Residential Installations

Unit 1

Criterios de Evaluación

Bloque II: INSTALACIONES EN VIVIENDAS

1. Describir los elementos que componen las distintas instalaciones de una vivienda y las normas que regulan su diseño y utilización.
2. Realizar diseños sencillos empleando la simbología adecuada.
3. Experimentar con el montaje de circuitos básicos y valorar las condiciones que contribuyen al ahorro energético.
4. Evaluar la contribución de la arquitectura de la vivienda, sus instalaciones y de los hábitos de consumo al ahorro energético.

Instrumento-> Criterio	Observación directa en clase	Cuaderno individual de Tecnología	Memoria de proyecto.	Objetos construidos o diseñados:	Pruebas escritas u orales individuales:	Trabajo en pizarra	Prácticas con simuladores.	Media
Bloque II - Crit1								
Bloque II – Crit2								
Bloque II – Crit3								
Bloque II – Crit4								

INDEX

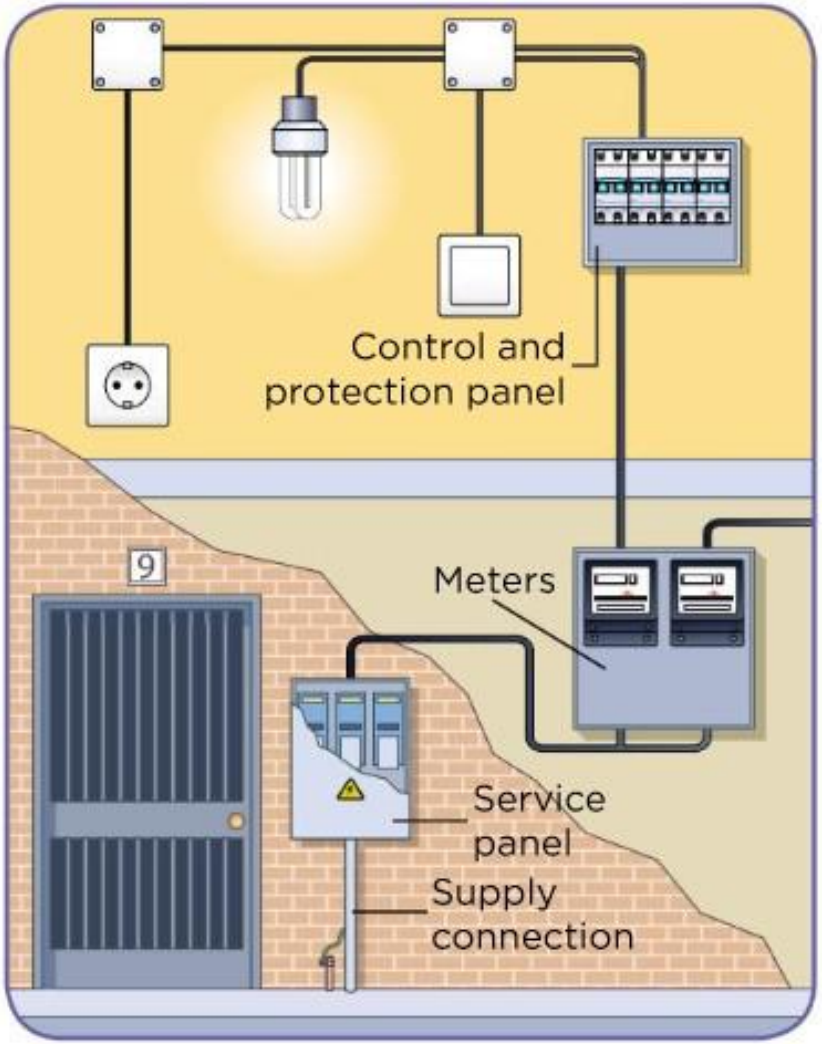
Residential electrical installations.

A. Structure of installations.
B. Detailed connections.
C. Safety measures.
D. Regulations.
E. The electricity bill.
F. Efficiency Labels.

Structure of installations

As seen in 3rd E.S.O…

- Generation and transformation.
  - Power plants.
  - Transformer stations
- Protection:
  - Service panel.
  - Control and protection panel.
- Measurement:
  - Meters.



Structure of installations

- Transport:
  - Supply connection.
  - Conductors → Wire.

COLOUR CODE

In order to be able to identify the different conductors in the electrical system, a colour code has been adopted. These colours have the additional advantage of being easily distinguishable, even by those who are colour-blind.

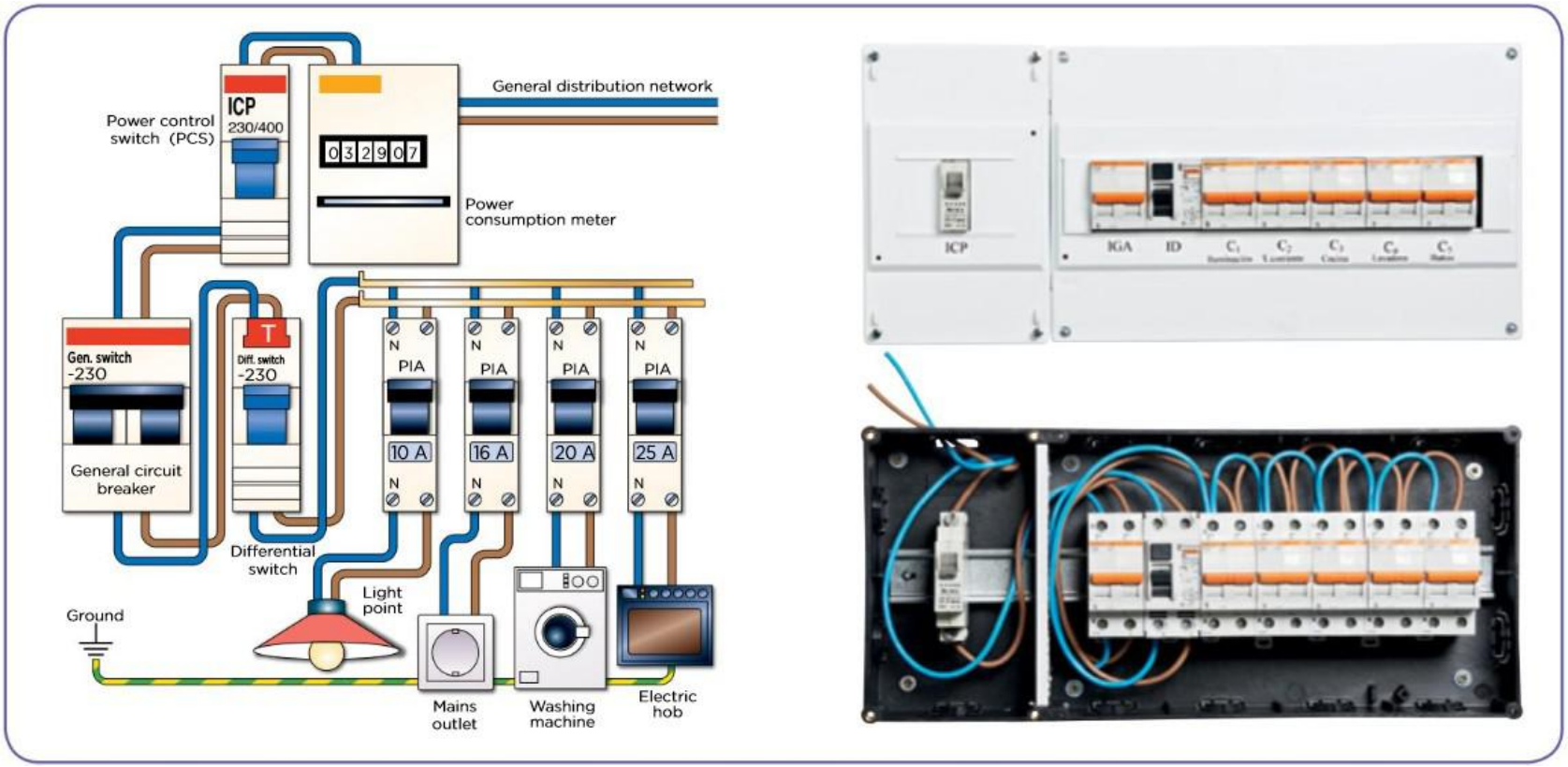
Phase: black, brown or grey

Neutral: blue

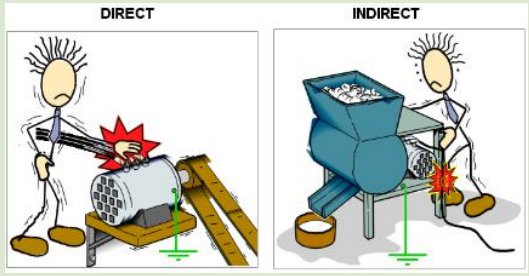
Ground wire: yellow and green stripes

Types of switches

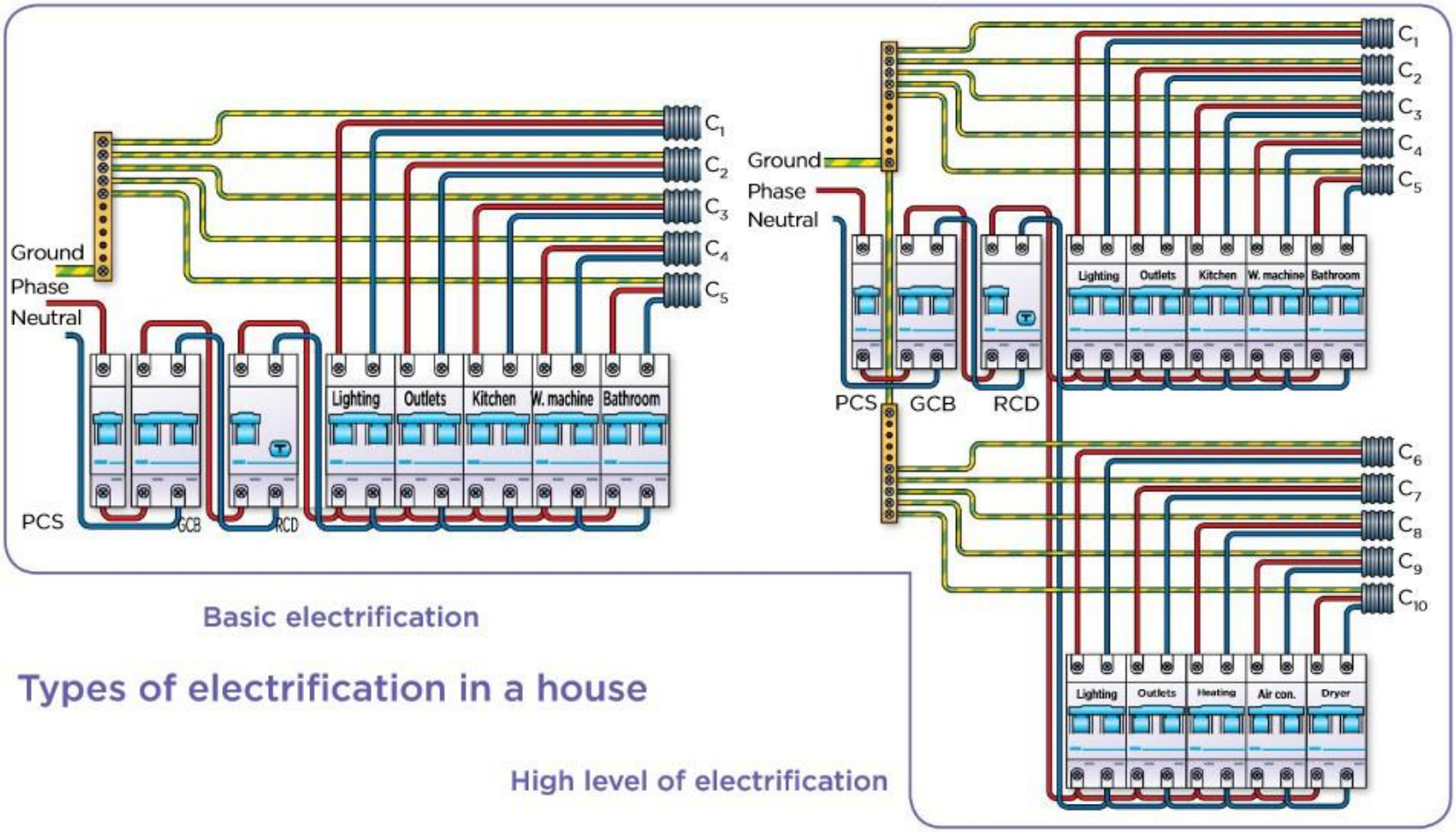
- Power Control Switch (ICP).
- General Circuit Breaker (IA).
- Differential Switch (ID).
- Automatic Circuit Breaker (PIA).



Types of switches

Switch	Protects against…	Consists on	Effects
General Circuit Breaker	Short-circuit		
Fuse	Short-circuit		
Differential	Direct and indirect contact		
Automatic Circuit Breaker	Overloads		

Structure of installations



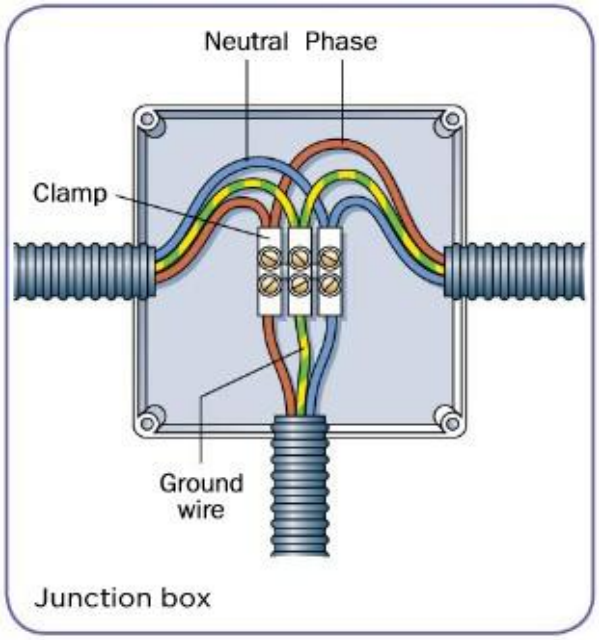
Threshold: **160 m²** of usable surface area.

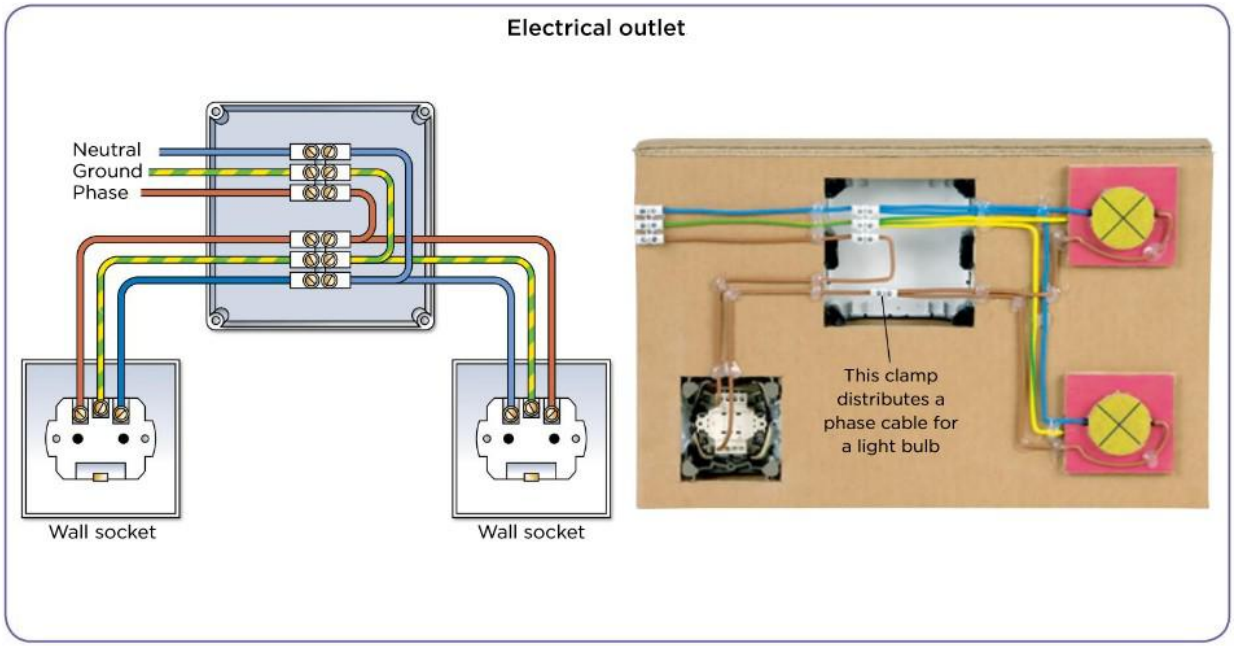
Structure of installations

Type of electrification	Circuit	Description	ACB (A)	Conductor cross section (mm^2)	Tube diameter (mm)	Maximum power per outlet (W)
Basic	Circuit 1	Light points (max. 30)	10	1.5	16	200
	Circuit 2	General use electrical outlets and refrigerator (max. 20)	16	2.5	20	3450
	Circuit 3	Hob and oven (max. 2)	25	6	25	5400
	Circuit 4	Washing machine, dishwasher and electric boiler (max 3)	20	4	20	3450
	Circuito 5	Bathroom electrical outlets and auxiliary kitchen electrical outlets (max 6)	16	2.5	20	3450
High	Circuit 6	Light points (max. 30)	10	1.5	16	200
	Circuit 7	General use electrical outlets and refrigerator (max. 20)	16	2.5	20	3450
	Circuit 8	Electric heating	25	6	25	5750
	Circuit 9	Air conditioning	25	6	25	5750
	Circuit 10	Standalone dryer	16	2.5	20	3450
	Circuit 11	Home automation	10	1.5	16	2300
	Circuit 12	Idem 3, 4 or 5 (according to use)	*	*	*	*

Threshold: **160 m^2** of usable surface area.

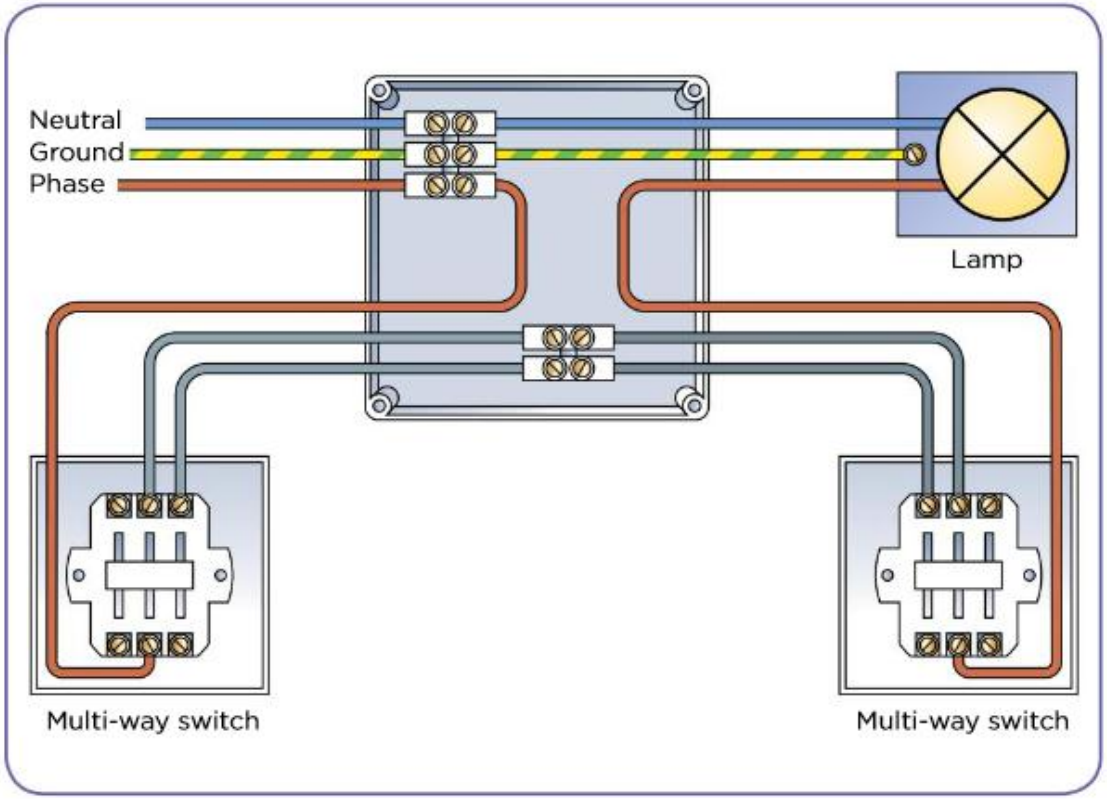
Detailed connections



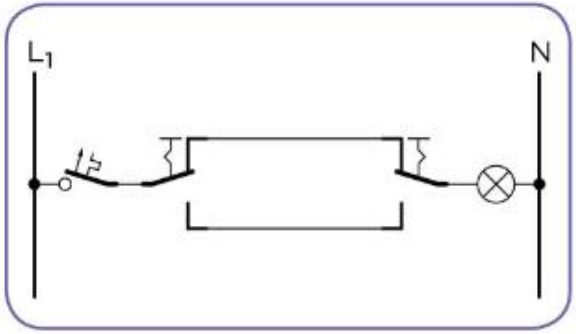


Usual terms: TUBE, WIRE, CLAMP, WIRE, GROUND, SOCKET

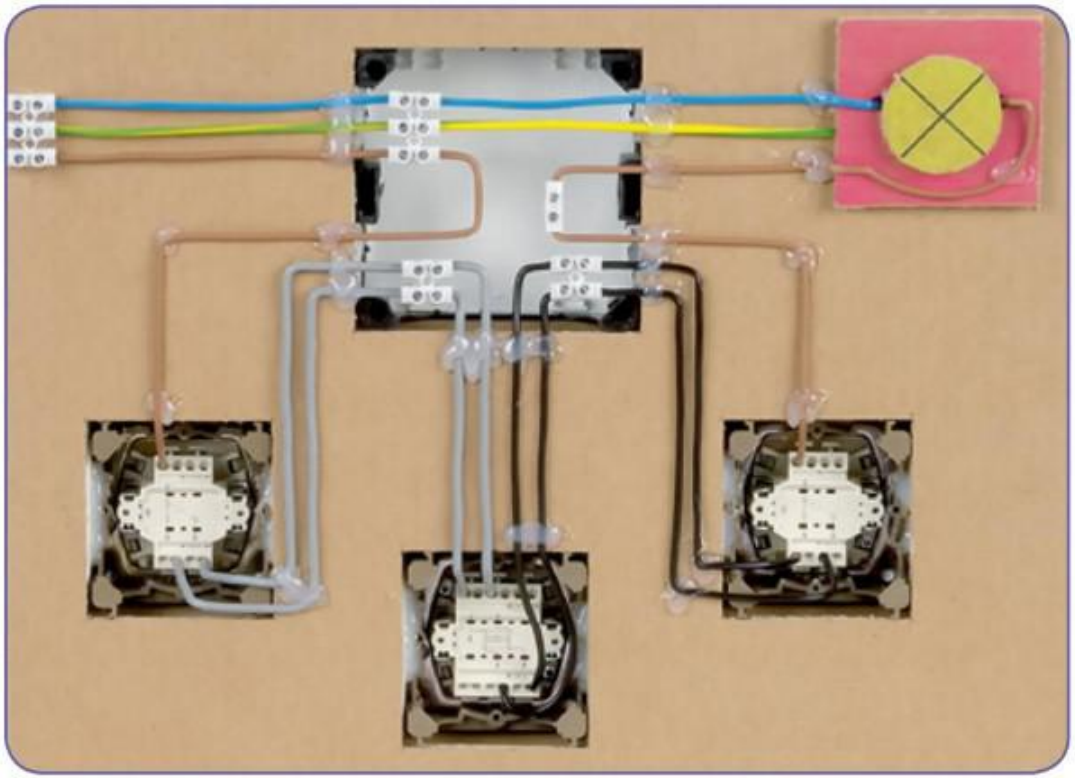
Detailed connections



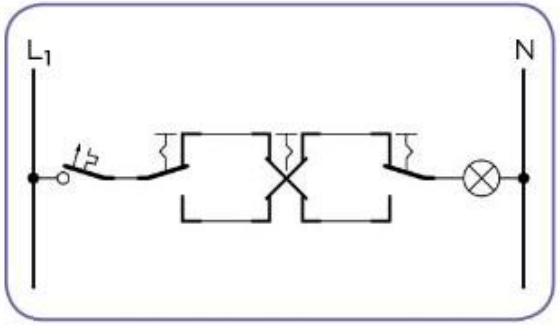
One or several lamps in parallel with two switches



Detailed connections



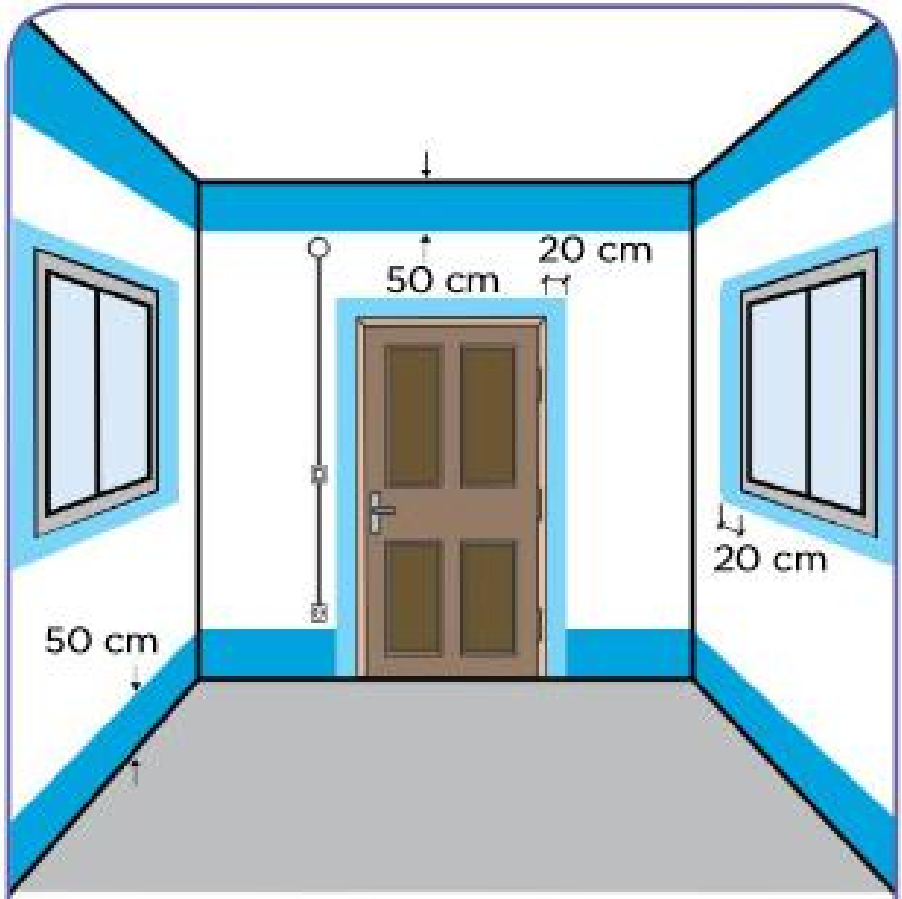
One or several lamps in parallel with three multi-way switches



Safety Measures

- Placing the tubes

Is this one right-placed?



When tubes embedded in walls are used, it is advisable to arrange horizontal pathways at 50 centimetres, at the most, from the ground or ceiling, and vertical pathways at a distance from the corner angles not greater than 20 centimetres.

Safety measures

Five golden rules for the prevention of electrical risk

Prevention of electrical risk

The execution of works with electrical circuits is regulated by occupational safety regulations that, among other things, propose five basic rules that must be followed in all work. These are:

1. Cutting voltage sources (mandatory), disconnecting the general switch or ACB corresponding to the circuit to be worked on.
2. Blocking access, if possible, to the breaker components or instruments (mandatory), closing the cabinet once the voltage has been disconnected and signposting it so that nobody touches it.
3. Checking for the absence of voltage (mandatory), for example, checking the operation of lamps or connecting a lamp to the electrical outlet to be worked on.
4. If possible, connecting to a ground and short-circuiting the components to be manipulated (recommended).
5. Signposting the work area (recommended).

Proposed exercises

10 What is the purpose of a differential switch?

11 Name, in the correct order, the elements that make up the building connection installation, from the public electrical distribution grid to the interior residential installation.

16 Summarise the five golden rules of security in electrical works.

.... and exercises 2, 3 and 5 of page 40

12 Within the control and protection panel, indicate which element is in charge of the following:

a) protecting us from electrical discharges;

b) cutting off the general current of the whole installation;

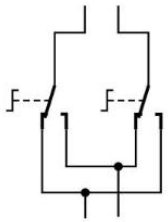
c) protecting the system from surges;

d) protecting the system against short circuits;

e) limiting the power consumed according to the contracted power.

Regulations

One code for the schedules to be understood by everyone.

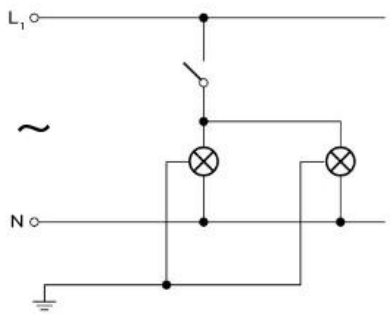
Mechanism	Symbol	
	One-line	Multi-line
Switch		
Multi-way switch		
Intermediate switch		
Push button		

Mechanism	Symbol	
	One-line	Multi-line
16 A electrical outlet with ground wire		
25 A electrical outlet with ground wire		
Light point		
Fluorescent lamp		
Doorbell		
Register box		
Washing machine		
Dishwasher		
Refrigerator		
Electric cooker		

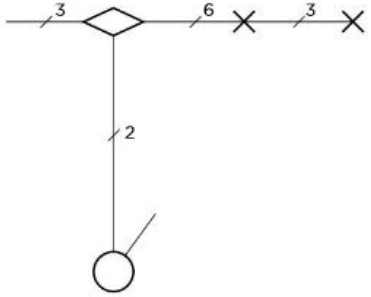
Regulations

COMMON INSTALLATIONS

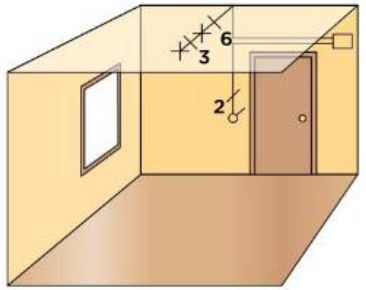
Two light points in parallel with a switch



Multi-line diagram

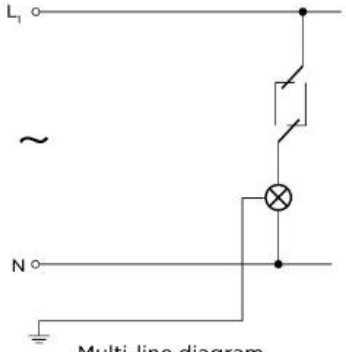


One-line diagram

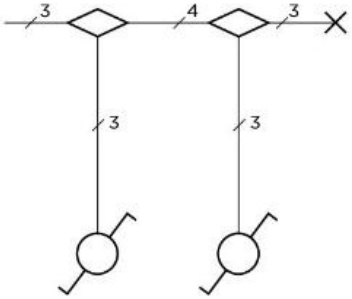


Topographic diagram

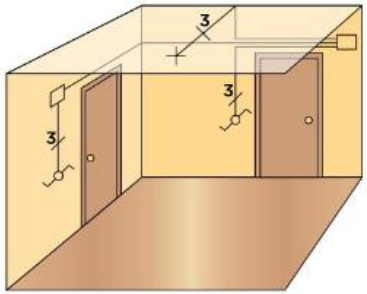
One light point with two switches



Multi-line diagram



One-line diagram

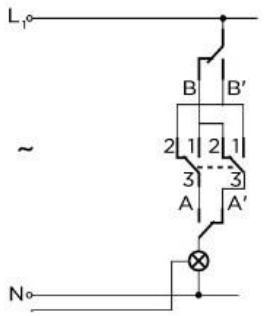


Topographic diagram

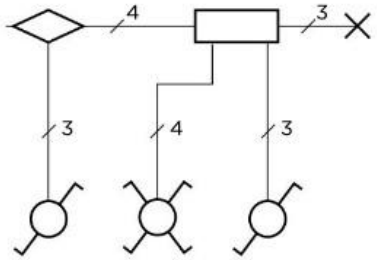
Regulations

COMMON INSTALLATIONS

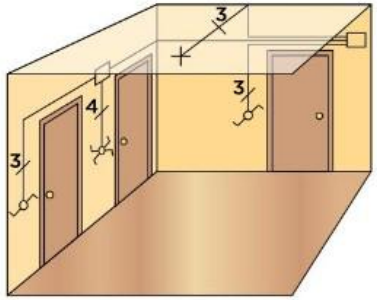
One light point with two switches and one four-way switch



Multi-line diagram

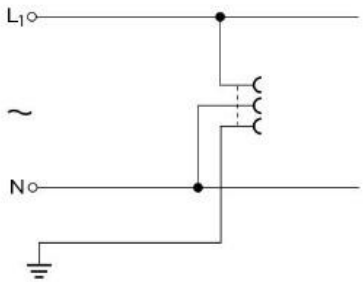


One-line diagram

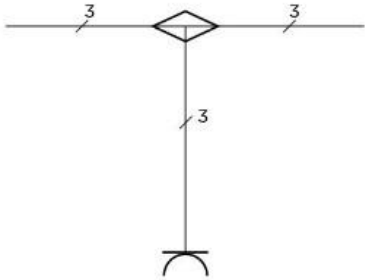


Topographic diagram

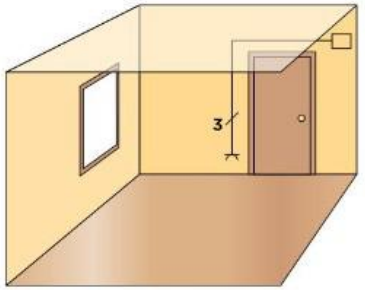
Mains outlet



Multi-line diagram



One-line diagram



Topographic diagram

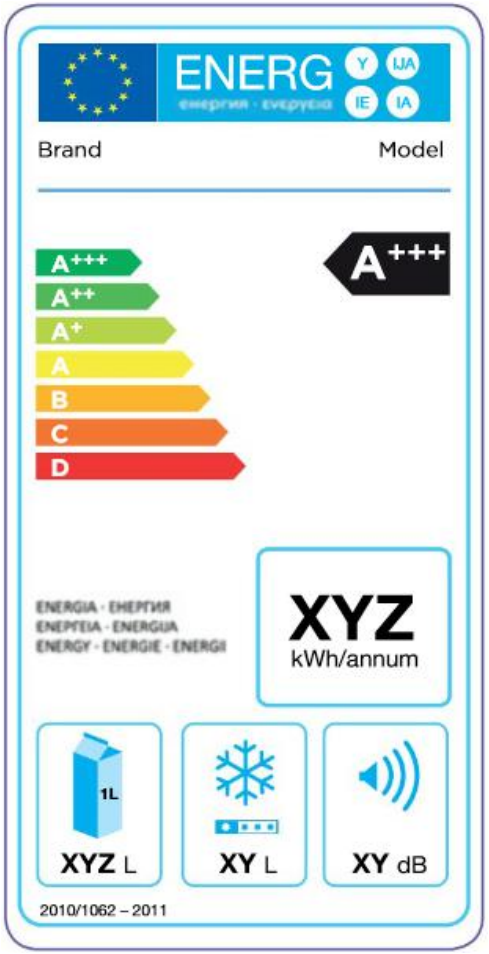
The Electricity bill

BILLING AND CONSUMPTION

Energy		
Power contracted from 01/01/2013 to 01/03/2013	3.3 kW x 60 days x 0.05998 €/kW day	11.88€
Consumption billed from 01/01/2013 to 01/03/2013	334 kWh x 0.150938 €/kWh	50.41€
Total		62.29€
Tax on electricity	5.1127 % of 62.29€	3.18€
TOTAL ENERGY		**65.47€**
SERVICES AND OTHER PAYMENTS		
Measurement equipment rental 01/01/2013 to 01/03/2013	2 months x 0.57€/ month	1.14 €
Emergency Electrical Service from 01/01/2013 to 01/03/2013	2 months x1.99€ / month	3.98 €
TOTAL SERVICES AND OTHER PAYMENTS		**5.12€**
TOTAL ENERGY, SERVICES AND OTHER PAYMENTS		70.59 €
VAT	21 % of 70.59€	14.82€
BILL TOTAL		**85.41€**

- Term of contracted power.
- Term of consumption.
- Tax on electricity.
- Additional services.
  - Equipment rental.
  - Emergency electrical service.
- Value Added Tax (IVA).

Efficiency labels



- Not all the goods consume the same doing the same tasks.
- They are qualified based on their consumption.
- It's a relative qualification according to the power spent.

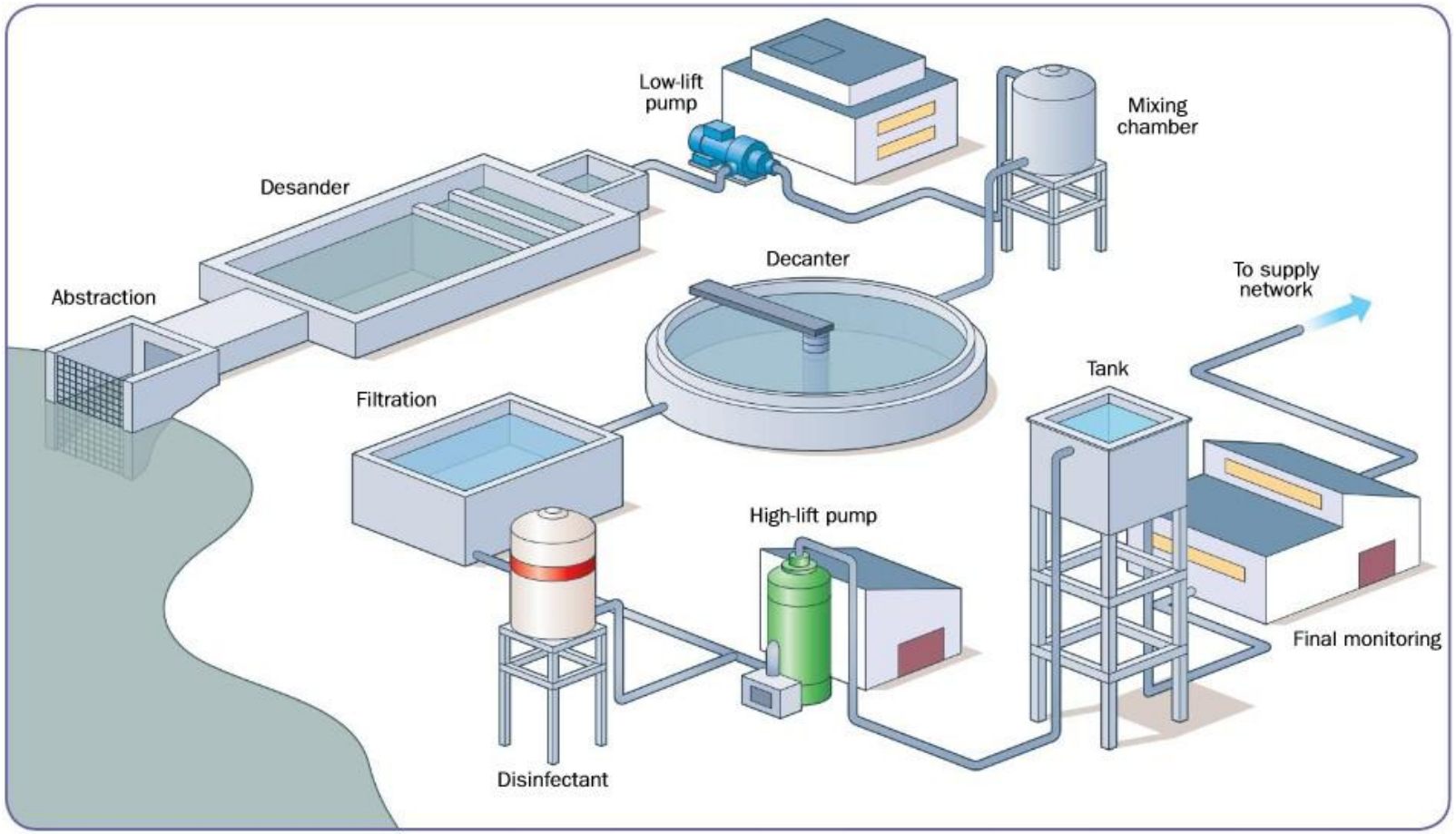
  The less they spend, the better they are qualified.
- Every good in sale has to be mandatorily tagged.

Residential water installations.

A. Drinking water installation.
B. Wastewater installation.
   - Rainwater installation.
C. Regulations.
D. The water bill.
E. Efficiency Measures.

Drinking water installation

What happens upstream the domestic installation:

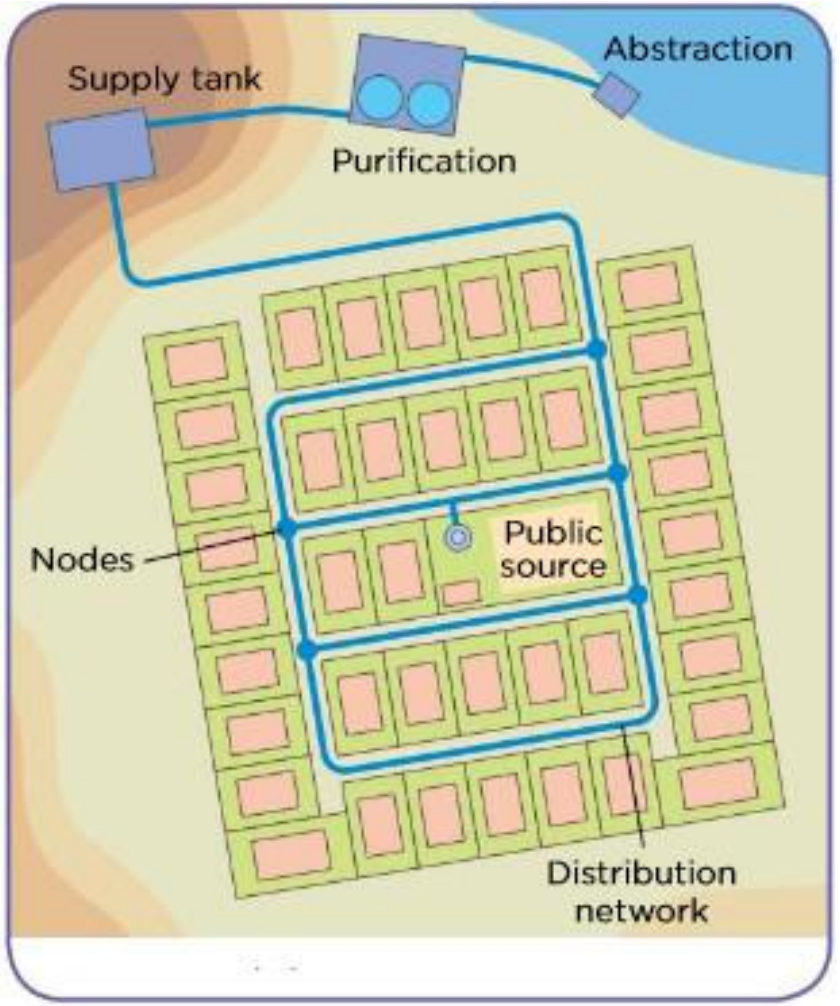


Drinking water installation

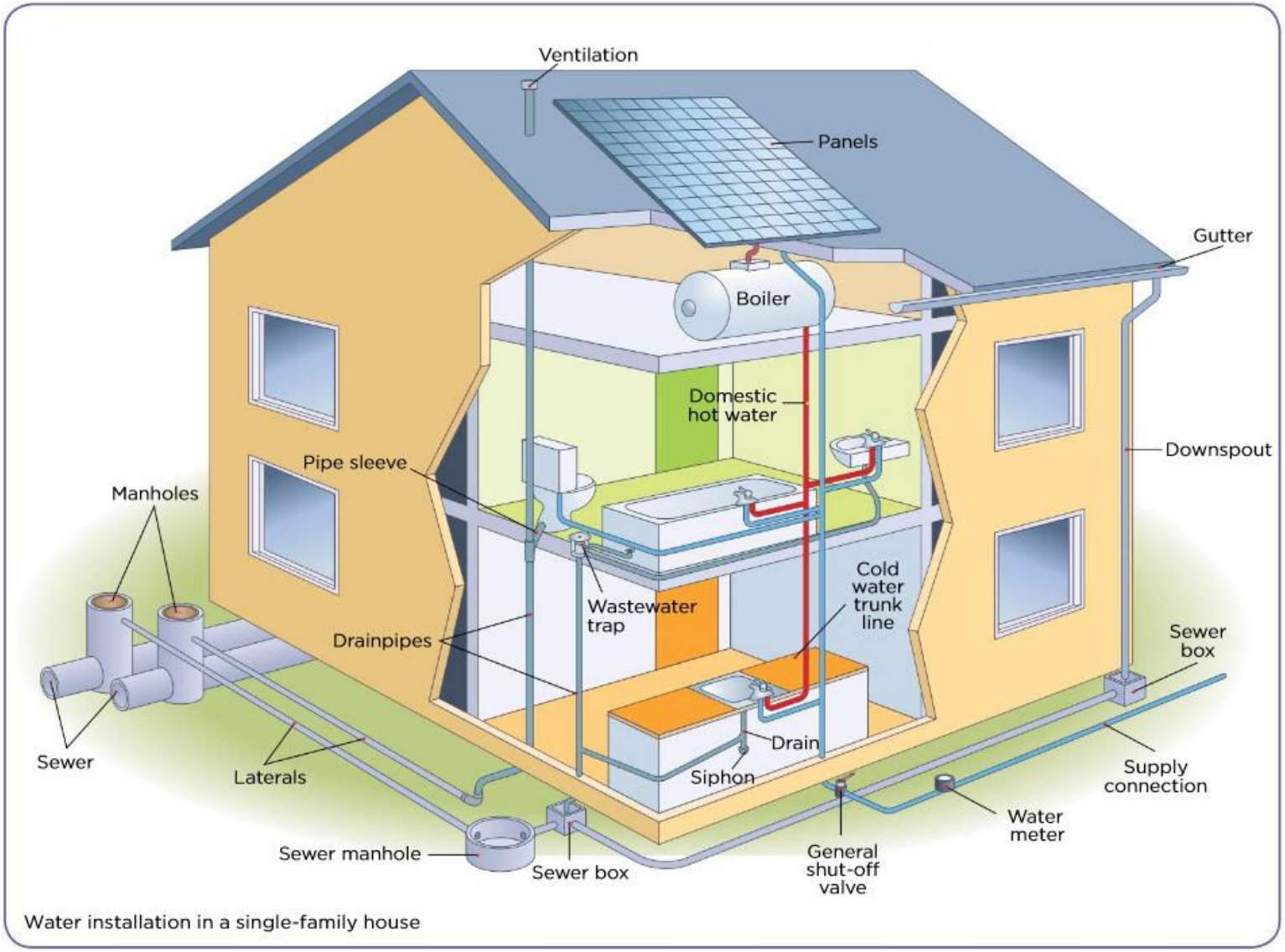
Local water distribution network

- Pressurised water
- Ring-shaped.
- Closed.

Meters and general shut-off valves in a residential building



Drinking water installation



Exercise

- Translate this text into Spanish.
- Meanwhile, write down the new words you're finding.

2.2 Water distribution

Once on the usage premises, whether in buildings with several dwellings or single-family houses, **connections** are found, composed of pipes and other elements that connect the public system with the residential **water supply system.** They also serve to delimit responsibility for repairs and maintenance. Finally, the **interior water supply system** is reached, which is the set of pipes and other elements that transport water within the property of the user, which the user is responsible for maintaining.

In these buildings there are curb cocks and general shut-off valves, consumption meters and a network of pipes that distribute the water to the different points of consumption.

Sometimes, the water supply pressure is not sufficient to satisfy consumer demand. This can be due to an excessively high point of consumption or too small of a distribution network. This results in a lack of suitable service pressure and therefore requires a pressure-raising setup that will have pressure equipment or pump sets to correct it.

2.3 Residential water installation

Within the building, we find the following installation components:

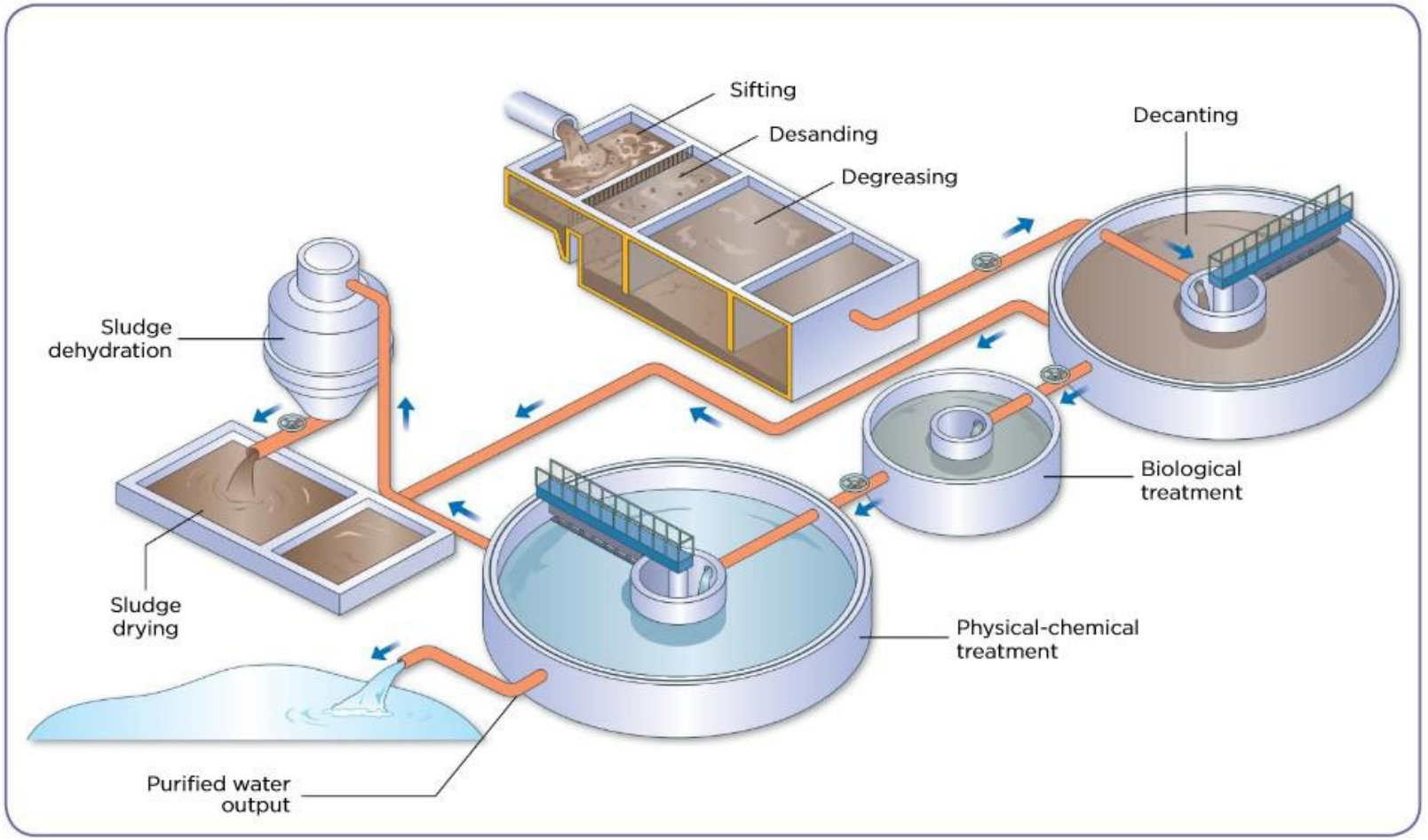
- **Trunk lines,** which are the vertical pipes that raise the water to the floors.
- **Branch lines,** which are horizontal pipes that distribute the water around each floor to each of the usage points in kitchens, bathrooms, etc.
- **Shut-off valves,** which are cut-off valves normally located at the entrance of each of the rooms with plumbing (kitchen, bathrooms, etc.)
- **Water intakes,** which are endpoints that connect the fixtures with the plumbing. They must always have their own shut-off valve.

Once inside the house, generally there are two differentiated plumbing circuits, one for cold water and one for domestic hot water. Different devices are used to heat water through different energy sources, such as gas, electric or solar water heaters and boilers, or solar thermal panels.

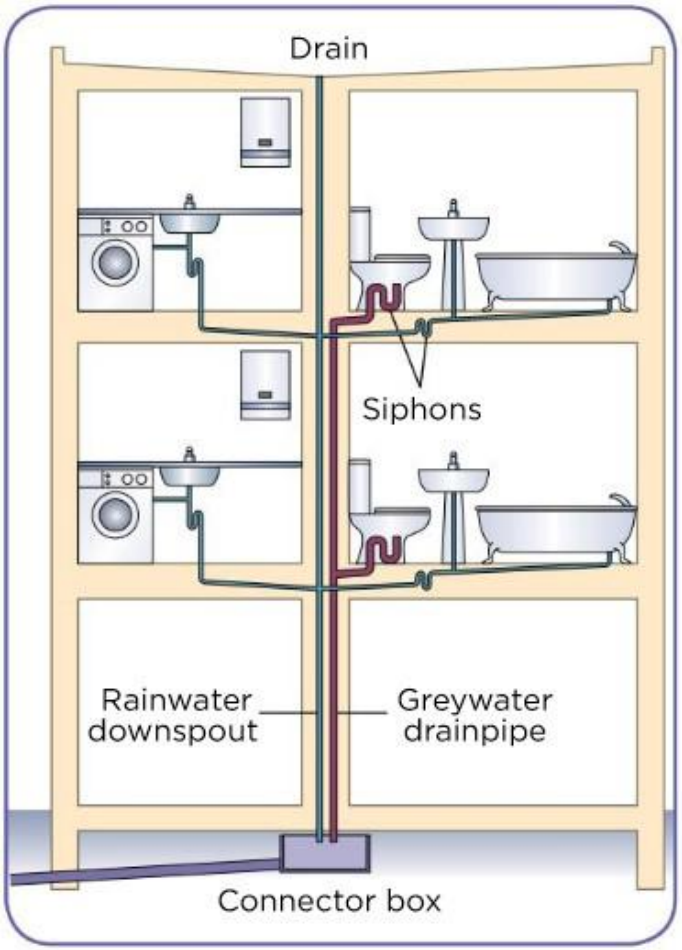
For interior plumbing, materials like galvanised steel, copper, stainless steel, ductile cast iron, PVC, polyethylene, polypropylene, etc. are used, as long as they are not materials that could transmit harmful substances into the water above the values allowed by law.

Wastewater installation

What happens downstream the domestic installation:



Wastewater installation



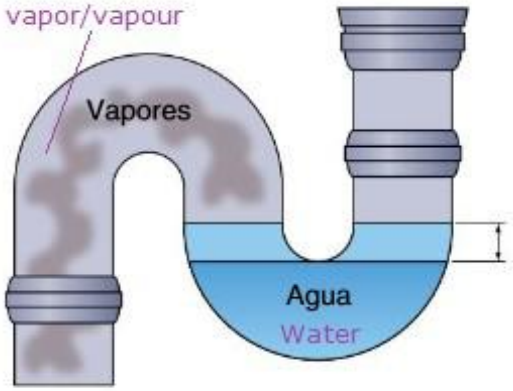
Be careful !! There's a mistake!

Residential wastewater network

- Non Pressurised water
- Tree-shaped.
- Open network.
- Water flows by gravity.

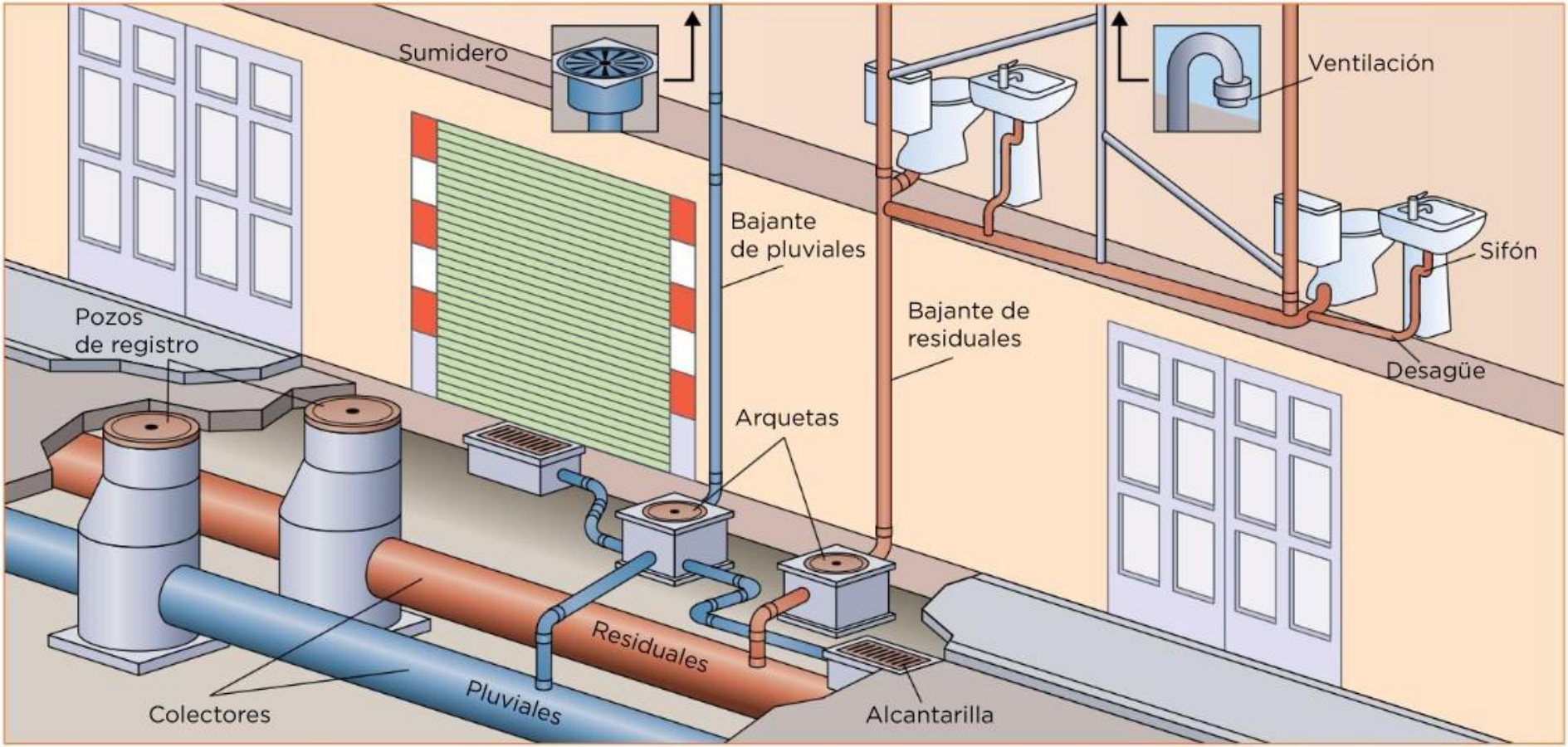
Bote sifónico.
Wastewater trap

Syphon



Cota de cierre de un sifón.

Wastewater installation



Are you able to appreciate where the mistake was?

Exercise

- Translate this text into Spanish.
- Meanwhile, write down the new words you're finding.

2.6 Components of the sewer network

Inside the house

Inside the house, the drainage network begins with sanitary fixtures, such as the toilet, the bidet, the sink and the washbasins, and household appliances, such as the washing machine, dishwasher and now condensing boilers and refrigerators, that also drain into the general drainage network.

Wastewater collection is done though a network of PVC pipes that use gravity to carry water to the public sewer network.

In this network, we can distinguish the following elements:

- **Branch lines,** which are the pipes that collect wastewater from the drains of each sanitary fixture and carry it towards the drainpipes.
- **Drainpipes** are the vertical pipes that collect wastewater from the branch lines and carry it towards the laterals. They can also collect rainwater from the gutters of terraces, patios or decks.
- **Siphons or waste traps.** Siphons are devices that are placed at the outlet of kitchen sinks or washbasins whose purpose is to keep bad smells from the pipes from escaping through the drains. Waste traps perform the same function but join different pipes from different fixtures together at a single point.
- **Pipe sleeves** are large-diameter tubes that connect the toilets directly to the drainpipes.
- **Laterals or sewers** are the pipes that link the building's sanitation network with the sewer system network through sewer boxes. If these pipes are visible, they are called sewers, whereas if they are buried, they are called laterals.

Finally, the network of laterals ends at the building's main sewer box, which connects directly to the sewer network.

Exercise

- Translate this text into Spanish.
- Meanwhile, write down the new words you're finding.

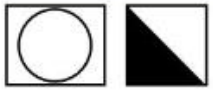
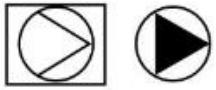
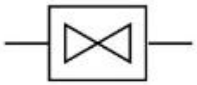
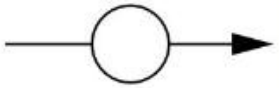
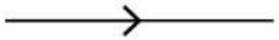
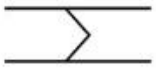
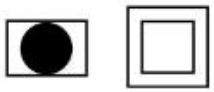
Outside the house

Outside the house we find:

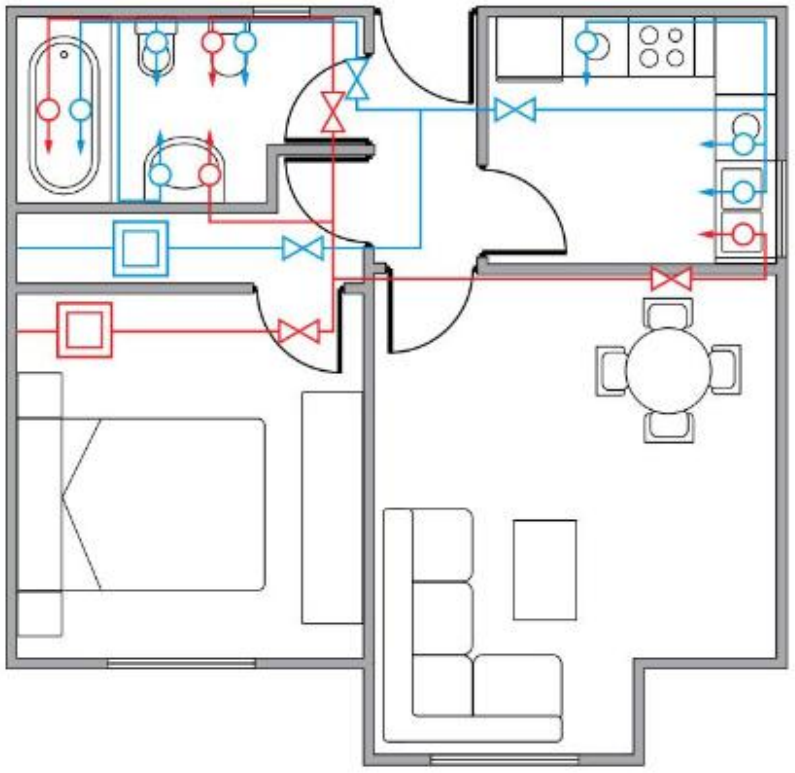
- **Connections.** These are the set of elements that connect the water discharged by a house or building to the building's lateral, consisting of the connection drain, which marks the separation between private and public pipes; pipes to the lateral and the junction; or connection to the public lateral, consisting of a sewer box, well or other technical solution.
- **Laterals.** Larger-section conduits buried in public thoroughfares that transport the flow from connections and scuppers.
- **Scuppers.** The set of grates and boxes that collect rainwater and roadway runoff.
- **Manholes.** They allow access to the laterals to facilitate their inspection and maintenance through the manhole covers.
- **The main laterals.** They are larger sections of pipe, some accessible, that collect water from the laterals and take it to the water purifier or discharge it into the natural environment, but with its volume already regulated by the existence of a reservoir or **spillway.**

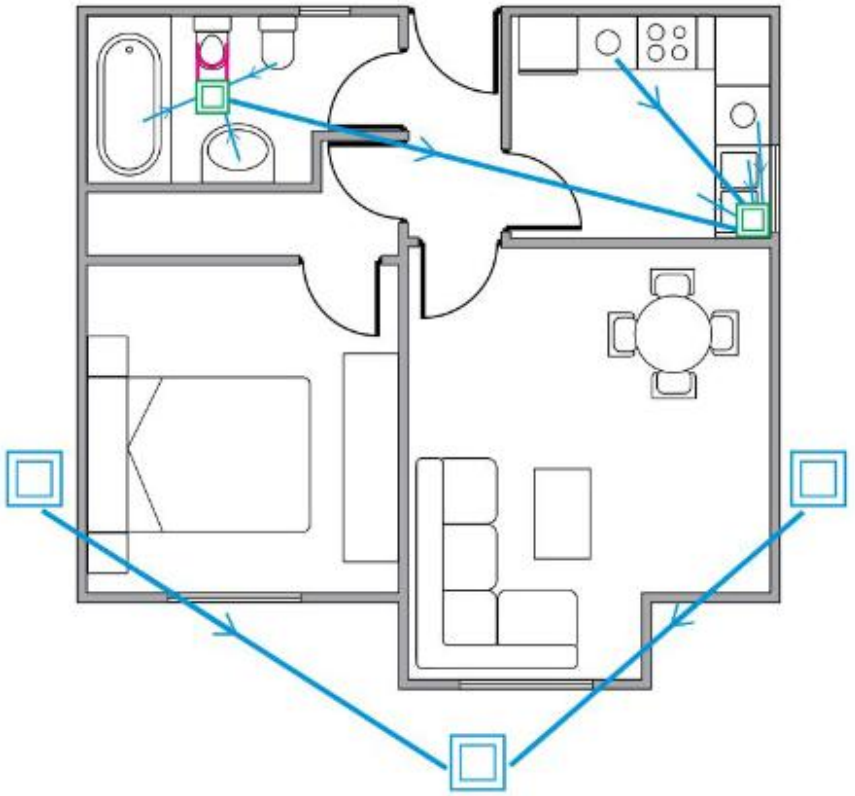
Sometimes, the smooth flow of waste by means of gravity is not possible, for example when the slope is small. This would cause a very slow displacement of liquids that could favour waste sedimentation. On these occasions, pumping stations may be used to elevate the water to higher levels.

Regulations

Device	Symbol	Device	Symbol
Meter (monitors household consumption)		Pump	
Shut-off valve (both general, as well as for the room)		Heater	
Cold water pipe (trunk line and branch line)		Hot water pipe (trunk line and branch line)	
Water intake		Tap	
Drain pipe		Downspout	
Trap		Sewer drain pipe	
Pipe sleeve		Box	
Wastewater trap		Manhole	

Regulations





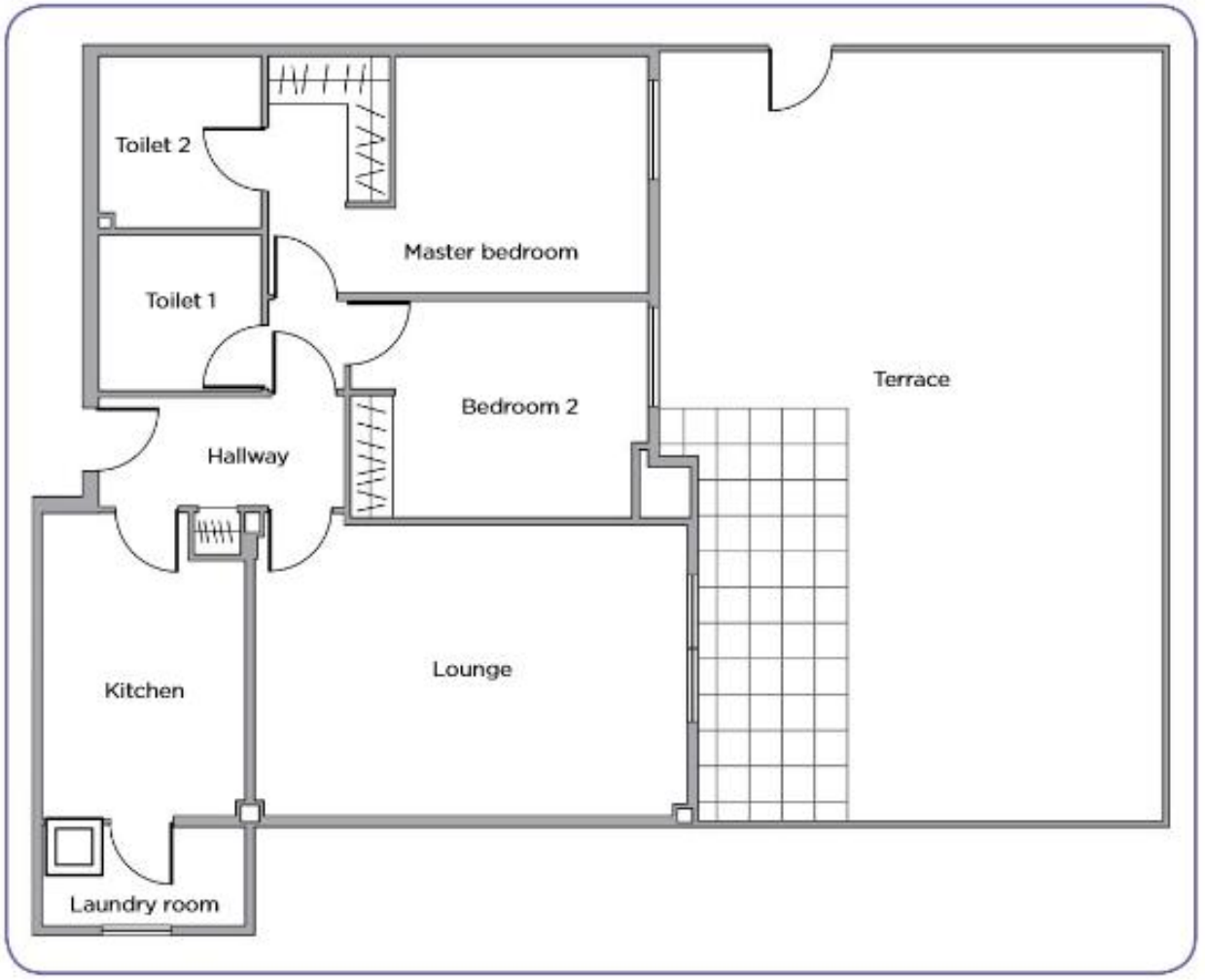
Representation of the water and sewer installations of a house

Regulations

Understand, think, search

1 Draw the plumbing diagram for the house in the drawing, indicating the elements in each room and the cold and hot water pipes.

Consider that the connection, the main valve and the boiler are in the laundry room. Consider the normal service of sinks, washing machine, dishwasher, bath fixtures and watering on the terrace.



The water bill

INVOICE

WACO

INVOICE	
Contract Nº	
INVOICE Nº	

Use: Domestic
Counter Nº: 0123456 Diameter: 20 mm.
Type of supply: SINGLE CONNECTION

READINGS AND USAGE

Period: 01-01-2016 to 01-02-2016
Last reading: 1.050
Current reading: 1.080

Usage
Method of calculation m³
Index difference: 30

INVOICE

Concept:	Amount	VAT amount	Total
Adduction	16.62	1.70	18.62€
Distribution	7.72	0.78	8.50€
Purification	10.10	1.00	11.50€
Sewer system	5.28	0.00	5.28€
Total invoice (euros)	**40.02**	**3.48**	**43.50€**

Total amount to pay **43.50€**

The total amount to be paid indicated on this invoice, will be charged directly to the bank account indicated below. The payment of this invoice does not assume settlement of previous invoices.

Bank	Branch	Account Nº	Name
0000 Bank S.A.	1234	98765432****	Xxxx Xxxxx

- Adduction and distribution.
- Sewer system and purification
- Term of consumption.
- Service fee.
- Value Added Tax (IVA).
- In many municipalities of Spain it’s usual to find an extra tax for urban solid wastes collection.

Efficiency measures

SOME MEASURES TO REDUCE TO DOMESTIC IMPACT ON WATER

Take quick showers instead of baths.

Do not dump oil or toxic substances into drains.

Check that toilets and faucets do not have leaks or drips.

Use the washing machine and dishwasher at maximum capacity and using the economy settings.

Do not leave the water running unnecessarily; for example, while brushing your teeth.

Install a dual-flush toilet and do not use the toilet as a wastebasket.

Place diffusers and other water-saving systems on faucets.