UNIT-VI

DISTRIBUTION OF WATER

GENERAL INTRODUCTION:

After treatment, water is to be stored temporarily and supplied to the consumers through the network of pipelines called distribution system. The distribution system also includes pumps, reservoirs, pipe fittings, instruments for measurement of pressures.

Q1. REQUIREMENT OF A DISTRIBUTION SYSTEM:

1. The should convey the treated water upto consumers with the same degree of purity
2. The system should be economical and easy to maintain and operate
3. The diameter of pipes should be designed to meet the fire demand
4. It should safe against any future pollution. As per as possible should not be laid below sewer lines.
5. Water should be supplied without interruption even when repairs are undertaken
6. The system should be so designed that the supply should meet maximum hourly demand. A peak factor 2.5 is recommended for the towns of population 0.5. to 2 lakhs. For larger population a factor of 2.0 will be adequate.

2Q. LAYOUTS OF DISTRIBUTION SYSTEM:

Generally in practice there are four different systems of distribution which are used. They are:

1. Dead End or Tree system
2. Grid Iron system
3. Circular or Ring system
4. Radial system

DEAD END OR TREE SYSTEM:

This system is suitable for irregular developed towns or cities. In this system water flows in one direction only into submains and branches. The diameter of pipe decreases at every tree branch.

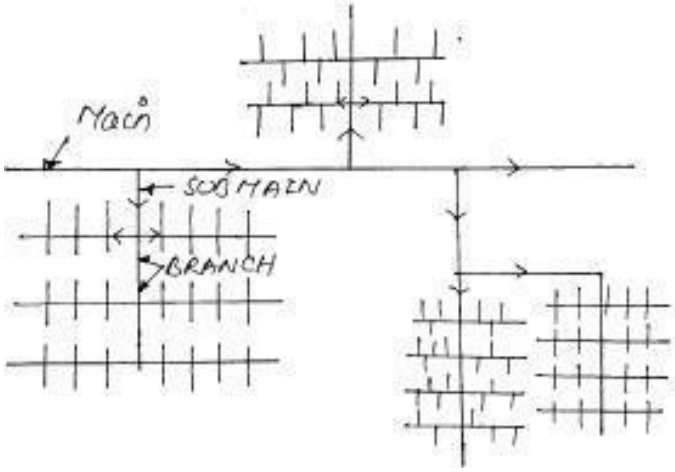


Fig Dead End System

ADVANTAGES

1. Discharge and pressure at any point in the distribution system is calculated easily
2. The valves required in this system of layout are comparatively less in number.
3. The diameter of pipes used are smaller and hence the system is cheap and economical
4. The laying of water pipes is used are simple.

DISADVANTAGES

1. There is stagment water at dead ends of pipes causing contamination.
2. During repairs of pipes or valves at any point the entire down stream end are deprived of supply
3. The water available for fire fighting will be limited in quantity

GRID IRON SYSTEM :

From the mains water enters the branches at all Junctions in either directions into submains of equal diameters. At any point in the line the pressure is balanced from two directions because of interconnected network of pipes.

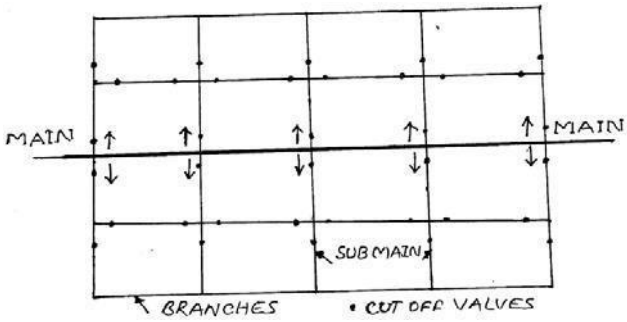


Fig Grid – Iron Method

ADVANTAGES

1. In the case of repairs a very small portion of distribution are a will be affected
2. Every point receives supply from two directions and with higher pressure
3. Additional water from the other branches are available for fire fighting
4. There is free circulation of water and hence it is not liable for pollution due to stagnation.

DISADVANTAGES

1. More length of pipes and number of valves are needed and hence there is increased cost of construction
2. Calculation of sizes of pipes and working out pressures at various points in the distribution system is laborious , complicated and difficult.

CIRCULAR OR RING SYSTEM :

Supply to the inner pipes is from the mains around the boundary. It has the same advantages as the grid-Iron system. Smaller diameter pipes are needed. The advantages and disadvantages are same as that of grid-Iron system.

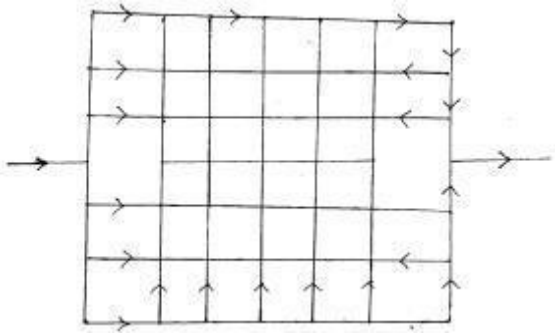


Fig Circular of Ring System

RADIAL SYSTEM:

This is a zoned system. Water is pumped to the distribution reservoirs and from the reservoirs it flows by gravity to the tree system of pipes. The pressure calculations are easy in this system. Layout of roads need to be radial to eliminate loss of head in bends. This is most economical system also if combined pumping and gravity flow is adopted.

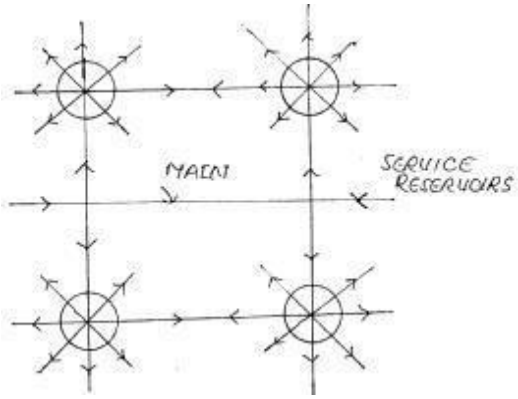


Fig. Radial System

3Q. **SYSTEM OF DISTRIBUTION:**

For efficient distribution it is required that the water should reach to every consumer with required rate of flow. Therefore, some pressure in pipeline is necessary, which should force the water to reach at every place. Depending upon the methods of distribution, the distribution system is classified as the follows:

1. Gravity system
2. Pumping system
3. Dual system or combined gravity and pumping system

GRAVITY SYSTEM**:**

When some ground sufficiently high above the city area is available , this can be best utilized for distribution system in maintaining pressure in water mains . This method is also much suitable when the source of supply such as lake, river or impounding reservoir is at sufficiently higher than city. The water flows in the mains due to gravitational forces. As no pumping is required therefore it is the most reliable system for the distribution of water as shown in fig.

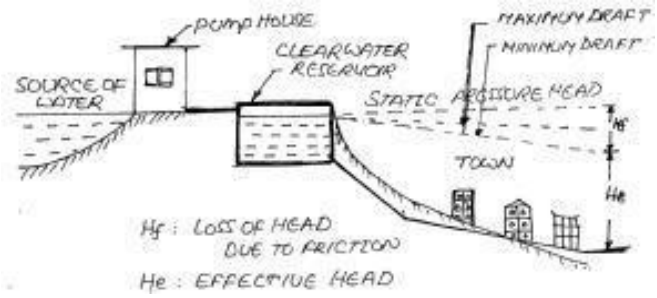


FIG Gravity System

PUMPING SYSTEM:

Constant pressure can be maintained in the system by direct pumping into mains. Rate of flow cannot be varied easily according to demand unless number of pumps are operated in addition to stand by ones. Supply can be effected during power failure and breakdown of pumps. Hence diesel pumps also in addition to electrical pumps as stand by to be maintained. During fires, the water can be pumped in required quantity by the stand by units.

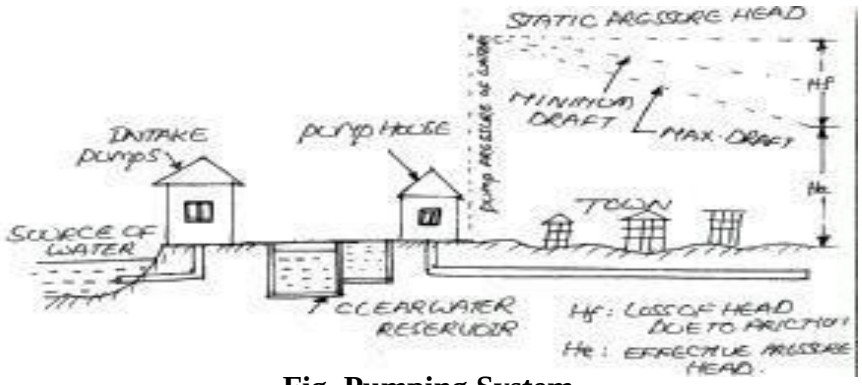


Fig Pumping System

COMBINED PUMPING AND GRAVITY SYSTEM**:**

This is also known as dual system. The pump is connected to the mains as well as elevated reservoir. In the begining when demand is small the water is stored in the elevated reservoir, but when demand increases the rate of pumping , the flow in the distribution system comes from the both the pumping station as well as elevated reservoir. As in this system water comes from two sources one from reservoir and second from pumping station, it is called dual system. This system is more reliable and economical, because it requires uniform rate of pumping but meets low as well as maximum demand. The water stored in the elevated reservoir meets the requirements of demand during breakdown of pumps and for fire fighting.

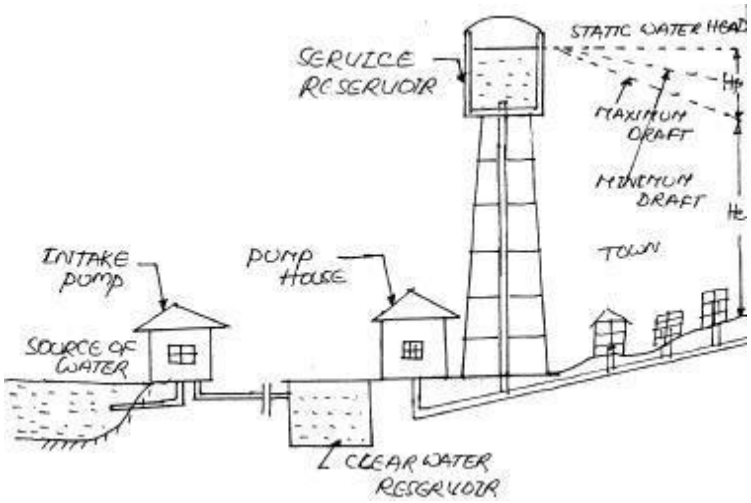


FIG Dual System of Distribution

4.Q.Systems of water supply

The water may be supplied to the consumers by either of the two systems.

1. CONTINUOUS SYSTEM

This is the best system and water is supplied for all 24 hours. This system is possible when there is adequate quantity of water for supply. In this system sample of water is always available for fire fighting and due to continuous circulation water always remains fresh. In this system less diameter of pipes are required and rusting of pipes will be less. Losses will be more if there are leakages in the system.

2. INTERMITTENT SYSTEM :

If plenty of water is not available, the supply of water is divided into zones and each zone is supplied with water for fixed hours in a day or on alternate days. As the water is supplied after intervals, it is called intermittent system. The system has following disadvantages:

1. Pipelines are likely to rust faster due to alternate wetting and drying. This increases the maintanance cost.
2. There is also pollution of water by ingress of polluted water through leaks during non-flow periods.
3. More wastage of water due to the tendency of the people to store more water than required quantity and to waste the excess to collect fresh water each time.

Inspite of number of disadvantages, this system is usually adopted in most of the cities and towns of India. In this system water can be supplied in the high level localities with adequate pressure by dividing the city in zones. The repair work can be easily done in the non-supply hours.

UNDERSTAND THE VARIOUS APPURTENANCES IN A DISTRIBUTION SYSTEM

The various devices fixed along the water distribution system are known as appurtences.

The necessity of the various appurtenances in distribution system are as follows

1. To control the rate of flow of water
2. To release or admit air into pipeline according to the situation
3. To prevent or detect leakages
4. To meet the demand during emergency and
5. Ultimately to improve the efficiency of the distribution

The following are the some of the fixtures used in the distribution system.

(i) Valves

(ii) Fire hydrants and

(iii) Water meter

5.Q. TYPES OF VALVES

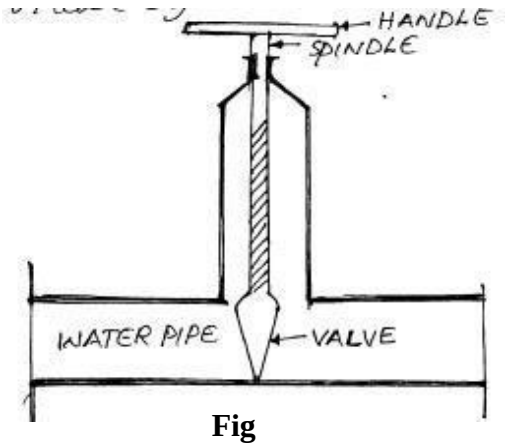
In water works practice, to control the flow of water, to regulate pressure, to release or to admit air, prevent flow of water in opposite direction valves are required.

The following are the various types of valves named to suit their function

1. Sluice valves
2. Check valves or reflex valves
3. Air valves
4. drain valves or Blow off valves
5. Scour valve

SLUICE VALVES :

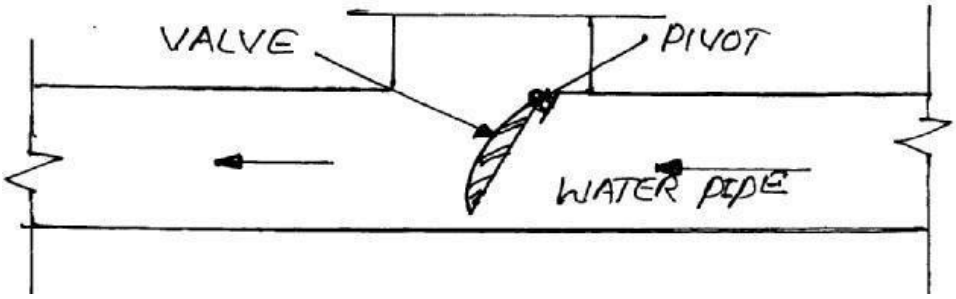
These are also known as gate-valves or stop valves. These valve control the flow of water through pipes. These valves are cheaper, offers less resistance to the flow of water than other valves. The entire distribution system is decided into blocks by providing these valves at appropriate places. They are provided in straight pipeline at 150-200m intervals. When two pipes lines interest, valves are fixed in both sides of intersection. When sluice valve is closed, it shuts off water in a pipeline to enable to undertake repairs in that particular block. The flow of water can be controlled by raising or lowering the handle or wheel.



Fig

CHECK VALVE or REFLUX VALVE :

These valves are also known as non-return valves. A reflux valve is an automatic device which allows water to go in one direction only. The swing type of reflux valve as shown in fig 7.2 is widely used in practice.



Fig

When the water moves in the direction of arrow, the valve swings or rotates around the pivot and it is kept in open position due to the pressure of water. When the flow of water in this direction ceases, the water tries to flow in a backward direction. But this valve prevents passage of water in the reverse direction.

Reflux valve is invariably placed in water pipe, which obtain water directly from pump. When pump fails or stops, the water will not run back to the pump and thus pumping equipments will be saved from damage.

AIR VALVES :

These are automatic valves and are of two types namely

1. Air inlet valves
2. Air relief valves

1. AIR INLET VALVES

These valves open automatically and allow air to enter into the pipeline so that the development of negative pressure can be avoided in the pipelines. The vacuum pressure created in the down streamside in pipelines due to sudden closure of sluice valves. This situation can be avoided by using the air inlet valves.

2. AIR RELIEF VALVES

Some times air is accumulated at the summit of pipelines and blocks the flow of water due to air lock. In such cases the accumulated air has to be removed from the pipe lines. This is done automatically by means of air relief valves.

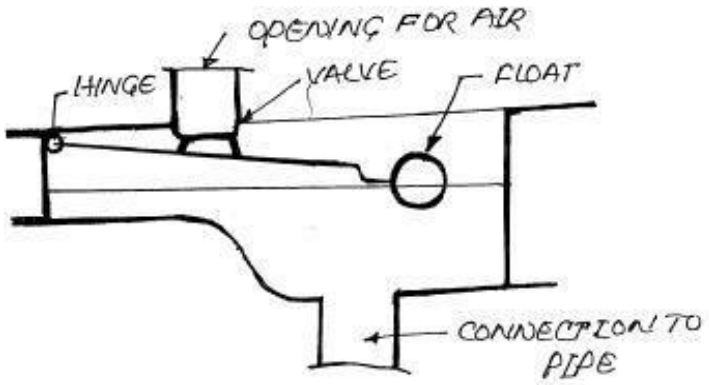


Fig . Air Valve

This valve consists of a chamber in which one or two floats are placed and is connected to the pipe line. When there is flow under pressure in the pipeline water occupies the float chamber and makes the float to close the outlet. But where there is accumulation of air in the pipeline, air enters the chamber, makes the float to come down, thus opening the outlet. The accumulated air is driven out through the outlet.

DRAIN VALVES OR BLOW OFF VALVES

These are also called wash out valves they are provided at all dead ends and depression of pipelines to drain out the waste water. These are ordinary valves operated by hand.

SCOUR VALVES

These are similar to blow off valves. They are ordinary valves operated by hand. They are located at the depressions and dead ends to remove the accumulated silt and sand. After the complete removal of silt; the value is to be closed.

WATER METER

These are the devices which are installed on the pipes to measure the quantity of water flowing at a particular point along the pipe. The readings obtained from the meters help in working out the quantity of water supplied and thus the consumers can be charged accordingly. The water meters are usually installed to supply water to industries, hotels, big institutions etc. metering prevents the wastage of purified water.

6.Q.T YPES OF FIRE HYDRANTS

A hydrant is an outlet provided in water pipe for tapping water mainly in case of fire. They are located at 100 to 150 m a part along the roads and also at junction roads. They are of two types namely.

1. Flush Hydrants. 2. Post Hydrants

1. Flush Hydrants

The flush hydrants is kept in under ground chamber flush with footpath covered by C.I. cover carrying a sign board "F-H".

2. Post Hydrants

The post hydrant remain projected 60 to 90cm above ground level as shown in fig 7.4 They have long stem with screw and nut to regulate the flow. In case of fire accident , the fire fighting squad connect their hose to the hydrant and draw the water and spray it on fire.

A good fire hydrant

1. Should be cheap
2. Easy to connect with hose
3. Easily detachable and reliable
4. Should draw large quantity of water

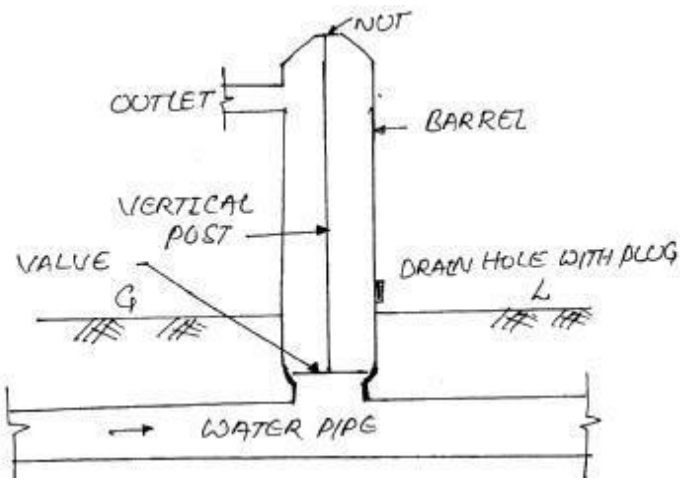


Fig POST FIRE HYDRANT