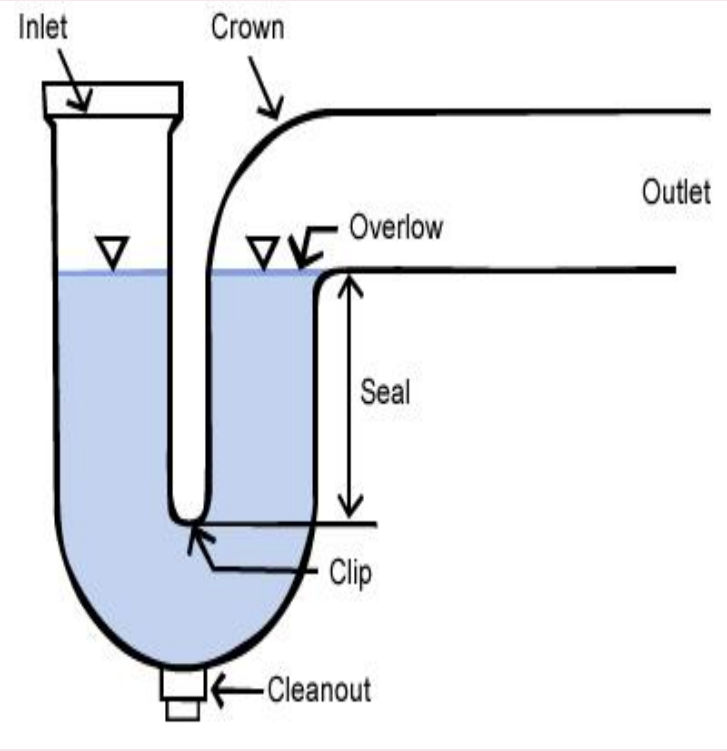


Figure 9-2. Trap Seal

REQUIREMENTS OF A GOOD TRAP:

- It should be made of non absorbent material.
- It should provide sufficient depth of water seal at all times (about 50 mm)
- It should be self cleaning and should not obstruct the flow
- It should be provided with access door for cleaning



WATER SEAL CAN GET BROKEN IF:

- There is any crack in the bottom of seal.
- Due to blockage, there is increase in the pressure of foul gases
- Partial vacuum is created in sewer fittings, it will suck up the seal water. Portion between trap and soil pipe should be connected to the vent pipe.

TYPES OF TRAPS:

P,Q,S TRAPS:

- These consist of a U-tube which retains water that acts as seal between foul gas and atmosphere.
- Used for baths, sinks and lavatories.
- They are made with enlarged mouths so that waste pipe may be thoroughly flushed out.

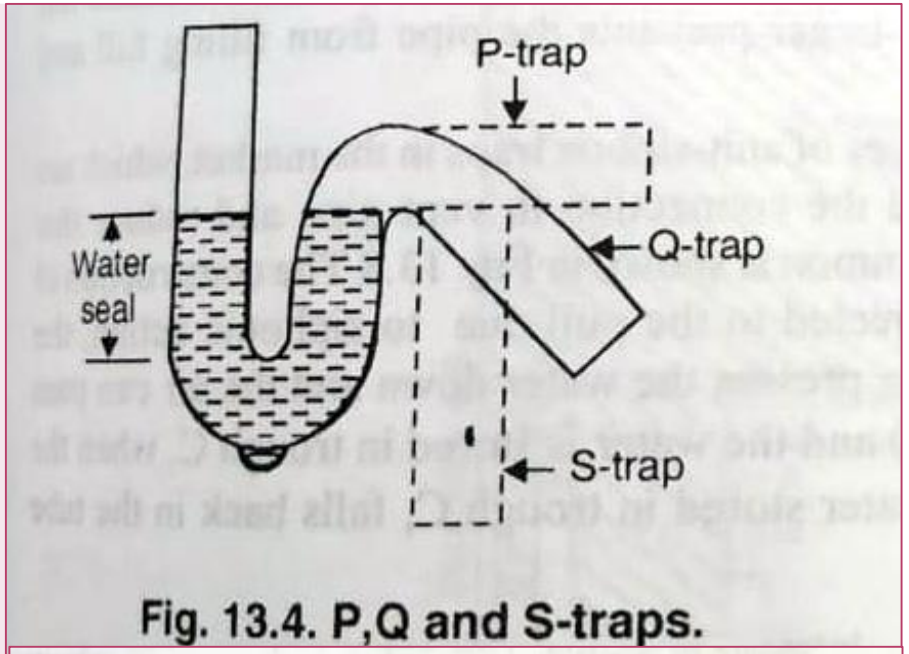


Fig. 13.4. P,Q and S-traps.

GULLY TRAPS:

- Provided at different places in drain pipes.
- Waste water from sinks, bath etc, enters in through back inlet and unfoul water from the sweeping of rooms, courtyards etc. enters from the top, where a coarser screen grating is fitte solid matter

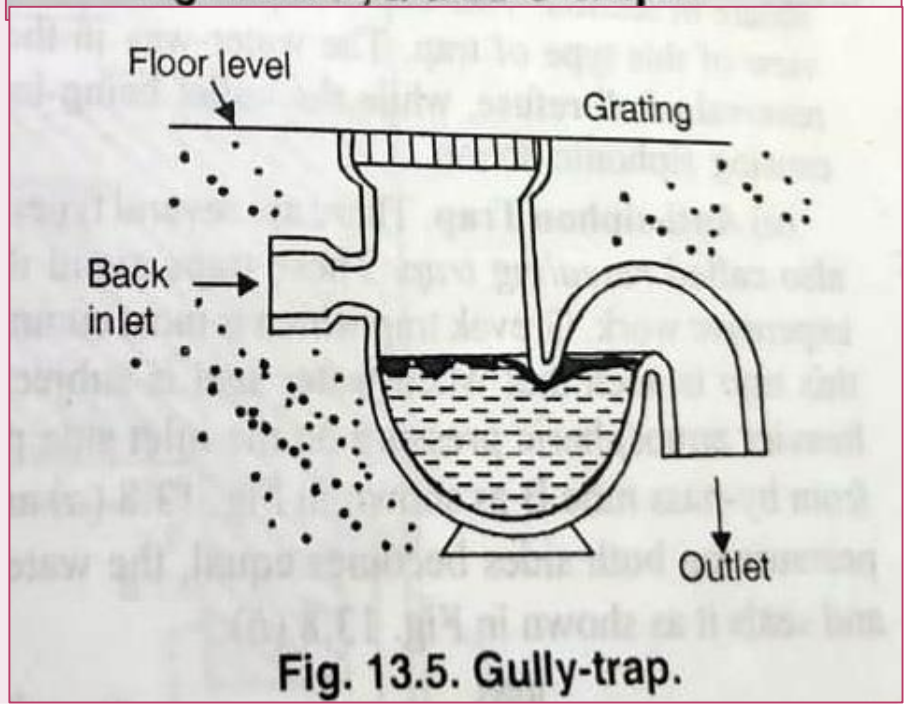


Fig. 13.5. Gully-trap.

INTERCEPTING TRAPS:

- A trap provided in one inspection chamber outside the house at exit of house drain, to prevent entry of sewer gases from public sewer line into the building, is called intercepting trap.
- House drain is directly let into the chamber, the floor of which is made in the form of U or V shaped funnel.
- Intercepting trap with 100 mm water seal fixed at end of this channel.
- Trap has cleaning eye (which is kept shut tightly using a plug) at top to remove silted matter in the trap.
- Fresh air inlet is also provided inside the chamber to dilute the air inside

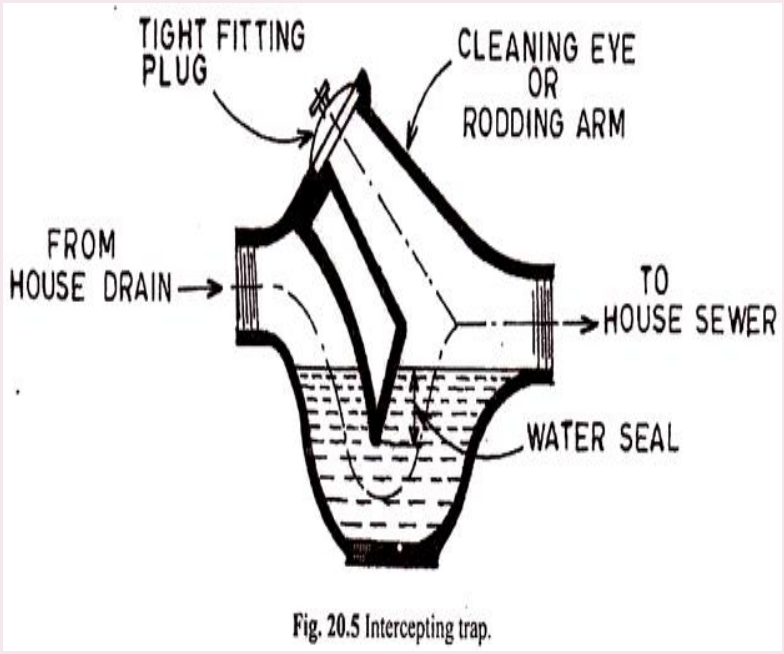


Fig. 20.5 Intercepting trap.

ANTI-D TRAPS:

- Water holding portion is contracted and outgo is larger and square in section.
- The shape prevents the pipe from filling full which may cause siphoning action

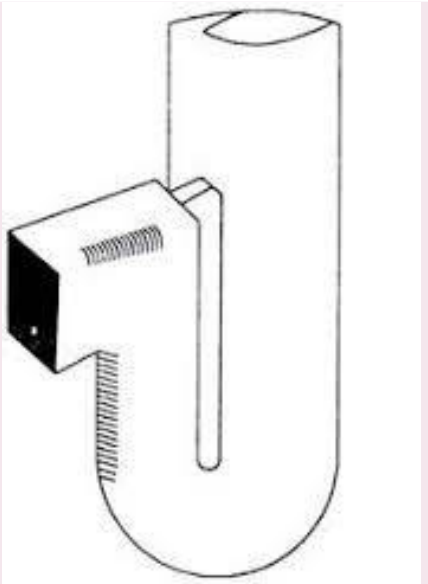


Fig. 24.17. Anti-D trap.

ANTI-SIPHON TRAPS (GREVAK TRAP):

- These avoid the connection to vent pipe and reduces the expensive work.
- Water seal is subjected to pull due to siphoning action, the heavier atmospheric pressure on inlet side presses water down and air can by pass from tube B and water is stored in C.
- When pressure on both sides becomes equal, water stored in C falls back in tube and seals it.

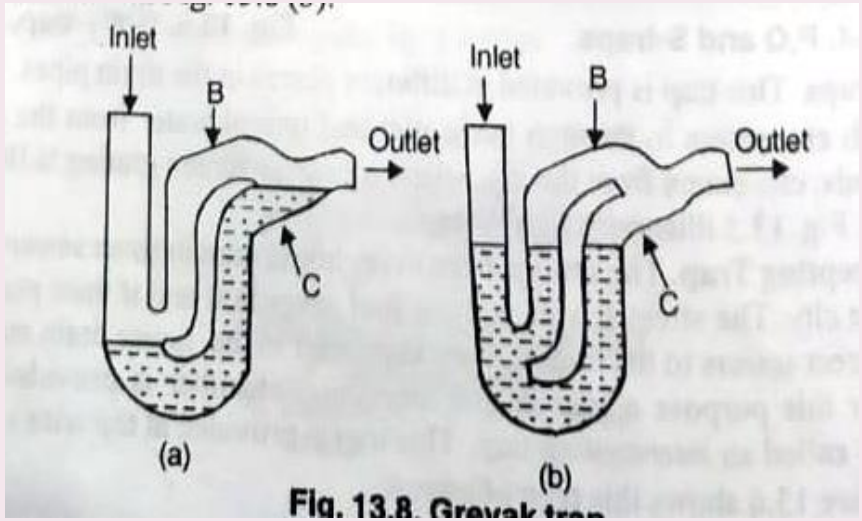


Fig. 13.8. Grevak trap

• FLOOR OR NAHNI TRAPS:

- Fixed in the floor of bathroom where slope is maximum.
- A cast iron grating is provided at top to prevent entry of solid objects.
- Outlet of trap is connected to waste pipe.

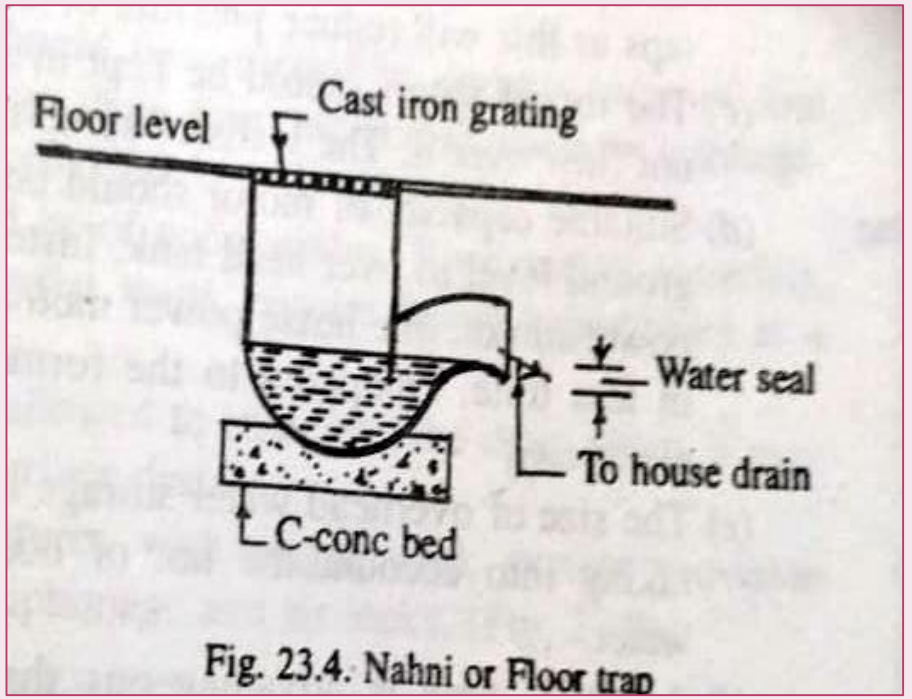
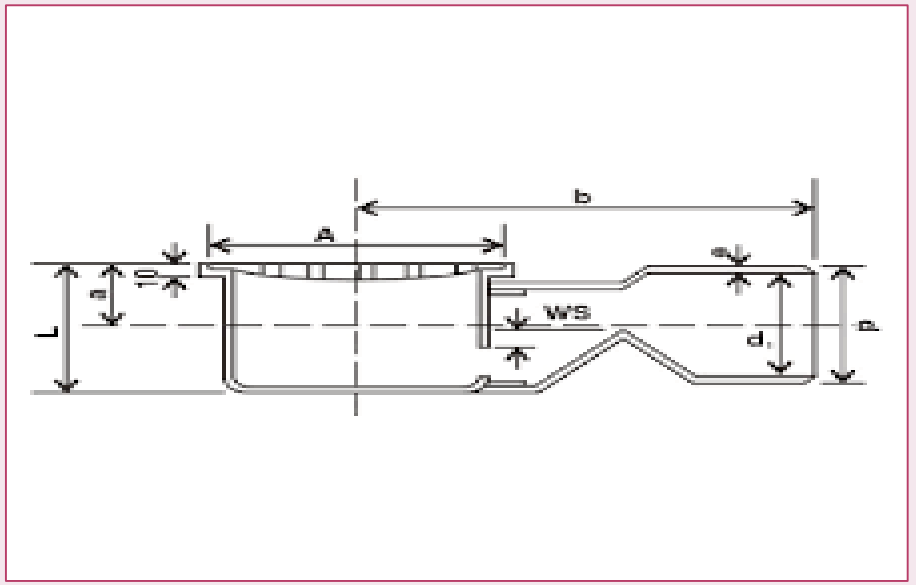


Fig. 23.4. Nahni or Floor trap



BATH TUBS

- Bath Tubs are used for bathing
- Provided with one outlet of 4 to 8 cm and one inlet pipe for filling the tub
- Taps for hot and cold water supplies are provided
- Provided with over flow pipe to take excessive water
- Waste pipe provided with a trap to prevent foul gases.

- Usual dimensions:
- length 1.7 to 1.85 m
- Width 70 to 80 cm
- Depth : 43 to 45 cm

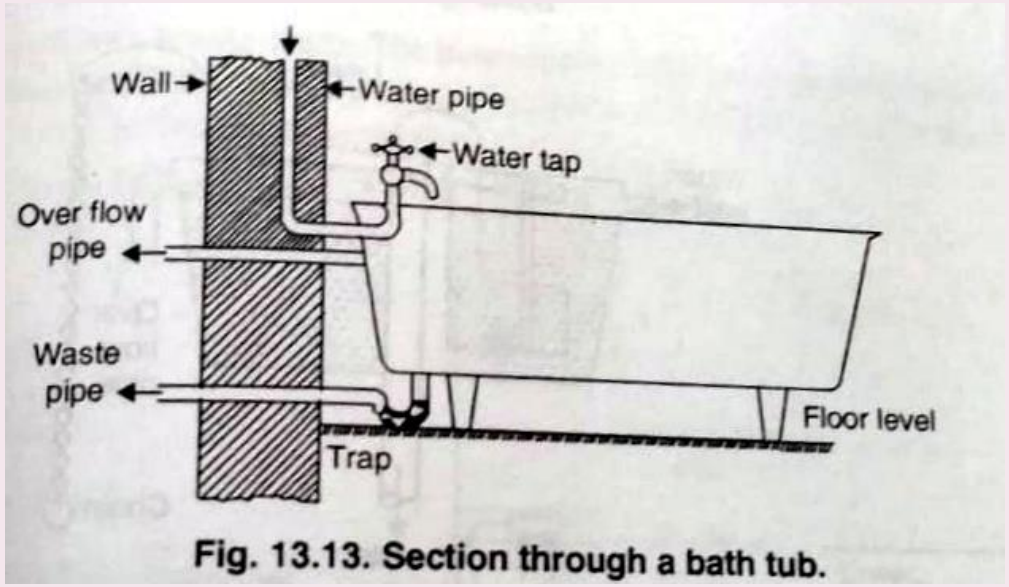


Fig. 13.13. Section through a bath tub.

TYPES OF BATHTUBS:

On the basis of Material

- Enameled Iron
- Plastic
- Cast Iron
- Marble
- Fire Clay
- Copper






• FLUSHING CISTERNS

- Used for flushing water closets and urinals after use

TYPES OF CISTERNS:

On the basis of Level

High-Level

(min height 125 cm between top of pan and underside of cistern)

Low- Level

(operate at a height of not more than 30 cm between top of pan and underside of cistern)

TYPES OF CISTERNS:

On the basis of Material

- Cast iron
- Ceramic
- Glazed Vitreous ware
- Stainless Steel
- Plastic

TYPES OF CISTERNS:

On the basis of Valve

Bell type without valve

(Bell kept above outlet pipe, inlet end slightly above water level. Chain is pulled to life the bell causing water to spill over the outlet pipe)

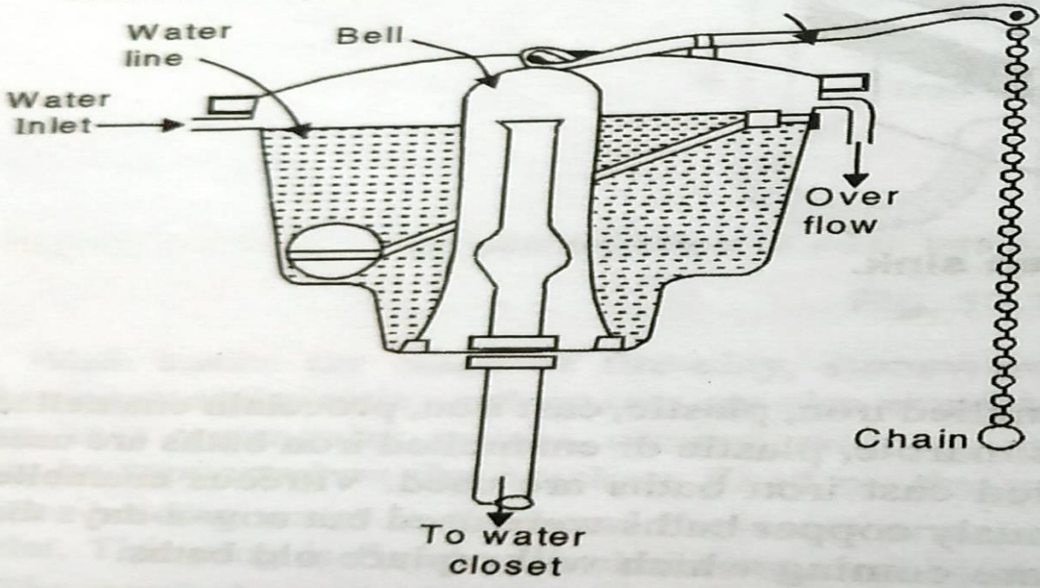


Fig. 13.19. Flushing cistern bell type.

Flat Bottom type fitted with valve

(When chain is pulled, it lifts the disc which lifts the water above it. Valve allows water to rush into the outlet pipe)

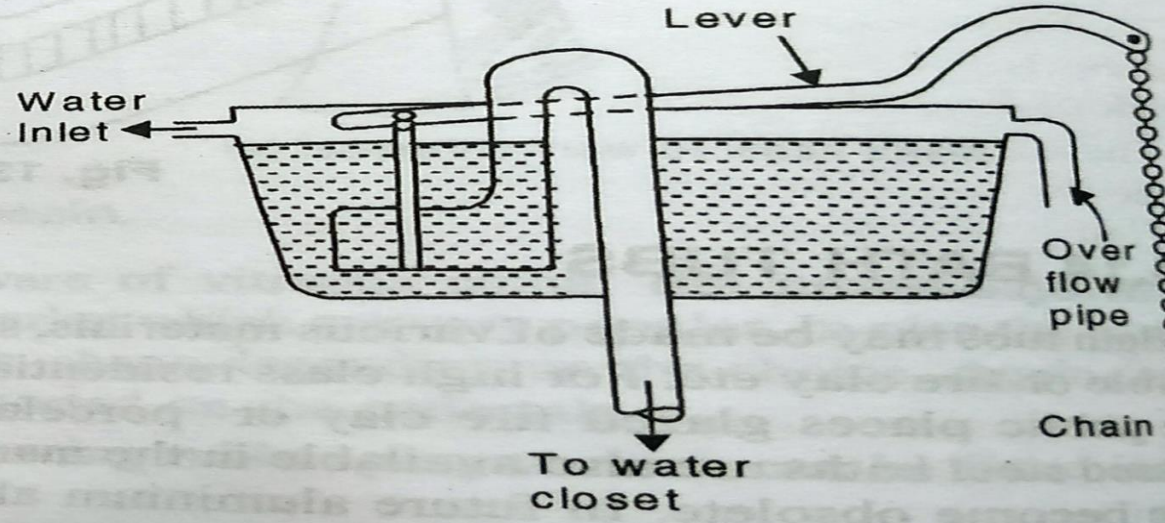


Fig. 13.20. Flat bottom type flushing cist

13.16 WATER-CLOSET

• WATER CLOSET

- Used to receive human excreta directly and is connected to soil pipe by means of trap.

◦ SQUATTING OR INDIAN TYPE:

- LONG PAN PATTERN (Length 450, 580, 680 mm)
- ORISSA PATTERN (Length 580, 630, 680 mm)
- RURAL PATTERN (Length 425 mm)

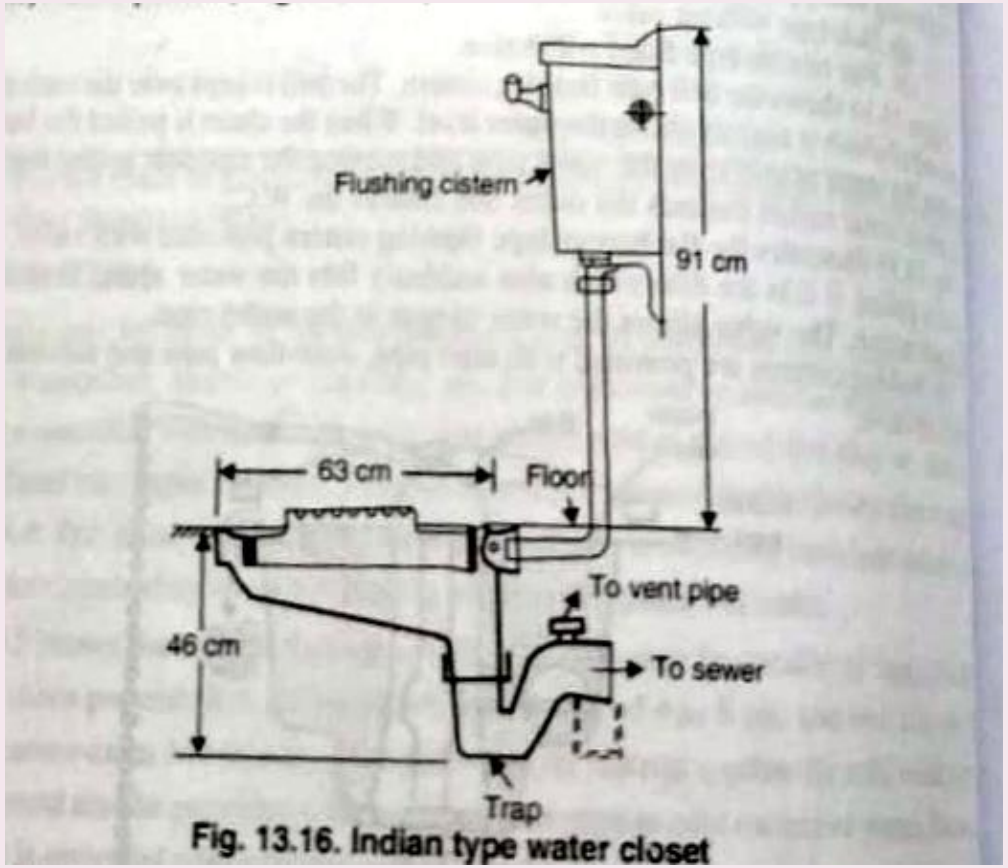


Fig. 13.16. Indian type water closet

WASH DOWN, PEDESTAL OR EUROPEAN TYPE:

- Inside of bottom of pan should have sufficient slope towards the outlet for quick disposal after flushing
- Pan connected to cistern by flushing pipe.
- Top of trap is connected to vent pipe.
- Made of vitreous china.

Fig. 13.19. Isometric view of a European type water-closet.

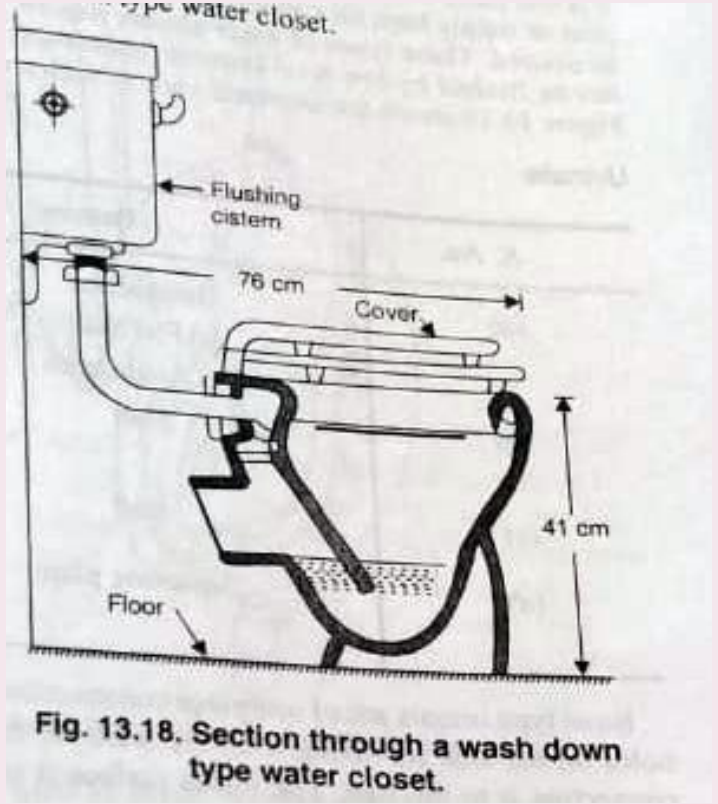


Fig. 13.18. Section through a wash down type water closet.

- **URINALS**

S. No.	Pattern	Sizes
(a)	Bowl shape (i) Flat back	430 mm min × 260 mm. min × 3[illegible] mm min.
	(ii) Angle back	340 × 430 × 265 mm.
(b)	Slab	Single 450 × 1000 mm. 600 × 1000 mm.
(c)	Stall	Single 1140 × 460 × 400 mm.
(d)	Squatting plate	600 × 350 mm. and 450 × 350 mm.

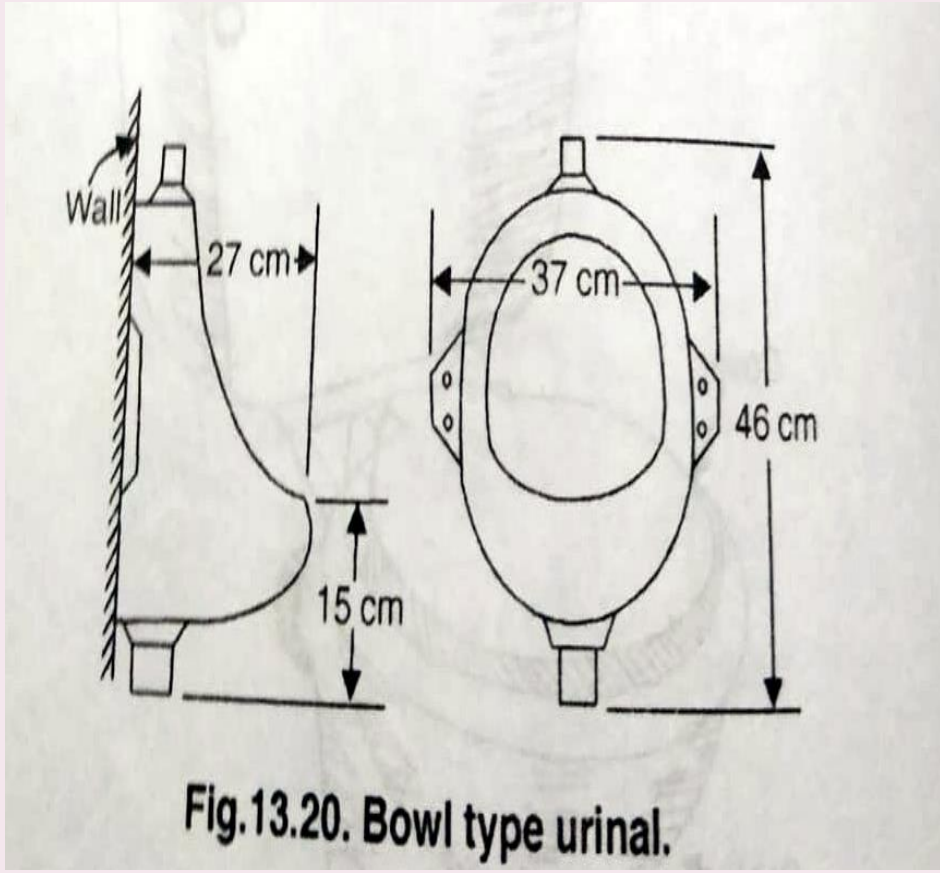


Fig.13.20. Bowl type urinal.

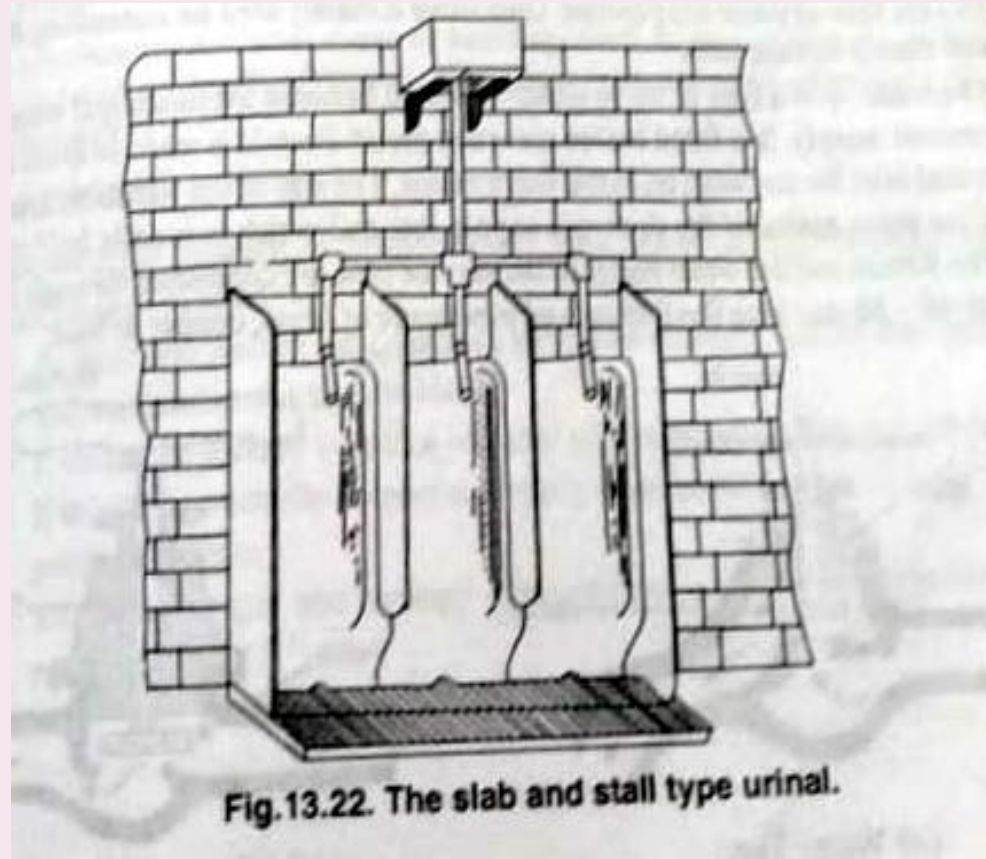


Fig.13.22. The slab and stall type urinal.

IS 1172 SANITARY FITTINGS RFEQUIREMENTS

Table 2 Office Buildings

(*Clause* 5.3)

Sl No.	Fitments	For Male Personnel	For Female Personnel
(1)	(2)	(3)	(4)
i)	Water-closets*	1 for every 25 persons or part thereof	1 for every 15 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-closet and urinals	1 in each water-closet
iii)	Urinals	Nil up to 6 persons 1 for 7 to 20 persons 2 for 21 to 45 persons 3 for 46 to 70 persons 4 for 71 to 100 persons From 101 to 200 persons add at the rate of 3 per cent For over 200 persons, add at the rate of 2·5 percent.	—
iv)	Wash basins	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)	Cleaner's sink	1 per floor, *Min*, preferably in or adjacent to sanitary rooms	

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

IS 1172 SANITARY FITTINGS RFEQUIREMENTS

Table 8 Hotels

(*Clause* 5.3)

Sl No.	Fitments	For Residential Public and Staff	For Public Rooms		For Non-Residential Staff	
			For Males	For Females	For Males	For Females
(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; and for over 400, add at the rate of 1 per 250 persons or part thereof	2 per 100 persons up to 200 persons; and for over 200 add at the rate of 1 per 100 persons or part thereof	1 for 1 to 15 persons 2 for 16 to 35 persons 3 for 36 to 65 persons 4 for 66 to 100 persons	1 for 1 to 12 persons 2 for 13 to 25 persons 3 for 26 to 40 persons 4 for 41 to 57 persons 5 for 58 to 77 persons 6 for 78 to 100 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 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 to 20 persons 2 for 21 to 45 persons 3 for 46 to 70 persons 4 for 71 to 100 persons	—
iv)	Wash basins	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 to 15 persons 2 for 16 to 35 persons 3 for 36 to 65 persons 4 for 66 to 100 persons	1 for 1 to 12 persons 2 for 13 to 25 persons 3 for 26 to 40 persons 4 for 41 to 57 persons 5 for 58 to 77 persons 6 for 78 to 100 persons
v)	Baths	1 per 10 persons omitting occupants of the room with bath en suite	—	—	—	—
vi)	Slop sinks	1 per 30 bedrooms; minimum 1 per floor	—	—	—	—

IS 1172 SANITARY FITTINGS RFEQUIREMENTS

Table 10 Schools and Educational Institutions

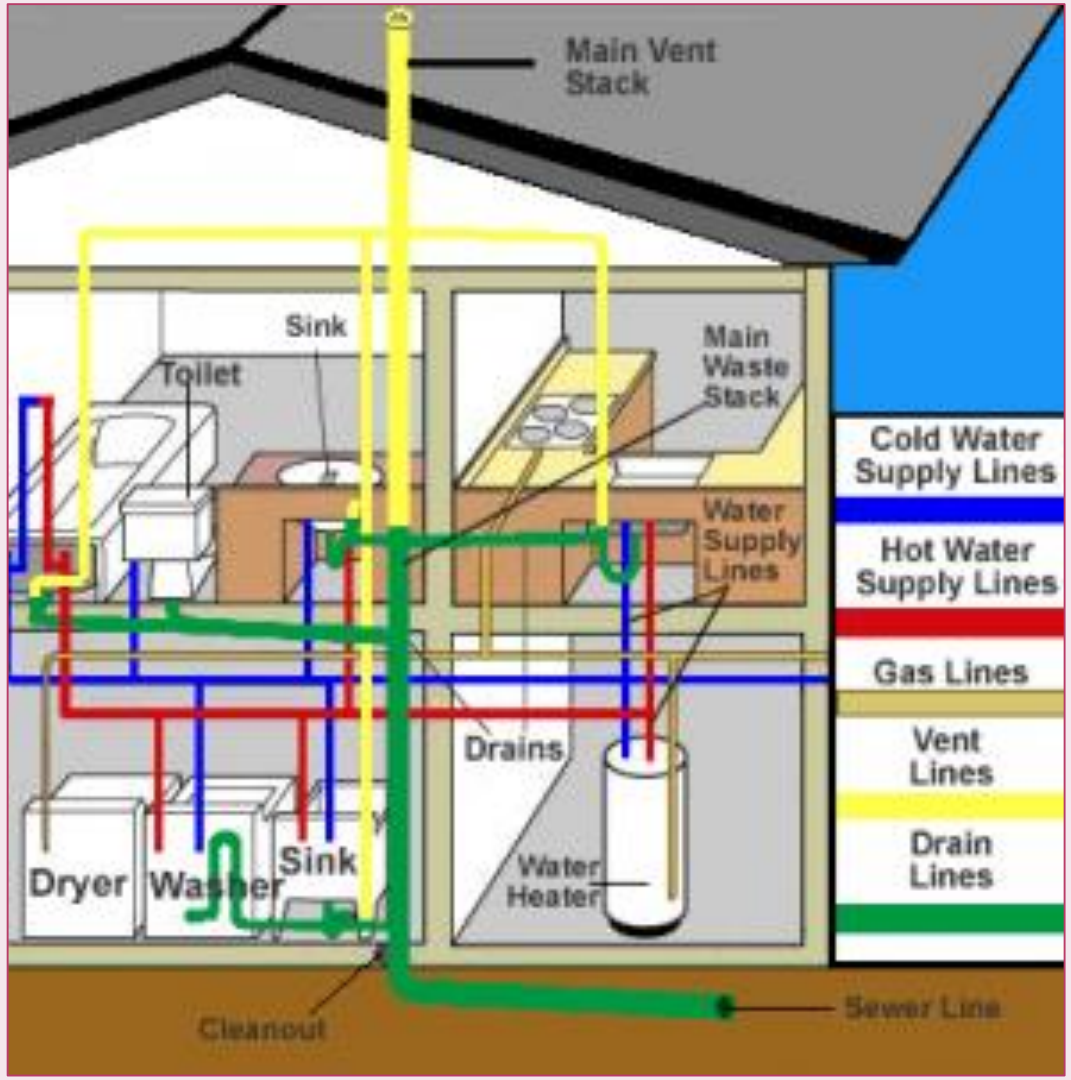
(Clause 5.3)

Sl 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	1 in each water-closet	1 in 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 pupils or part thereof in the vicinity of 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 per 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 or taps	1 for every 50 pupils or part thereof	1 for every 50 pupils or part thereof	1 for 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 sinks	← 1 per floor, *Min* →				

*For teaching staff, the schedules of fitments to be provided shall be the same as in the case of office buildings (*see* Table 2).

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

PLUMBING LAYOUT



PIPE AND FITTINGS LAYOUT

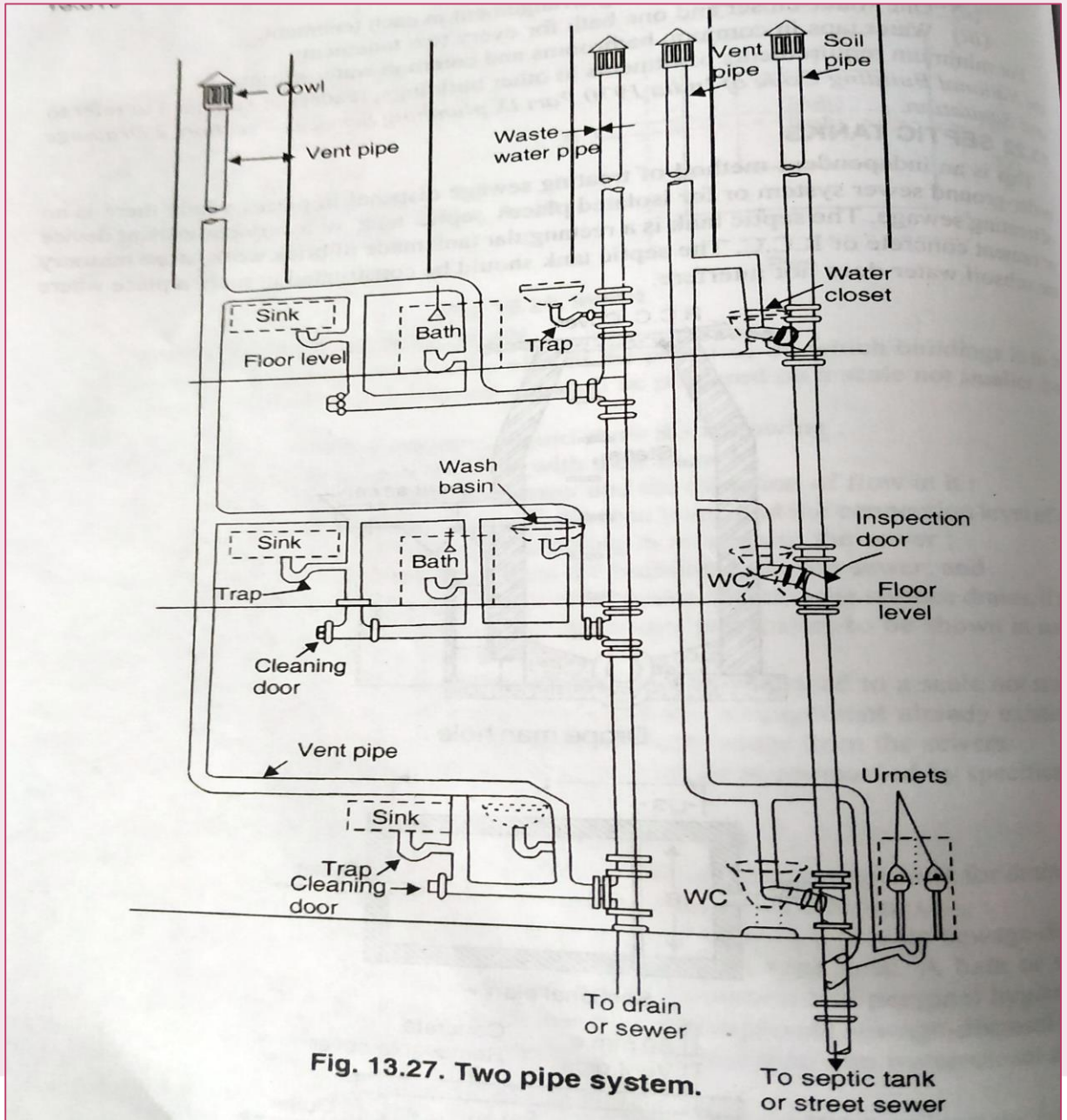


Fig. 13.27. Two pipe system.

PLUMBING DETAILS OF BATHROOM

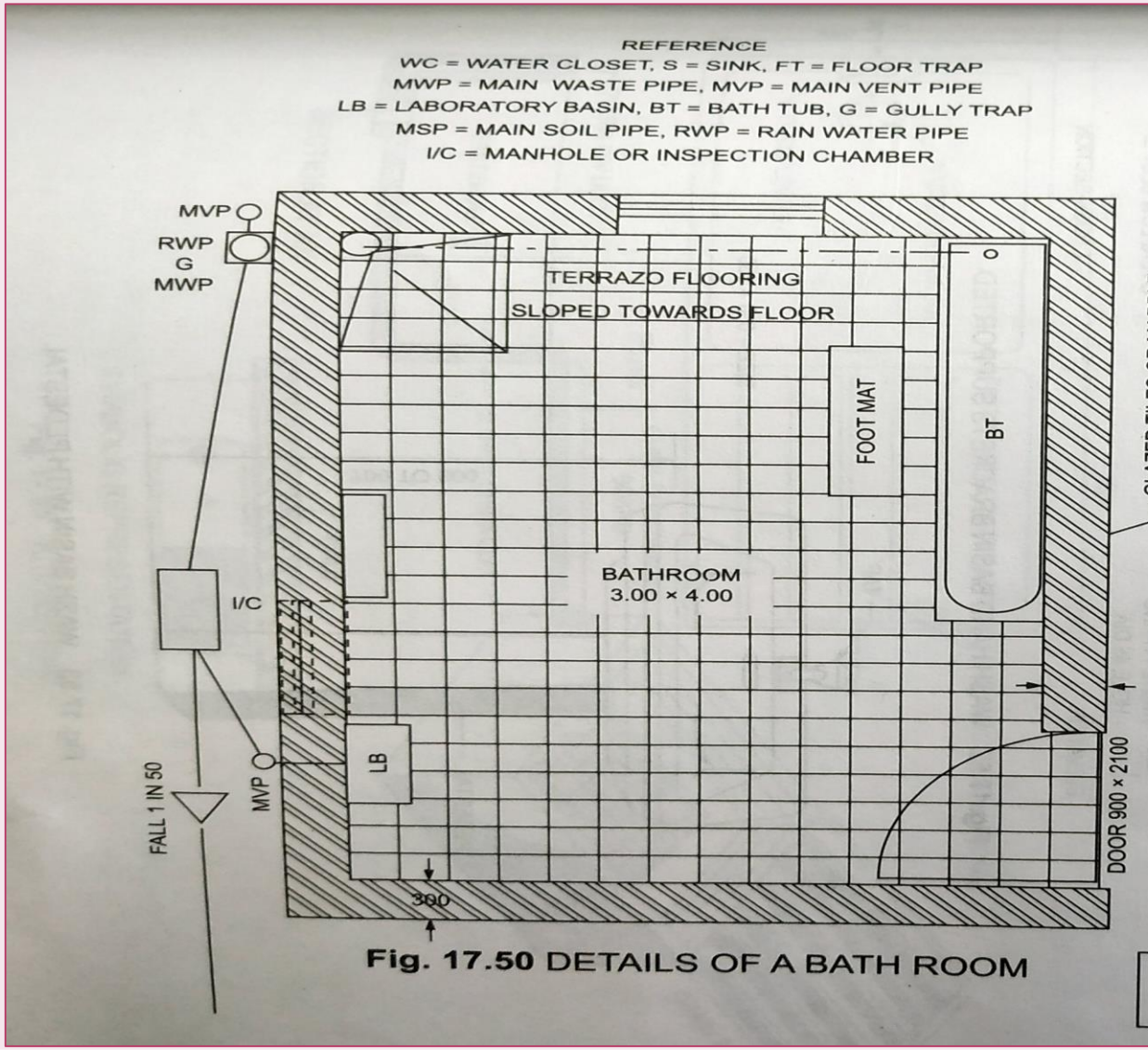


Fig. 17.50 DETAILS OF A BATH ROOM

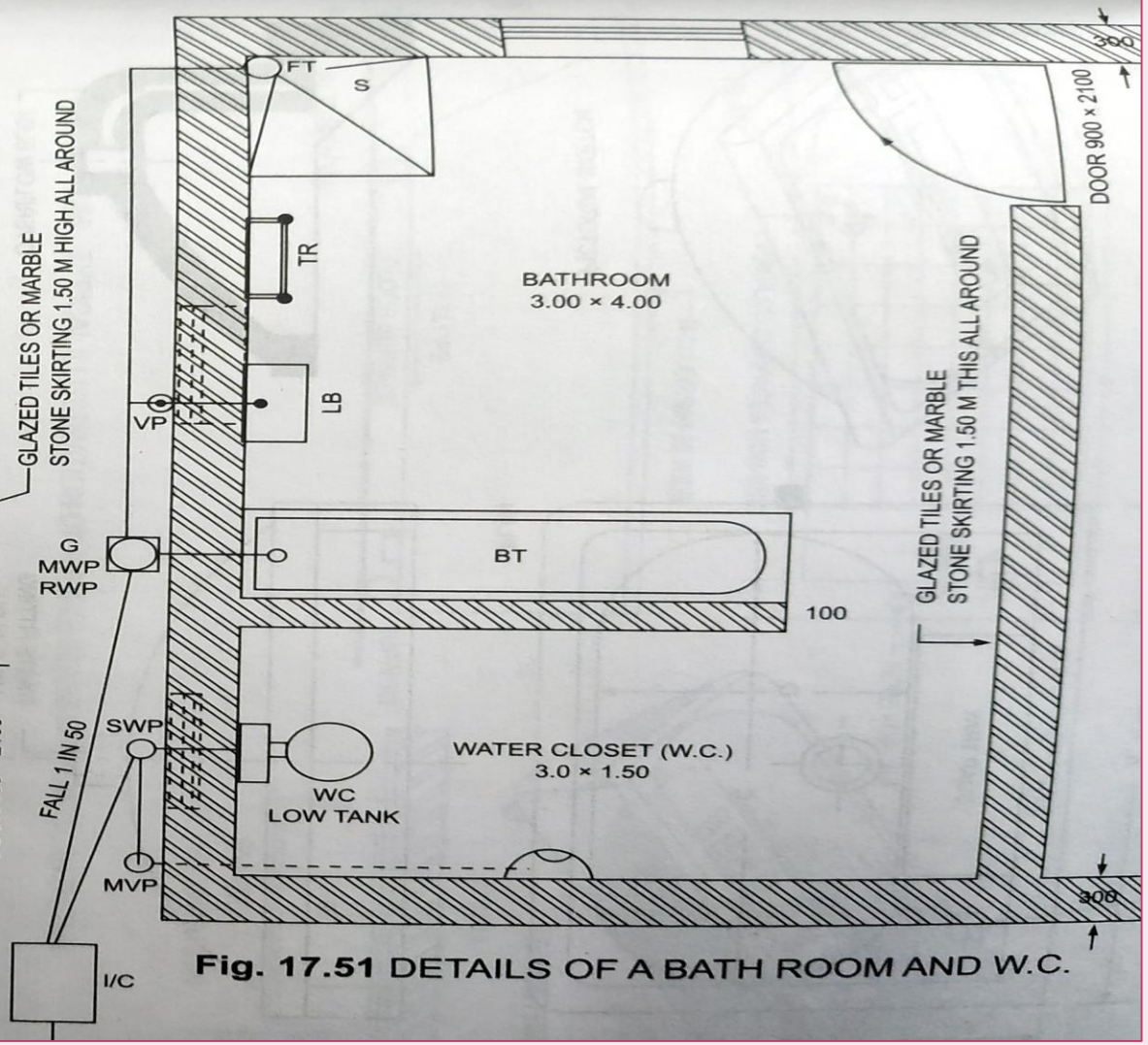
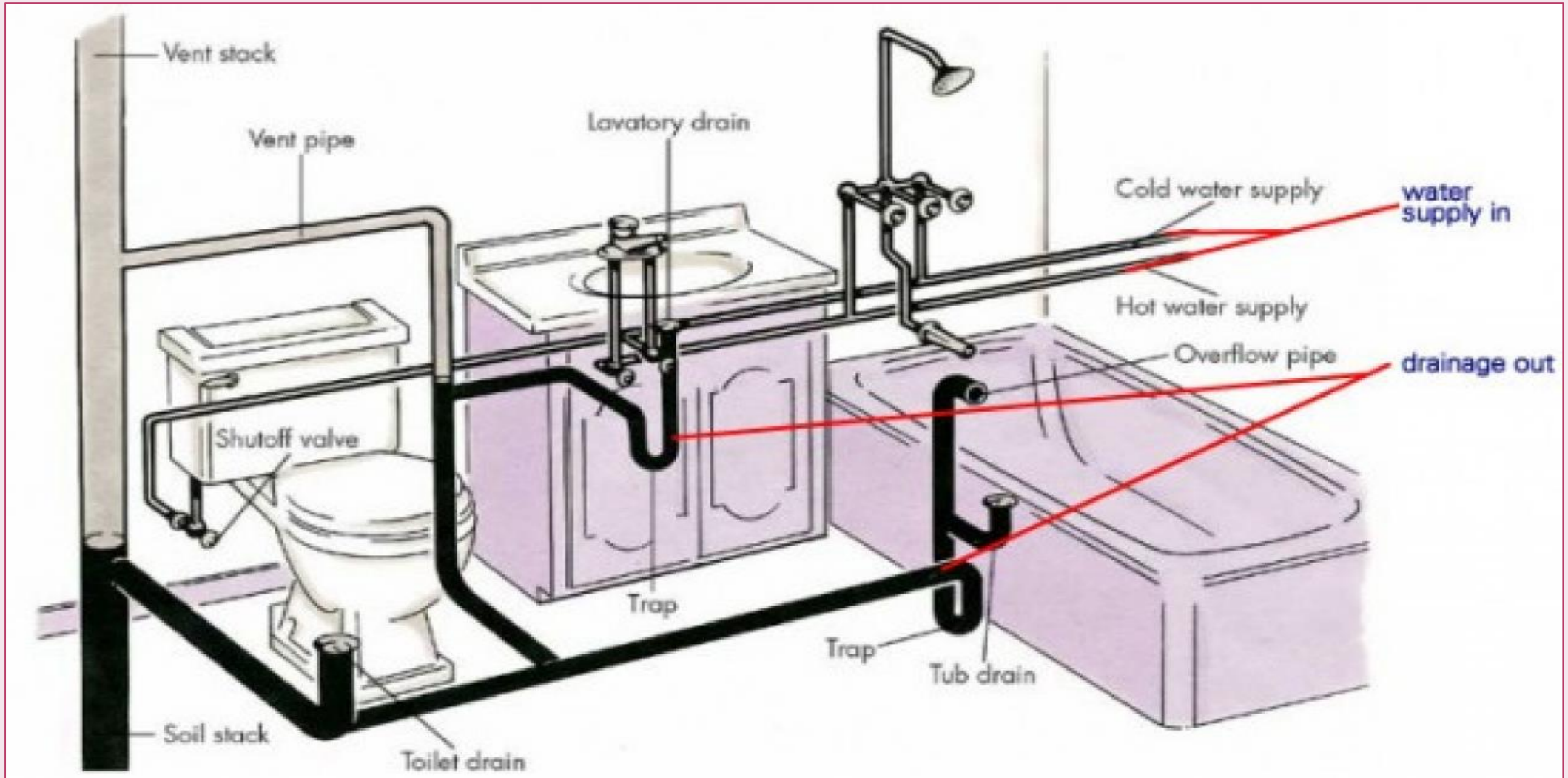


Fig. 17.51 DETAILS OF A BATH ROOM AND W.C.



Plumbing in your home consists of two distinct systems: supply, bringing fresh water in, and drainage, taking wastewater out. The pipes in black are drains. The vent pipes allow the drains to breath so preventing siphoning of trap water such as in toilets. http://home.howstuffworks.com

ARRANGEMENT OF BATHROOM FIXTURES

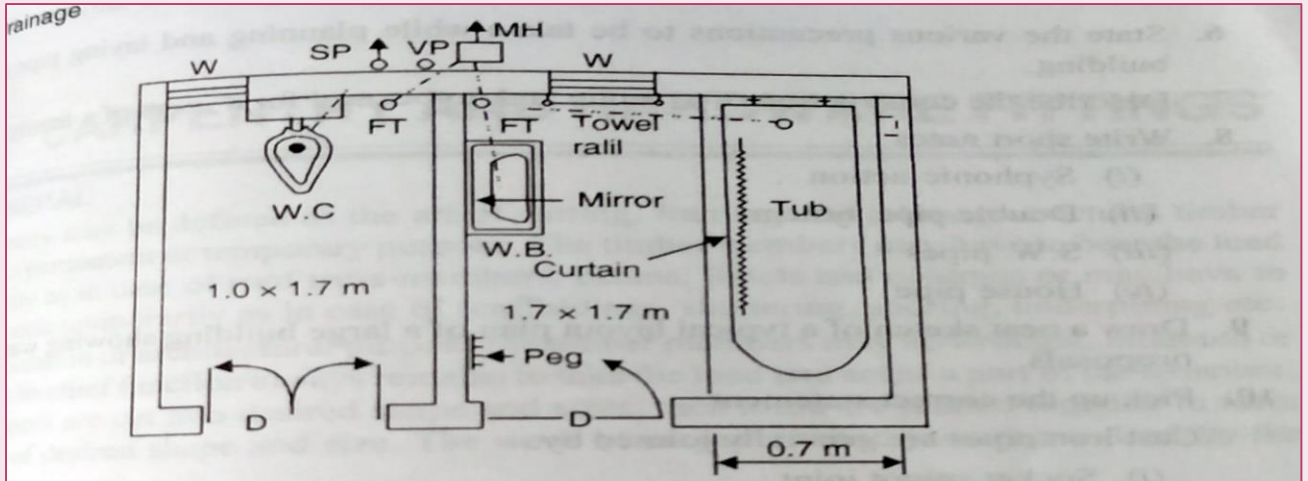


Fig. 13.35. Typical arrangements of bathroom fixtures in a residential building.

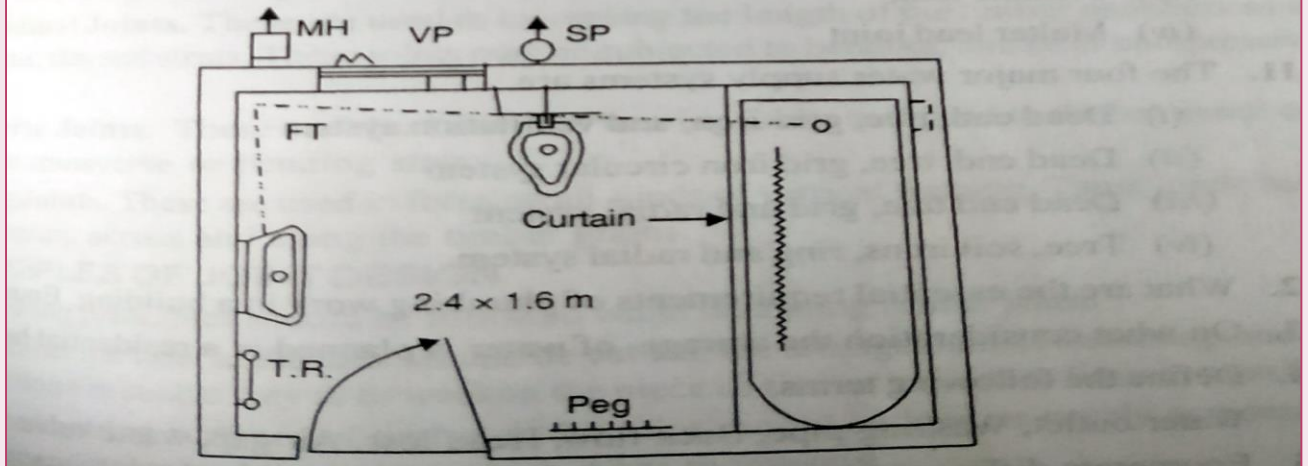


Fig. 13.36. Typical arrangements of bathroom fixtures in a residential building.

WATER SUPPLY DRAWING OF A RESIDENTIAL BUILDING

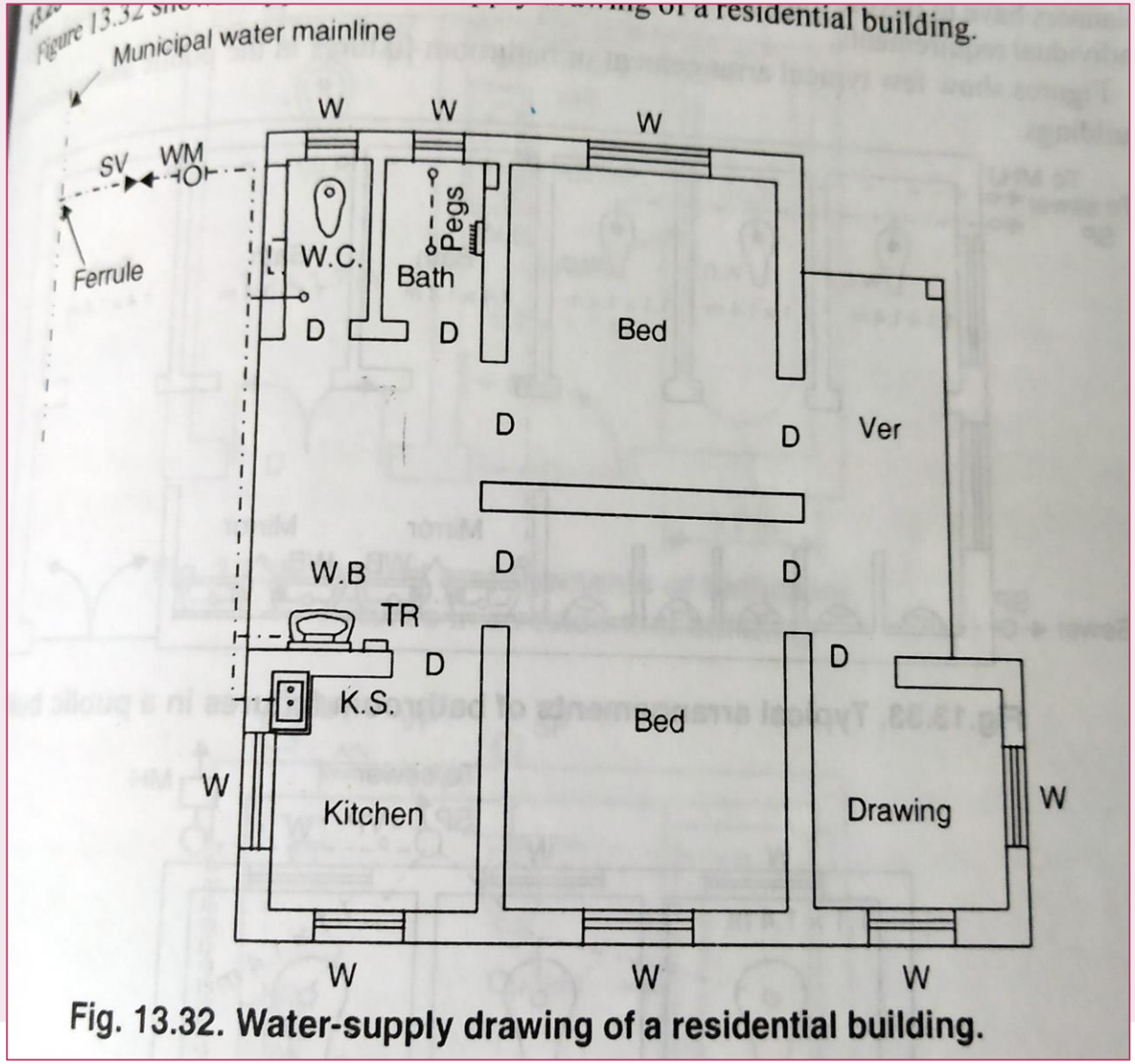


Fig. 13.32. Water-supply drawing of a residential building.

GUIDELINES TO BE FOLLOWED IN DESIGN OF WATER SUPPLY ARRANGEMENTS:

- Source of water supply should have clean surroundings
- Open wells should be well ventilated
- For water supply through taps, an underground sump may be constructed to store water initially.
- Top of sump should be kept on such a level that rain water does not flow over it.
- Suitable capacity of pump must be installed to raise the water from ground level to over head tank,
- Size and capacity of tank must be decided properly on the basis of no of occupants and requirement of water
- Tanks must have proper cover
- Distribution system must be planned correctly. Entire pipe system must be leak proof.

GUIDELINES TO BE FOLLOWED IN DESIGN OF SANITARY ARRANGEMENTS:

- Plumbing lines should be straight and as short as possible. All joints must be water tight.
- Pipe carrying soil water must not be less than 100 mm dia. Waste pipes must have a min dia of 75 mm. these pipes must be laid by side of building rather than in walls or underground for better repair and maintenance.
- Proper gratings must be provided on floor and gully trap to prevent entry of solid matters inside the pipe line.
- Proper gradient should be provided.
- Sufficient number of traps must be provided to prevent entry of foiul odours.
- Materials used must be of good quality.
- Rain water should not be allowed to enter into the drain pipes. It may be carried through surface drains.