



Abdelhafid University Center Bousouf - Mila

2024-2025 Semester 1

Water distribution and collection: HAS PART I: DRINKING WATER SUPPLY

– Course 1 –

Chapter 01 : *Design and sizing of distribution networks.*



Teaching staff

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Students concerned

Institute	Department	Year	Speciality
Science and Technology	GC and hydraulics	2nd year master's degree	Urban hydraulics

Course Objectives 1

The main objective of this course is to provide students with the theoretical and practical knowledge necessary for the hydraulic design and technical-economic dimensioning of drinking water distribution networks. It aims to:

- Understand the fundamental principles of drinking water distribution.
- Identify the different types of networks (branched, mesh) and their applications.
- Be able to calculate design flow rates based on population needs.
- Master hydraulic sizing methods (pressure losses, minimum admissible pressure).

Introduction

In this chapter we propose to focus on the different elements necessary for the design and sizing of a Drinking Water Supply (AEP) network.

We will cover the following aspects:

- The assessment of unit allocations for each type of consumer.
- Projection of water consumption for different horizons.
- Design and sizing of a drinking water supply network.

In general, the drinking water supply of any agglomeration includes the following elements:

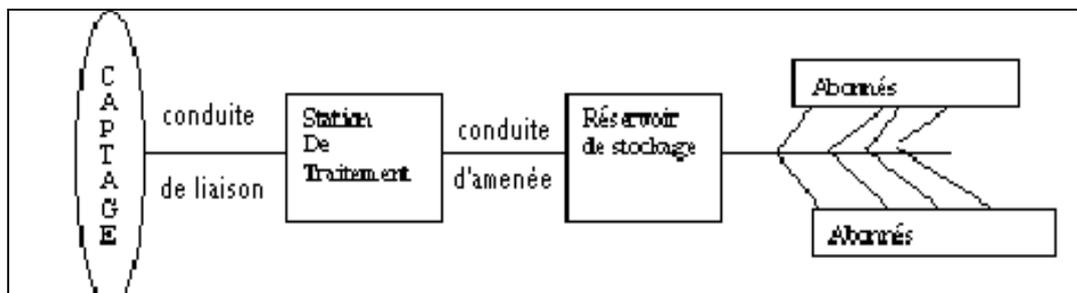


Figure 01. Drinking Water Distribution Diagram: From Collection to Subscribers.

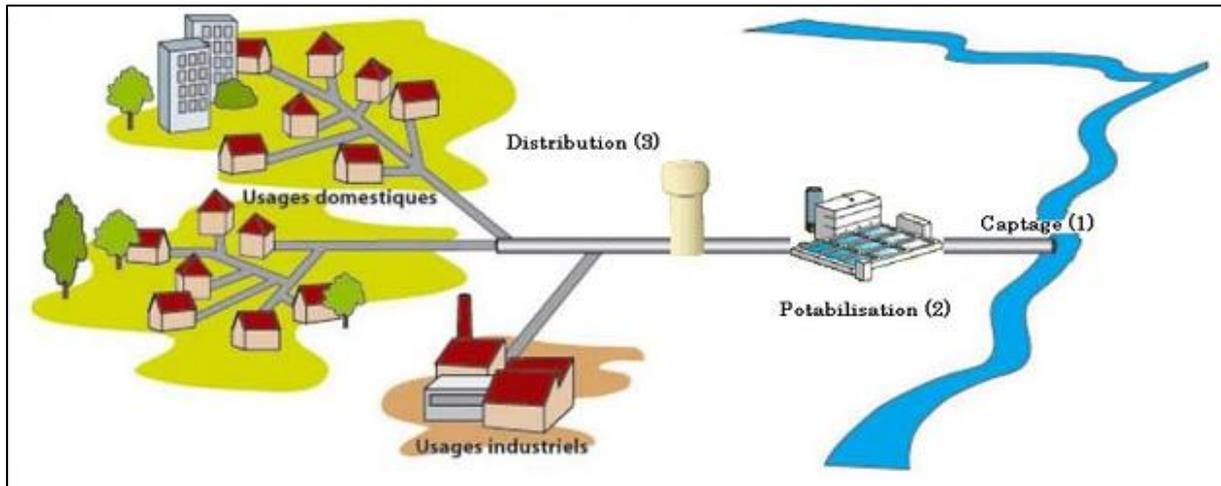


Figure 02. Drinking Water Production and Distribution Chain: From Capture to Use.

I.1 Distribution network

THE networks of distribution constitute the whole of circuit hydraulic Who allow of to bring back water, has leave of Or of the tanks until consumers (subscribers). That's to say, provide **THE Speed maximum** with a **pressure At ground (Or charge) minimal** compatible with there height of the buildings.

I.2. Classification of networks

Distribution networks can be classified as follows:

or star-shaped distribution network

This type of network is characterized by a one-way supply. Any section that must be decommissioned results in the decommissioning of all downstream pipes.

This network is less easy to operate and maintain.

Has the advantage of being economical, but lacks security and flexibility in the event of a breakage.

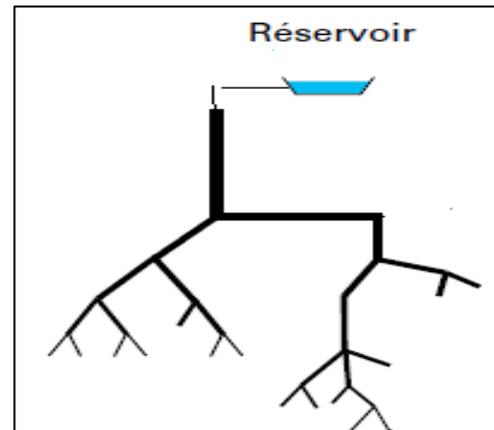
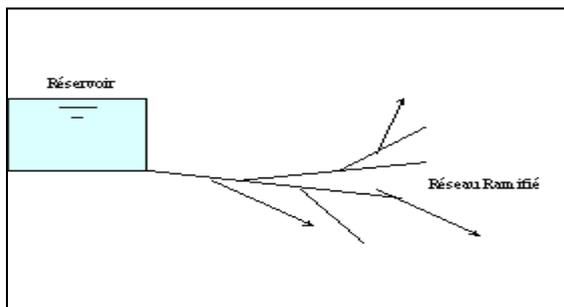


Figure 03. Branched network.

I.2.2 Mesh distribution network

This type of network offers particularly interesting hydraulic advantages since it allows supply to a point from several directions.

This allows a pipe to be isolated while maintaining the supply in the pipes located downstream.

It is of course more expensive to establish, but due to the security it offers, it should be preferred to the branched network.

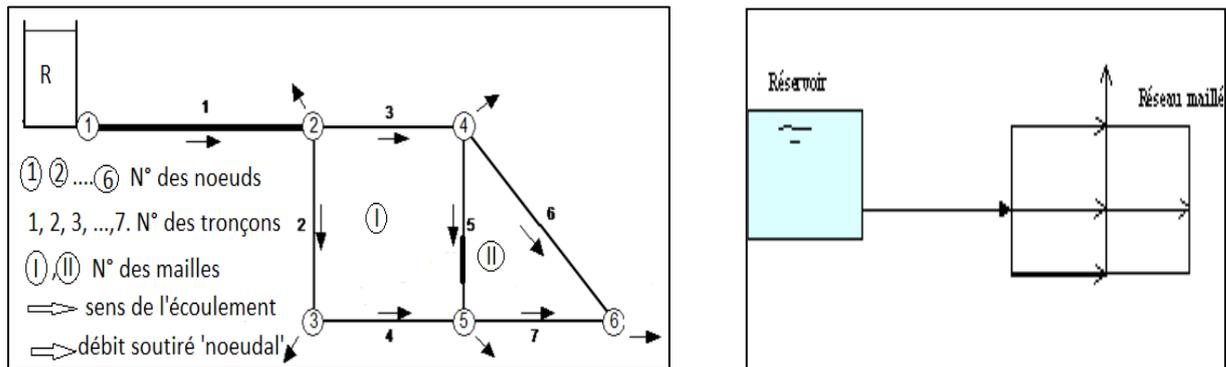


Figure 04. Mesh network.

I.2.3 Mixed distribution network

It is an intermediate network comprising both of the above-mentioned types. It offers broadly the same hydraulic advantages as the mesh network.

However, thanks to the reduction of special parts used at intersections such as crosses and tees, construction costs are generally lower than previously.

Mixed network is calculated after separating the network into two networks, one branched and the other meshed, each calculated separately .

I.3 Study of drinking water needs

A drinking water project must cover the water needs of the population throughout the project area, and over a pre-determined period.

Each study must therefore begin by determining:

- current and future drinking water needs of the population.
- the extent of the project area.
- of the horizon (the previously determined period).
- characteristics of the population.

Data collection

Before calculating water requirements, a number of surveys must be carried out to determine the current baseline data and to be able to forecast the future situation within the study horizon.

To do this, you need to do a survey:

- at the level of the municipality and other local authorities
- at the level of government services (health, education, etc.)
- at the level of private organizations (for example URBACO).

Next, a field survey must be organized. This survey can be part of the socio-organizational study that precedes each project.

The elements that are of interest for calculating the need are the number of people, the type of housing, the desire to have a private connection installed and industrial and agricultural activities (short term and long term).

I.3.1 Water requirement

The water requirement of an area is the sum of the requirements of the different groups in that area:

1- domestic needs, i.e. the needs of each inhabitant of the house.

In general, a rural population uses less water than an urban population.

2- the need for public services: health, education, administration, religious.

3- the need for trade and industry.

4- the need for agriculture.

❖ The horizon

The study horizon is the future time for which the elements of the drinking water system will be sized. The system will be saturated at that time.

The longer this period, the higher the initial investment costs will be.

For small systems, two situations are normally considered:

- the current situation (when the system was started).
- the future situation (20 to 25 year horizon).

I.3.1 Domestic consumption

The annual variation in domestic consumption depends on the population growth, the importance of specific consumption and the type of distribution.

a) Population estimation

The geometric growth formula:

$$P_n = P_0 * (1+t/100)^n$$

Or

P_0 = initial number of inhabitants, i.e. the value at the time of inauguration

P_n = number of inhabitants to be determined after n years

t = growth rate in %

n = number of years in the period concerned (the horizon).

Example

P_0 = 2,000 inhabitants

t = 3.5%

n = 20 years

$P_{20} = P_0 * (1+t/100)^n = 2,000 * (1+3.5/100)^{20} = 3,980$ inhabitants

This example shows that the population has almost doubled in 20 years.

d) The endowment

Specialists in the field have tried to evaluate the average daily consumption of a man for each type of agglomeration: this is what we now call the **endowment**. This is not only attributed to human beings but also to domestic animals (cattle, poultry, etc.) and local facilities (schools, hotels, hospitals, etc.), its unit varies according to the consumer (table)

Consumer	Endowment Unit
Man	l /d/hab.
Cattle	l /j/head
Hospital	l /j/lit
School	l /j/student
Mosque	l /j/ fid

The supply of drinking water differs from one horizon to another for the same locality and this is due to:

- Population growth.
- Lifestyle.
- Progress due to hygiene.

For a rural agglomeration of 2000 inhabitants we can take the allocation:

d = 125 l/d/inhabitant, if the breeding is intensive we take d = 150 l/d/inhabitant.

For an urban population it can take up to 200 l/day/inhabitant.

b) Average flow rate

The water requirements for an agglomeration depend on the number of the population of the area to be studied and the amount of water required per person per day (allocation), depending on the relationship:

$$Q_{moyj} = C_{moyj} = \frac{P_f d}{1000} \quad \left(\frac{m^3}{j}\right)$$

With :

$C_{averagej}$: the average daily consumption

d : the allocation (the water requirement for an inhabitant).

I.3.2 Equipment requirements

Equipment requirements are calculated in the same way, namely, knowledge of the nature of the equipment and the amount of water needed by each equipment.

So the average daily consumption is the sum of the daily needs of all the current and future populations and equipment for an agglomeration.

$$Q_{moyj} = Q_{moyj\ population} + Q_{moyj\ equipment}$$

Generally, distribution networks are subject to the phenomenon of aging as well as possible accidents which cause considerable water losses which cannot be control that occur in the frame of exploitation and management (channel rupture, repairs, losses , poor closure inside valve buildings).

In order to ensure the population has the necessary quantity of water, the previously calculated value (average daily consumption) is increased to varying degrees. (20% -50%), depending on the nature and maintenance methods of the network.

- Network maintenance is Good: 20%
- Network maintenance is average : (25 – 30) %
- Old network : 50%

$$Q_{moyj\ maj} = Q_{moyj} + \alpha Q_{moyj}$$

With :

$C_{averagej\ maj}$: the major average daily consumption

$C_{averagej}$: the average daily consumption

α : increase coefficient

I.3.1 Flow rate variation

Due to all these variations, it is necessary to apply an increase coefficient to the average flow rate, to obtain the value of the peak flow rate on the busiest day of the year.

Water requirements are not constant but vary over time:

a - hourly variations, i.e. during the day. Normally the need is highest during the morning and towards the evening.

b - daily variations, depending on the day of the week (market day, for example).

c - monthly variations, significant in areas characterized by high migration.

d - annual variations are based on, on the one hand, population growth and hygiene; and on the other hand; population growth. The need increases over time.

I.3.2 Hourly variation

a) Daily irregularity coefficient K_j :

It is defined as the ratio between the consumption of the busiest (maximum) day and the consumption of the average day.

$$K_j = \frac{\text{Consommation maximale journalière}}{\text{Consommation moyenne journalière}}$$

$K_j = (1.1 - 1.3)$ we generally take $K_j = 1.2$

b) Hourly irregularity coefficient K_h :

It is the ratio between the maximum hourly flow rate and the average hourly flow rate.

$$K_h = \frac{Q_{\max h}}{Q_{\text{moy } h}} \quad K_h = (1.1 - 3)$$

It can also be calculated by the following formula:

$$K_h = \alpha \beta$$

With :

α : coefficient varies according to the comfort level Coefficient (the nature of the buildings , hotels, departments etc ...) $1.2 \leq \alpha \leq 1.4$ we take a value $\alpha = 1.3$

β : coefficient varies depending on the population (see table 2 – 4).

Table 2 – 4: values of β

population	500	1000	1500	2500	4,000	6,000	50,000	100.00
β	2.5	2	1.8	1.6	1.5	1.4	1.15	1.1

The aim of studying the variation in flow rate is to determine:

- The maximum daily flow rate $Q_{\max j}$.
- The point flow rate Q_p .

I.3.2 The maximum daily flow rate $Q_{\max j}$

The maximum daily flow rate is defined as the flow rate on a day when consumption is at its maximum during a year.

$$Q_{\max j} = K_j Q_{\text{moy } j \text{ maj habitant}} + Q_{\text{moy } j \text{ maj équipement}}$$

With :

$Q_{\max j}$: maximum daily flow rate (l/s)

$Q_{\text{avg } j \text{ maj}}$: the major daily average flow rate (l/s)

K_j : Daily irregularity coefficient

I.3.3 The point flow rate Q_p

This is the flow rate required at peak time, it is calculated using the following formula:

$$Q_p = K_p Q_{moy j maj habitant} + Q_{moy j maj équipement}$$

K_p : Point irregularity coefficient. It can be calculated from one of the following relationships:

1. First method:

$$K_p = K_h K_j$$

K_j : Daily irregularity coefficient

K_h Coefficient of hourly irregularity

2. Second method:

$$K_p = 1.5 + \frac{2.5}{\sqrt{Q_{moy j maj domestique}}}$$

$Q_{avg j maj domestique}$: the average daily flow rate of the population.

When $Q_{moy j} < 5$ l/s ; $K_p = 3$

3. Third method:

$$K_p = 2.6 - 0.4 \log_{10} \frac{N_p}{1000}$$

N_p : number of inhabitants.

Note :

- For rural populations we take $K_p = 3$.
- In general $k_p \leq 3$.

I.4 Hydraulic calculation of the network

Conditions of validity of a drinking water system

ONEP requires a certain number of conditions to give its approval to a distribution network.

- **Traffic speed**

The water flow rate in the distribution pipes must not be below 0.5 m/s, as this will promote the formation of deposits and water stagnation, and consequently the deterioration of its quality.

Furthermore, it must not exceed 1.5 m/s to avoid damaging the network components, but above all to avoid causing significant pressure losses.

- **Ground pressure**

The operating pressure in accordance with ONEP requirements varies between 1 and 6 bars, or 10 and 60 m. As for the minimum pressure, the ground pressure under the most adverse conditions must be as follows:

$$P_s = p_r + H + J$$

P_s : ground pressure

P_r : residual pressure which is 10 m

H : height of the accommodation: 3m/level

J : pressure losses for each floor equal to 0.5 m/floor

Also the network must be calculated to provide the following soil pressures:

18 m for one floor; 22 m for two floors; 26 m for three floors; 36 m for five floors; 40 m for six floors; 44 m for seven floors; 31 m for four floors;

1.4.1 Case of a branched network

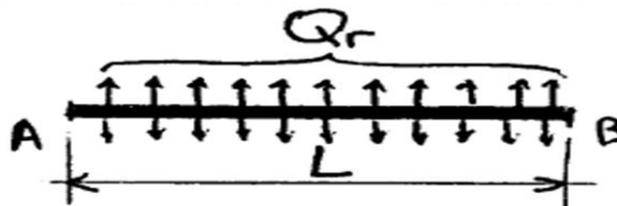
In a supply pipe, the water flow is constant. In distribution pipes, the situation is completely different.

Each section of distribution pipe is characterized by two flow rates:

-An end flow which must pass through the pipeline noted Q_t (downstream flow).

-And a flow rate consumed by the connections connected to the pipe, called the flow rate in route noted Q_r .

The flow rate in the pipeline is assumed to be uniformly distributed along the pipeline.



Furthermore, the flow rate of the pipe is calculated using the following formula:

$$Q = q + 0.55 Q_r$$

With :

Q : flow rate of the section.

q : downstream flow.

Q_r : flow rate en route. $Q_r = Q_{sp} \times L$

A) Determine the specific flow rate

There are three methods for determining this flow rate:

a- Length method

$$Q_{sp} = \frac{Q'}{\sum L}$$

With $Q' = Q_p - Q_{\acute{e}q}$

With:

Q_{sp} : the specific flow rate.

Q_p : the peak flow rate.

$Q_{\acute{e}q}$: the flow rate of the equipment.

$\sum L$: the sum of the network lengths.

$$\text{SO : le d\u00e9bit de route} = Q_{sp}L_i + Q_{\acute{e}q}$$

b- Surface method

$$Q_{sp} = \frac{Q'}{S_t}$$

S_t : total surface area.

I_f : surface corresponds to section i

$$\text{SO : le d\u00e9bit de route} = Q_{sp}S_i + Q_{\acute{e}q}$$

c- Population-based method

$$Q_{sp} = \frac{Q'}{N_p}$$

N_p : number of inhabitants.

I_f : number of inhabitants connected to section i

SO :

$$\text{le d\u00e9bit de route} = Q_{sp}N_{pi} + Q_{\acute{e}q}$$

I.4.2 Case of a mesh network

One of the most used methods in the calculation of mesh networks is the **Hardy Cross method**; by successive approximations .

The Hardy Cross Method

This method is based on the following two laws:

- **1st law:** At any node in the network, the sum of the flows arriving at this node is equal to the sum of the flows leaving it:

$$\sum Q_e = \sum Q_s$$

- **2nd law:**

Along a closed oriented path (one mesh) the algebraic sum of the pressure losses is zero:

$$\sum J = 0$$

The Hardy Cross method consists first of all in establishing a provisional distribution of flows, as well as a direction of flow throughout the network, while respecting the first law.

This first distribution allows you to **choose the diameters** temporary pipelines (with speeds between 0.5 and 1.5m/s) and to calculate the corresponding **pressure losses** .

Ordinarily the algebraic sum of the pressure losses cannot be zero, in all the meshes at the first attempt.

Without changing the chosen diameters and without disturbing the 1st law, we must modify the initial assumed distribution of the flows in the sections in order to rectify the pressure losses and verify the 2nd law.

How to find the debit correction to be made to the first distribution?

Generalizing on any closed storyteller comprising **n sections**, we obtain:

$$Q_1 = Q_0 + \Delta Q_0$$

With :

Q_1 : corrected flow rate.

Q_0 : assumed flow rate.

ΔQ_0 : the corrective flow rate, it is calculated by the following formula:

$$\Delta Q = - \frac{\sum \Delta H}{2 \sum \frac{\Delta H}{Q}}$$

$\sum \Delta H$: the algebraic sum of the pressure losses in a mesh

$\sum \Delta H/Q$: the sum of the percentage of the pressure loss of each section of the mesh compared to the flow rate flowing from this section.

The pressure losses are proportional to the square of the flow rates so we can write:

$$\Delta Q = - \frac{\sum r Q^2}{2 \sum r Q}$$

With : $\Delta H = J L = \frac{\lambda v^2}{2 g D} L = \frac{8 \lambda Q^2}{\pi^2 g D^5} L = r Q^2$

r : the resistance of the pipe over the length L (L equivalent length).

Each mesh is calculated separately, the corrections made to the flow rates are of two types:

- Correction specific to the mesh considered with the sign ΔQ .
- Correction specific to the adjacent mesh with the sign affixed to $-\Delta Q$.

Remember that the positive flow rates relative to the chosen orientation will be corrected by Δq affected by its sign, while negative flows will be corrected by $-\Delta q$.

If the 2nd law is not always verified for the new flow rates, the flow rates will have to be corrected again.

In the case of two adjacent meshes, the common pipe will be affected by the two corrections of the flow rates calculated for the two meshes affected by their respective signs.

- **Calculates nodal flow rates**

There are several methods for calculating nodal flows:

a) Length method

The nodal flow rate of a node is given by the following formula:

$$Q_n = \frac{\sum Q_{tri}}{2} = \frac{\sum (q_{sp} L_{tr(i)} + Q_{moy j maj \text{ \u00e9}quipement})}{2}$$

With :

Q_n : flow rate of node (i) l/s.

q_{sp} : the specific flow rate (calculated by the length method) (l/s/ml).

$\sum L_{tri}/2$: the sum of half the lengths of the section connected to the node (m).

$Q_{avg j equipment}$: the flow rates of equipment connected to node (i) (l/s).

b) Surface method

The principle of this method is to cut the total surface into partial surfaces, each of which is surrounded by a node.

$$Q_n = \frac{\sum Q_{tri}}{2} = \frac{\sum (q_{sp} S_i + Q_{moy j maj \text{ \u00e9}quipement})}{2}$$

With :

Q_n : flow rate of node (i) l/s.

q_{sp} : the specific flow rate (calculated by the surface method) (l/s/ha).

S_i : the surface area occupied by node (i) (ha)

$Q_{avg j equipment}$: the flow rates of equipment connected to node (i) (l/s).

The disadvantage of this formula is that it does not take into account the distribution of inhabitants over the total area; one can have a large area node supplying water to a small number of inhabitants.

c) Method based on the number of inhabitants

This is the most accurate method compared to other methods.

$$Q_n = \frac{\sum Q_{tri}}{2} = \frac{\sum (q_{sp} N_{ptri} + Q_{moy j maj \text{ \u00e9}quipement})}{2}$$

With:

Q_n : flow rate of node (i) l/s.

q_{sp} : the specific flow rate (calculate per inhabitant) (l/s/ hab).

$\sum L_{tri}/2$: the sum of half the number of inhabitants connected to the node (hab).

$Q_{avgj\ equipment}$: the flow rates of equipment connected to node (i) (l/s).

FIRST ITERATION

mesh	N of the sections	Length (m)	Flow rates Q (l/s)	Diameter (mm)	$\Delta H = J \times L$ (m)	$\Delta H/Q$	ΔQ Mesh-specific	ΔQ Sections in common	Total ($\sum \Delta Q$)
I							ΔQ_1		
							ΔQ_1		
							ΔQ_1		
							ΔQ_1		
	$\Delta Q_1 = \frac{-\sum \Delta H}{2\sum \frac{\Delta H}{Q}}$					$\sum \Delta H =$	$\sum \frac{\Delta H}{Q} =$		
II							ΔQ_2		
							ΔQ_2		
							ΔQ_2		
							ΔQ_2		
	$\Delta Q_2 = \frac{-\sum \Delta H}{2\sum \frac{\Delta H}{Q}}$					$\sum \Delta H =$	$\sum \frac{\Delta H}{Q} =$		

SECOND ITERATION

mesh	N of the sections	Length (m)	Flow rates Q (l/s)	Diameter (mm)	$\Delta H = J \times L$ (m)	$\Delta H/Q$	ΔQ Mesh-specific	ΔQ Sections in common	Total ($\sum \Delta Q$)
							ΔQ_1		
							ΔQ_1		
							ΔQ_1		
							ΔQ_1		

I	$\Delta Q'_1 = \frac{-\sum \Delta H}{2\sum \frac{\Delta H}{Q}}$						$\sum \Delta H =$	$\sum \frac{\Delta H}{Q} =$	
II							ΔQ_2		
							ΔQ_2		
							ΔQ_2		
							ΔQ_2		
	$\Delta Q'_2 = \frac{-\sum \Delta H}{2\sum \frac{\Delta H}{Q}}$						$\sum \Delta H =$	$\sum \frac{\Delta H}{Q} =$	

If the solution obtained does not meet the imposed conditions ($0.5 \text{ m/s} < V < 1.5 \text{ m/s}$ and, possibly, sufficient pressures), the initial choice of diameters of certain sections must be modified and the calculation must be restarted from the beginning.

Note that the solution (the final distribution of flows) will depend on the diameters chosen from the start (which depend on the first distribution of flows). The solution is therefore not unique. A detailed cost calculation may allow the most economical solution to be chosen (the best distribution of diameters).

The **Hardy Cross method** has enabled the development of several flow calculation software programs in mesh networks under load and which are currently available: 'the Newton Raphson method , LOOP, EPANET'

Fire Condition Check

For a distribution network (branched network or mesh network), the fire conditions must be checked. This involves recalculating the network, with the same diameters, adding one or more fire flow rates (17 l/s) to the sensitive points of the network. It must then be checked that **the speeds** in all sections are less than 1.5 m/s (2.5 m/s) and that the pressures in all nodes are greater than **10 mce** .

If these conditions are not met, the diameters of certain sections must be modified and the calculation must be restarted from the beginning (during rush hour, then another check during rush hour + fires).

II.5 design and sizing

II.5.1 Network shape

The distribution network is made up of bars (pipes), nodes and a network power source (reservoir, pumping station).

The shape of the network can be modified over time, due to the extension of the areas served or the flow transported, through a renewal of techniques in order to improve the safety and quality of operation. The new shape is also obtained by optimization in the new conditions.

I.5.2 Nature of conduct

The range of pipes on the market is very wide in terms of the nature of the manufacturing material, the most used are:

- Plastic (PVC and HDPE).
- Metallic (cast iron pipe, galvanized steel).
- Cement based (AC).

On the other hand, this diversity is really important, which lies in the advantages that each of these pipes can offer, but in general the choice of the appropriate type is linked to technical and economic factors, such as: plastic pipes are known for their lightness, flexibility, resistance to aggressive fluids and corrosion, their flexibility (HDPE), their seamless connection (PVC) and their small diameters, but the most important thing is their cost, unlike metal pipes and those made from cement, which have larger diameters.

In our case, the choice of pipe is imposed by the ONEP prescriptions which recommend plastic pipes if the simulation diameters are small, for their aforementioned reasons, we will then use PVC for the network and HDPE for the connection of subscribers.

I.5.3 Properties of pipes

a) Roughness

Roughness defines the condition of the internal surface of the pipe. It describes its degree of asperity, and may or may not have a unit depending on the authors who use it in the formulas for calculating pressure losses (table). It differs from one pipe to another and depends on the nature of the base material and the age of the pipe.

b) Nominal diameter

The other characteristic is the nominal or external diameter. Each type of pipe has a specific nominal diameter range, from which the most suitable can be chosen.

For example :

Nominal Diameter in mm	Thickness in mm
25	3.0
32	3.6
40	4.5
50	5.6
63	7.1
75	8.4

Table : HDPE PN 16 dimensions (Bourbon plastic, 2009)

External diameter (mm)	Internal diameter (mm)
50	42.6
63	53.6
75	63.8
90	76.8
110	93.8
125	102.2
140	114.6

Table: PVC dimensions PN 16 (ONEP, 2011)

c) Nominal pressure

This is one of the most important properties of pipes. For plastic pipes, it corresponds to the permissible working pressure, in bar, for transporting water at 20°C.

The choice of the appropriate nominal pressure is made by taking a PN greater than the highest pressure declared in a node of the network.

1.5.4 Accessories

Any part fitted to the pipe network is referred to as an accessory: elbows, tees, valves, etc. These are generally identified by two elements: the DN and the PN.

- **Shut-off valves**

Also called gate valves, they are used to isolate the different sections of the network during a repair on one of them, by turning a screw which lowers or raises vertically, a sort of lens.

Its symbol is: RV DN X

X being the nominal diameter of the valve



Figure 05. Gate valve for drinking water network.

- ***Crossing cuffs***

It is a cast iron accessory whose role is to support the weight of the concrete forming the manhole wall and to protect the plastic pipe when it passes through this wall.

Its symbol is: MT DN X.

X being the nominal diameter of the cuff.



Figure 06. Flanged junction tube for water pipe.

- ***Elbows***

These are accessories for diverting the direction of water circulation, they exist in different angles.



Figure 07. Pipe bends for changing direction.

- ***The flanged reduction cone***

These are connecting devices in case of a change in diameter, from large to small and vice versa. Its symbol is CRB DN X/Y.

With: X is the nominal inlet diameter to the cone. And: Y the nominal outlet diameter of the cone.



Figure 08. Flanged reducer for water pipe.

- ***The solid plate***

It is a plug that is mounted at the end of an antenna pipe to stop the flow of water. In the pipes attached to these plates there will often be stagnant water, which is why we avoid them whenever possible.



Figure 09. Brass threaded plug with gasket.

- **The Tees**

T-shaped accessory used for connecting secondary pipes to main pipes, its symbol is:
DN X/Y tee.

With: X is the DN of the main pipe.

Y is the DN of the secondary pipe.



Figure 10. Steel connecting tee for circular conduits.

- **The fire hydrant**

Fire hydrants or hydrants must be connected, according to ONEP standards, to at least DN 90 pipes and must have a radius of influence of 200 m each. Their service flow rate of 17 l/s is not included in the calculations of water requirements, since this is only an occasional demand and the fire risks are truly negligible.

But in the event of a fire, the entire network is shut down and the supply is limited to the fire hydrants only.



Figure 11. Fire hydrant on drinking water network.

e) Ancillary works

These are works ensuring the efficient operation of the network.

- ***Drain inspection chamber***

It is a type of valve associated with a pipe flowing into a masonry manhole, mounted on the network at the lowest points.

They are used to drain the pipes, and consist of a pipe connected to the network and leading to a masonry inspection chamber which will be the temporary location for the drain water.

The tapping point must be below the network pipe to ensure that no water rises.



Figure 12. Drinking water network drain inspection chamber .

- ***Suction Cup Look***

The suction cup is a device installed at the highest points and used to evacuate air trapped in pipes to avoid devastating breakdowns related to compressed air. This device can also inject air into the pipes during the draining session in order to prevent any deformation of the pipes.

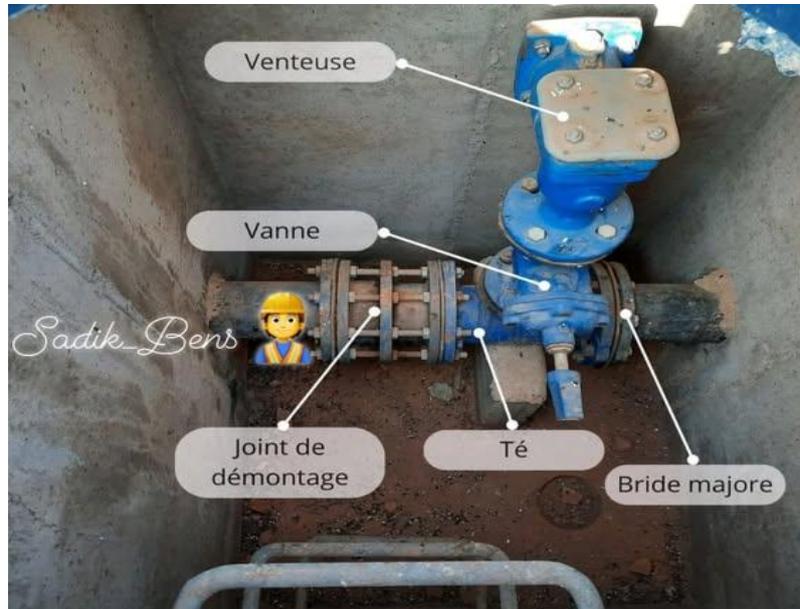


Figure 13. Triple-function suction cup for drinking water network.

Conclusion

The design and sizing of drinking water distribution networks is a crucial step in ensuring a reliable, sustainable supply that meets the health requirements of populations.

This technical process is based on a rigorous analysis of water needs (domestic, industrial, public), the topographical characteristics of the site, as well as the judicious choice of suitable materials and hydraulic equipment.

Useful links

- <https://youtu.be/vbIKcxt7Y6U>
<https://youtu.be/4u633ITH4mw?list=PLjV5XTNQA1rzrgQeTpfByEQviCR0AbccB>

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