# WATER TREATMENT

## Systems for the purification of waste water and for rainwater harvesting

valsir®

# WATERTREATMENT

## Water: use, treatment, re-use and discharge

Valsir products provide a solution for all the various phases of integrated water cycle management with the priority **objective of guaranteeing the preservation of this precious resource for man and the environment**.

The treatment schemes proposed allow the established limits to be reached for drain into sewers, dispersion in underground pipelines, discharge into a surface water body or into land and possible reuse depending on the specific context.

# SYSTEM ADVANTAGES

## Characteristics of PE

There are various materials for the production of water collection points and polyethylene (PE) is the most appropriate for this application.

## Design

The design criteria used refer to the standards in force and the technical regulations adopted by the national and regional authorities.
The sizing parameters derive from the many years of experience of the Valsir design office and refer to safety-orientated design hypotheses that are confirmed by experience.

**Lightweight**: easily handling during installation.

**Versatility**: thanks to the monoblock structure, use and installation are simplified.

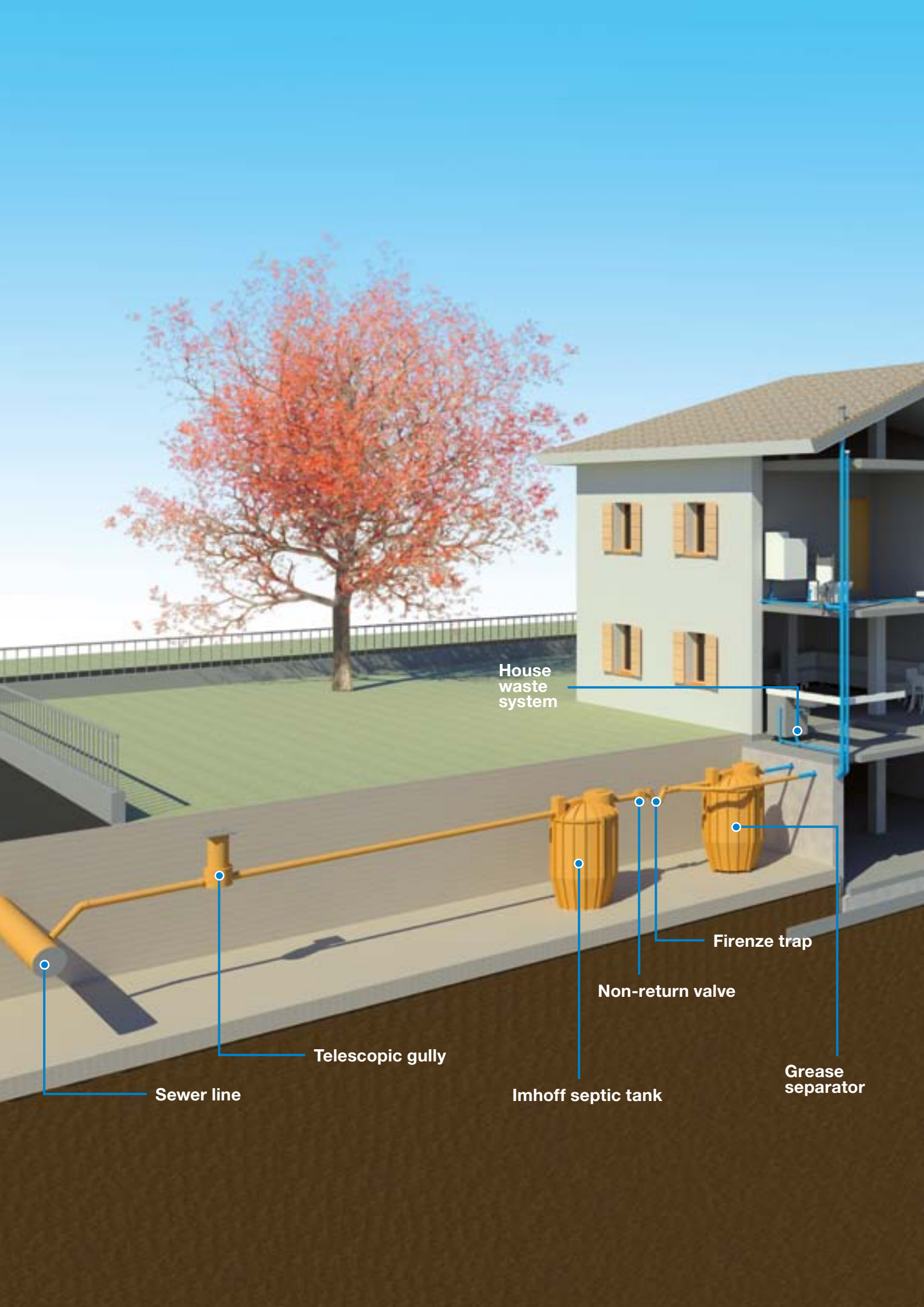
**Flexibility**: individually tailored situation-specific solutions thanks to the wide range of accessories.

**Long service life**: the material does not deteriorate in the presence of chemical substances.

**Competitiveness**: lightweight and monoblock structures make the system extremely competitive especially in plants with a population equivalent up to 325 and a treated surface of 1,000 $m^2$.

## Reference standards

**European Community**
In 1991, European directives stipulated that Member States elaborate programmes and laws for the application of the directive concerning the collection and treatment of wastewater.
Valsir respects the european legislations the above directives.


House
waste
system
Firenze trap
Non-return valve
Telescopic gully
Sewer line
Imhoff septic tank
Grease
separator

# RESIDENTIAL QUARTERS AND SIMILAR

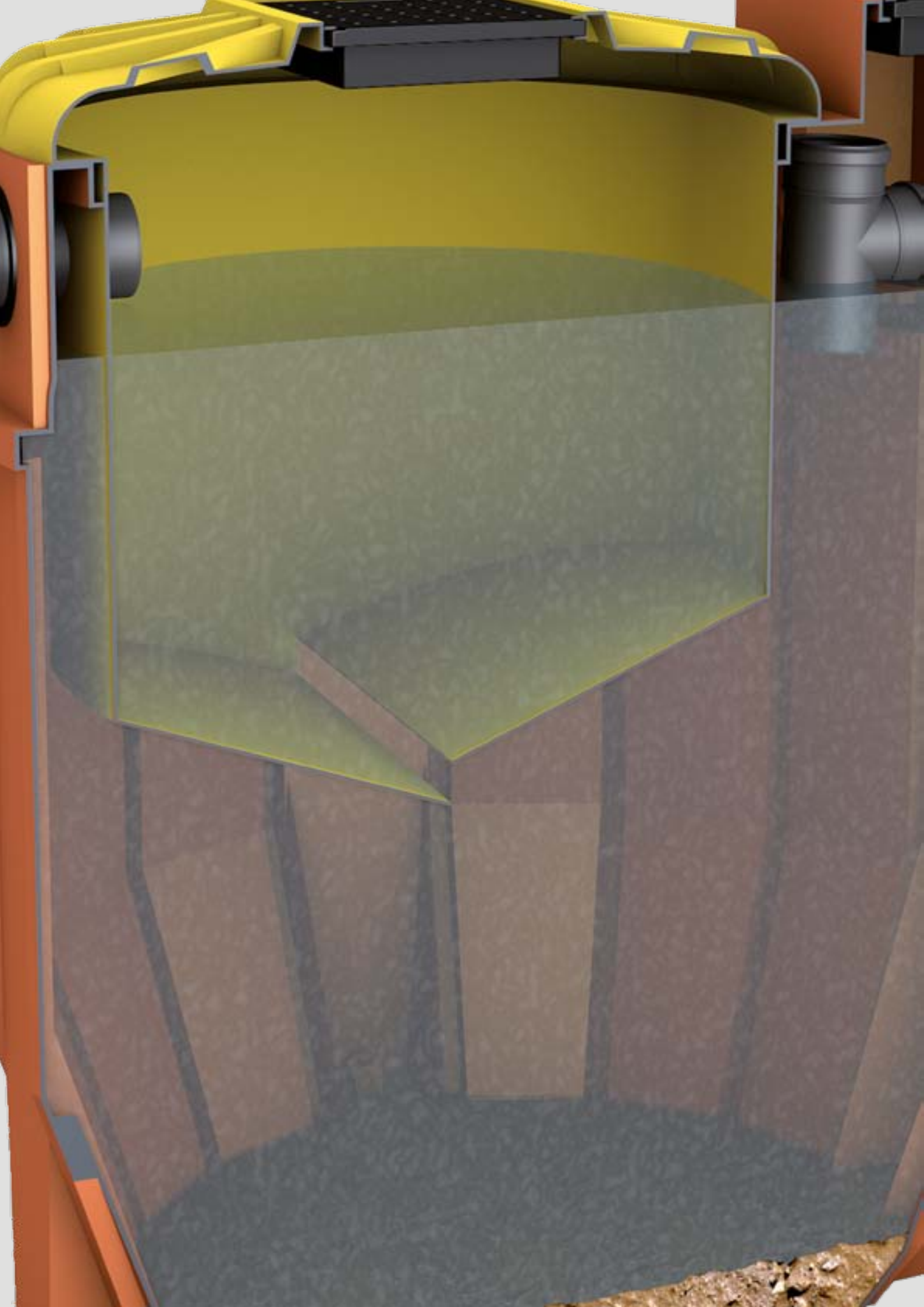
The characteristics of waste water from residential quarters and similar are comparable to those of households. Suitable parameterization coefficients translate the pollutant load from this type of user into “population equivalent”.

The content of the pollutants present is substantially expressed in terms of $BOD_5$* and nitrogen at discharge with the possible presence of suspended solids and floating materials such as fat or oil.
For the treatment of the wastewater from this type of urban settlement there are different system schemes available depending on the type of discharge: discharge into sewers, discharge into receiving water body, dispersion onto land, possible re-use of the treated water, for example, for irrigation.

**Primary treatment** schemes can be used for the removal of sedimentable suspended solids, fats, oil and floating materials when connecting to the sewerage network, in compliance with local regulations and the requirements of the managing entity.

In the case of direct discharge into a receiving body of water there will have to be **secondary treatments** aimed at the reduction of $BOD_5$ below the limits of the law: aerobic or anaerobic percolating filter systems or activated sludge plants.

*$BOD_5$: Expresses the amount of oxygen needed by aerobic microorganisms to break down organic material present in a given water sample so it is an indirect measurement of the bacterially degradable organic substances present in the water.



# PRIMARY TREATMENT

By primary treatment we mean the set of treatments aimed at the removal of macroscopic pollutants present in waste water, intended exclusively for sewage discharges unless otherwise provided for by local regulations.

The coarse and heavy solids, such as sand, soil, gravel, which are sedimentable, are separated by gravimetric sedimentation and collected on the bottom of the treatment tanks.

Light solids, such as fats and oils of alimentary nature or mineral, are instead removed by flotation and yes collect on the liquid surface of the tanks. Primary treatments are mainly made up of physical systems, even if in the tanks can be developed mechanisms of biological degradation of substances removed and decanted on the bottom, in the form of sludge.

Primary treatments include all the process steps that are used to remove suspended sedimentable solids and gravimetric floating solids.

Primary treatment occurs through the use of:

- Grease separator intended for the treatment of residential wastewater containing fats and oils.
- Imhoff biological tank for the clarification of sewage from civil and similar users.
- Septic tank for the treatment of black water free of fats and floating substances.

The combined products, taking into account the regulations and the needs of the end user, allow the construction of plants for primary purification.

The artefacts used consist of tanks of dimensions and geometry designed to favor the settling and / or flotation processes; tanks are generally free of moving parts and electromechanical equipment as the processes that take place there, of a static type, are determined by the gravimetric separation of the solids contained in the waste and having different specific weight.
The tanks have horizontal or vertical shape and capacity from 400 to 12,000 liters designed for use only for underground.

Surface layer: in the inlet area at the top of the tank where oil, emulsified fats, and floating foams are accumulated.

Cover for inspection and cleaning.

Inlet pipe.

Drainage pipe for the collection of the purified sewage. The pipe is positioned at a convenient height from the bottom of the tank in order to collect the purified wastewater.

In the centre of the tank, there is a clarified wastewater area from which the drainage pipe draws.

The coarse suspended solids that have a specific weight greater than that of the liquid, settle on the bottom of the tank by sedimentation.

## Grease removal unit under the sink

For applications where the installation of larger gullies is not possible.

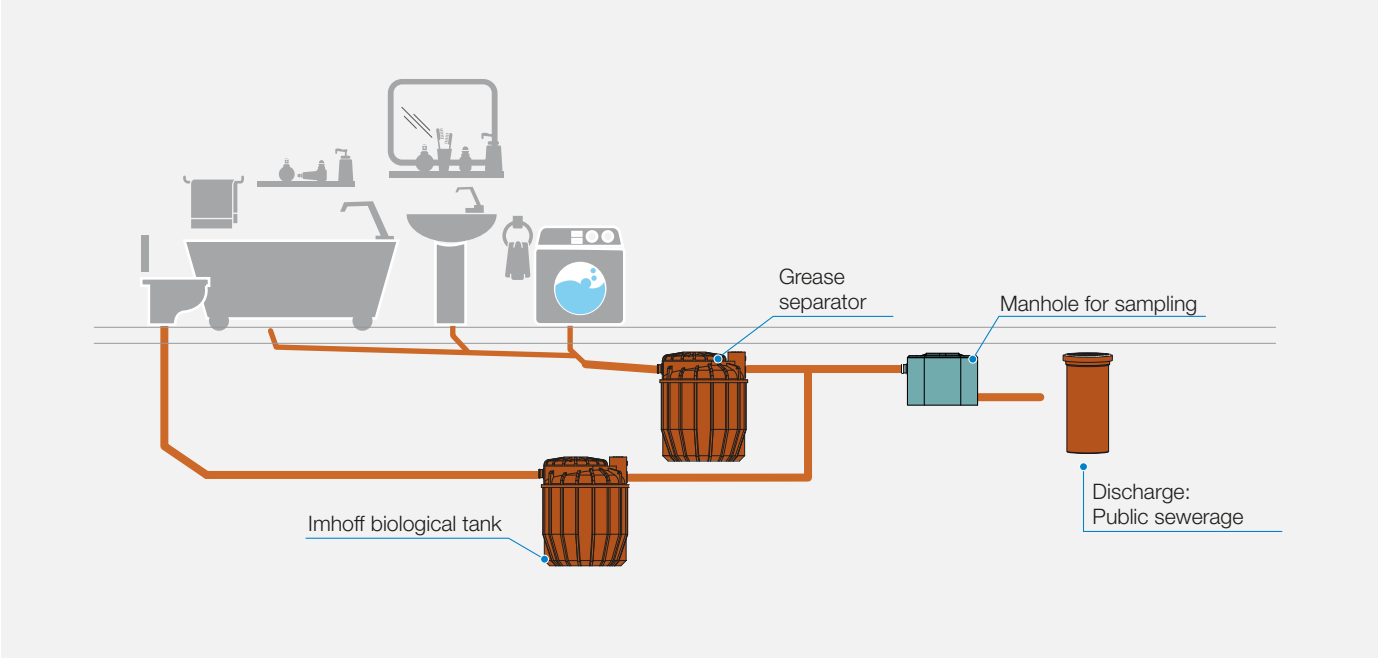
# GREASE SEPARATOR

The grease separator is required in the preliminary stage of the treatment of effluent containing organic fats and oil from residential users or from commercial enterprises with similar wastewater: community kitchens, restaurants, hotels, motorway catering areas, fast food restaurants, steakhouses, and similar.

The polyethylene tank comes integrated with a wastewater inlet and outlet system for the separation of floating materials and the settling of heavier substances.
The product avails of the principle of static settling for the removal of suspended solids with a specific weight greater than that of water and the flotation of the lighter materials that collect on the surface.

The treatment can be intended as a single stage before the effluent wastewater enters the sewer or as an initial stage of a more articulated system, whose aim is the complete purification of the water and final delivery into the receiving body of water or onto land. In this case, the grease separator eliminates all the substances that could interfere with the correct performance of biological purification treatments (anaerobic or aerobic percolators, activated sludge plants).

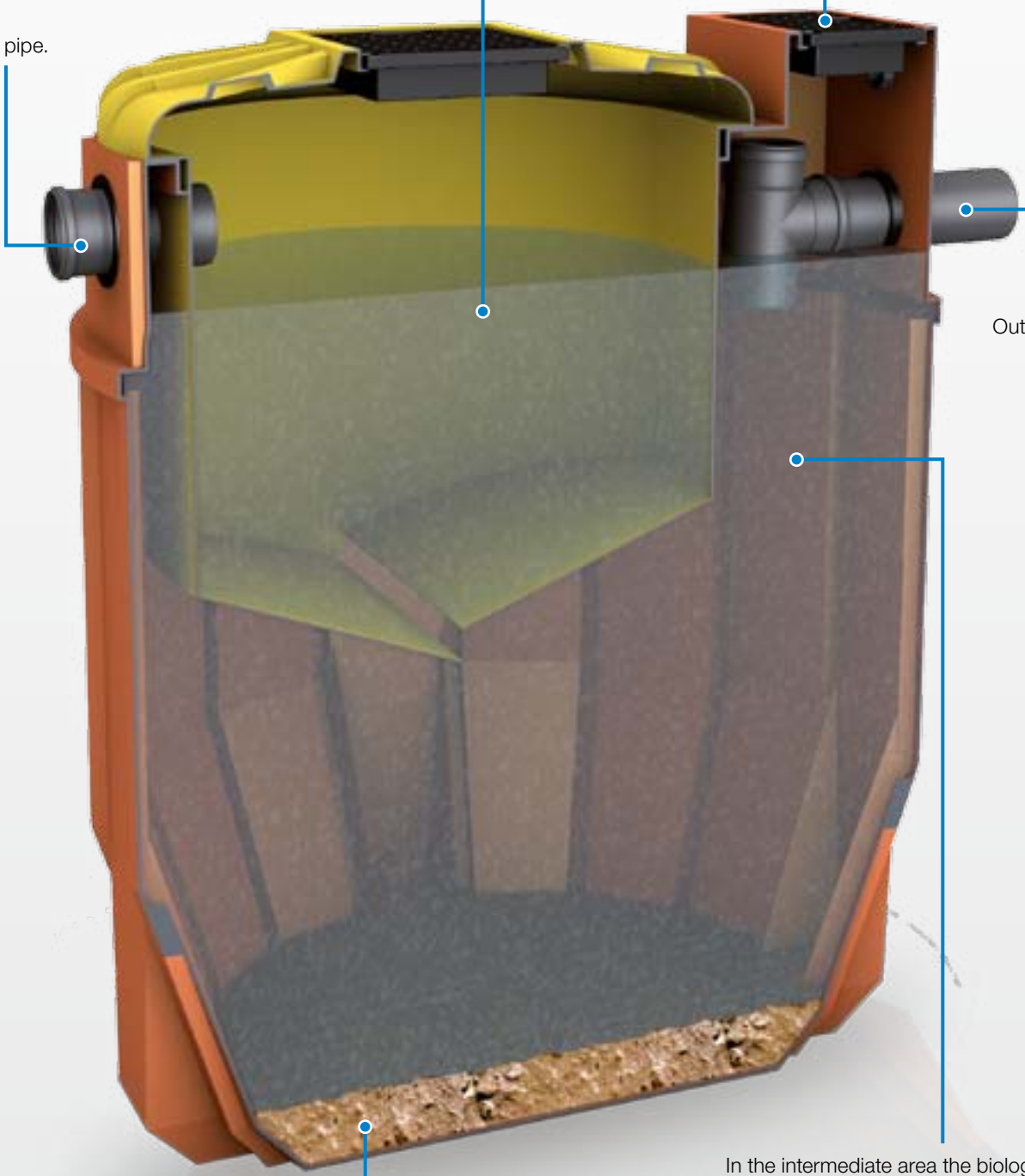
Product range:
- Three-chamber grease separator with a 300 to 900 liter capacity, population equivalent (P.E.) from 5 to 28.
- Vertical grease separator with a 500 to 12,000 liter capacity, population equivalent (P.E.) from 11 to 325.
- Horizontal grease separator with a 1,500 to 5,000 liter capacity, population equivalent (P.E.) from 47 to 157.



On entering, the effluent undergoes a static sedimentation process: the suspended solids with a specific weight greater than that of the water settle on the bottom.

Cover for inspection and cleaning.

Inlet pipe.



Outlet pipe.

In the intermediate area the biological digestion processes of the solid organic substances take place through the assimilation by the microbes present inside the liquid mass. The slurry, at the same time, is clarified before discharge inside a separator cone.

The digested and thickened sludge accumulates on the bottom of the tank, which must be desludged regularly.

# IMHOFF SEPTIC TANK

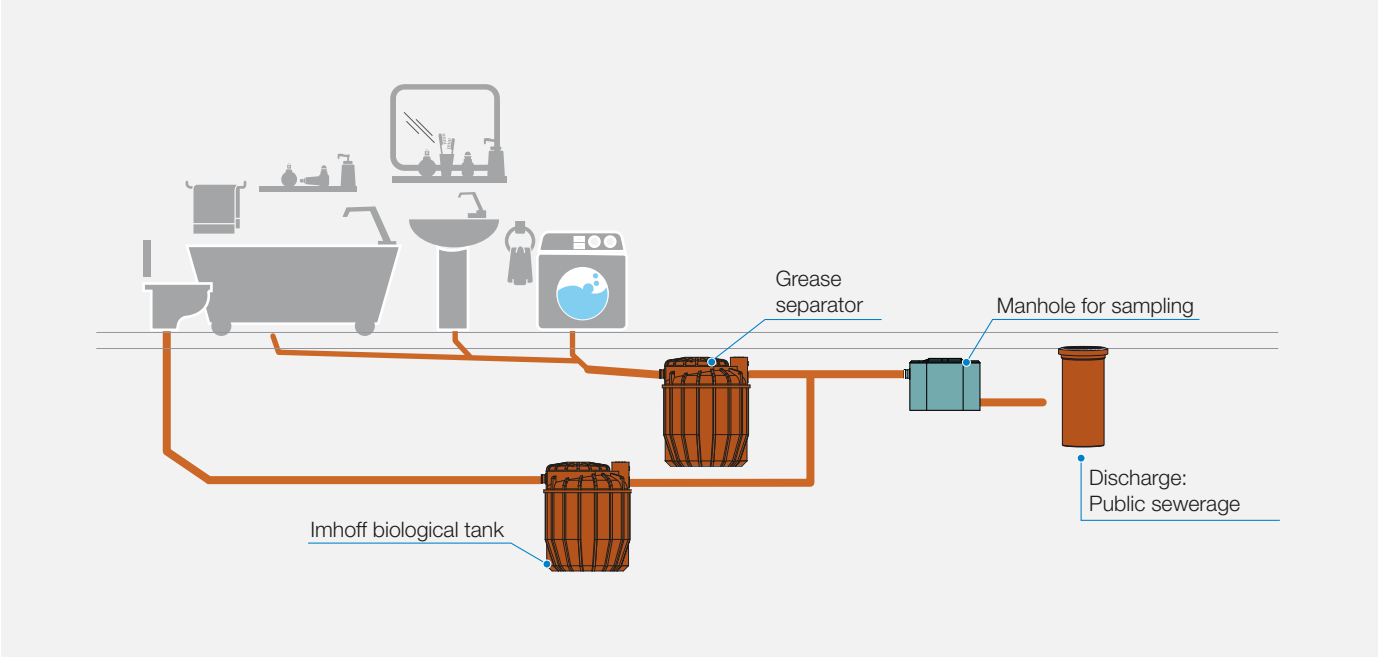
The Imhoff tanks are used to clarify raw sewage coming directly from residential waste systems and similar, such as schools, playschools, restaurants, hotels and communities.

Imhoff septic tanks consist of a suitably dimensioned tank to be installed in the ground and that can be inspected from above: in terms of functioning, the tank is divided into two compartments (hydraulically connected) by means of a suitably shaped internal separation cone, which allows the accumulation and anaerobic digestion of the settled sludge.

Upstream of the Imhoff tank the installation of a grease separator is appropriate to intercept those wastewater effluents (for example from kitchens) containing elevated quantities of floating substances which, if they were to otherwise gather on the surface of the Imhoff tank, would prevent it from functioning correctly. Dimensioning of the Imhoff tank depends on the number of inhabitants (users at discharge).

Product range:

- Vertical tanks with a 500 to 12,000 liter capacity, population equivalent (P.E.) from 2 to 97.




Cover for inspection and cleaning.
Vent, for deflection of the gas that is generated by decomposition of the sludge.
Inlet pipe.
Outlet pipe.
Inlet and calming area, sedimentation and clarification of the effluent, with settling of the coarse suspended solids and any flotation of the floating substances.
Accumulation area on the bottom of the tank with thickening and anaerobic digestion of the accumulated sludge.

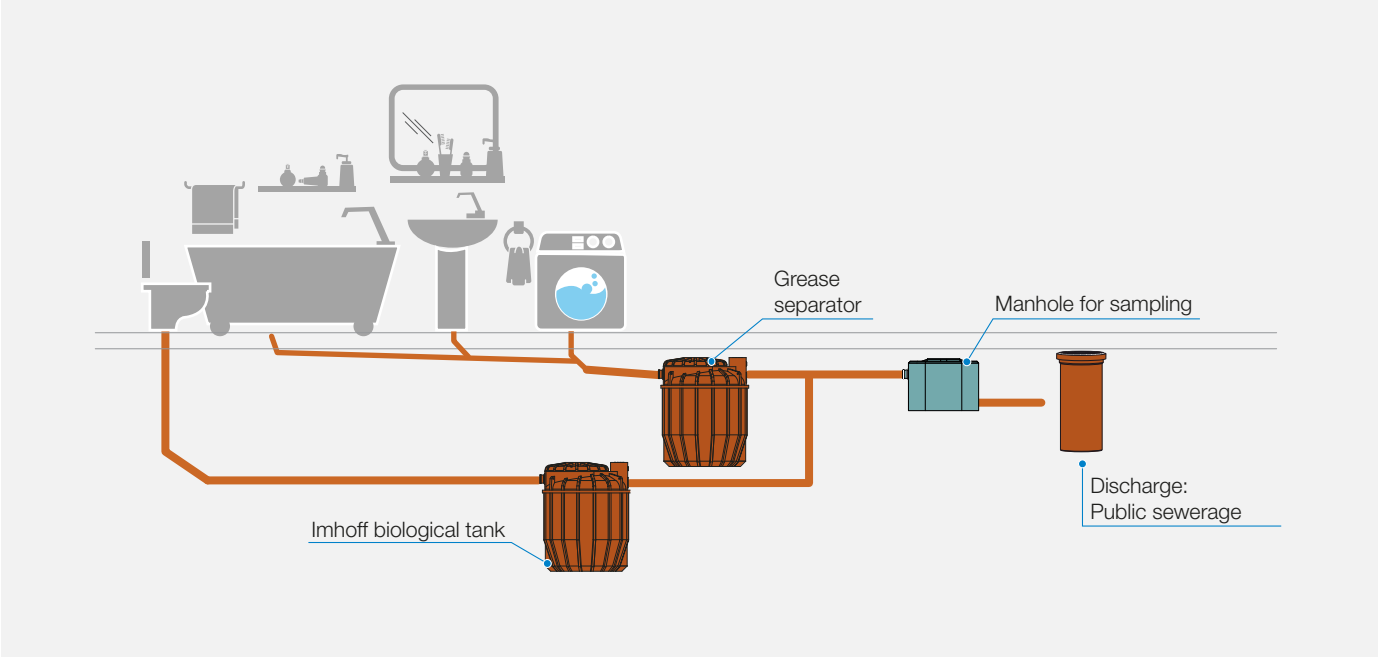
# SEPTIC TANK

Used for the treatment of black water that is substantially free of fats and floating substances, the septic tank consists of a sedimentation tank where static sedimentation of the suspended solids contained in the sewage takes place.

The product does not incorporate any physical separation between the sedimentation section and the anaerobic digestion of the sludge. It is possible to find suspended solids and dissolved residue in the effluent wastewater: for this reason the performance in terms of removal of suspended solids is not as good as the performance of an Imhoff tank of equal potential.

To increase the purification efficiency in terms of reduction of suspended solids, several septic tanks could be installed (two-chamber and three-chamber septic tanks).
The installation of one single septic tank is recommended for occasional use only.
The treatment is always to be considered as a preliminary measure before discharge into the sewer system and/or for use in subsurface irrigation or before proceeding with a subsequent secondary treatment.

Product range:
- Vertical tanks with a 912 to 12,000 liter capacity, population equivalent (P.E.) from 5 to 82.
- Horizontal tanks with a 1,500 to 5,000 liter capacity, population equivalent (P.E.) from 9 to 31.



# SECONDARY TREATMENT

The various secondary treatments put forward aim at the reduction of organic pollution (expressed in terms of $BOD_5$) in effluent wastewater and the simultaneous reduction by bacterial assimilation of the other micro pollutants (phosphorus and nitrogen).

The removal of $BOD_5$ is made possible through biological synthesis by means of bacterial populations whose growth is promoted by the particular conditions and microclimate that are established inside the purification tank, which becomes, in all respects, a biological reactor.

The various treatments proposed differ according to the way in which the biological reactions take place:

- **Suspended biomass** bacterial population grown in the indistinct mass of the reactor.
- **Adherent biomass** bacterial population developed on a solid support consisting of a series of plastic type filling media.

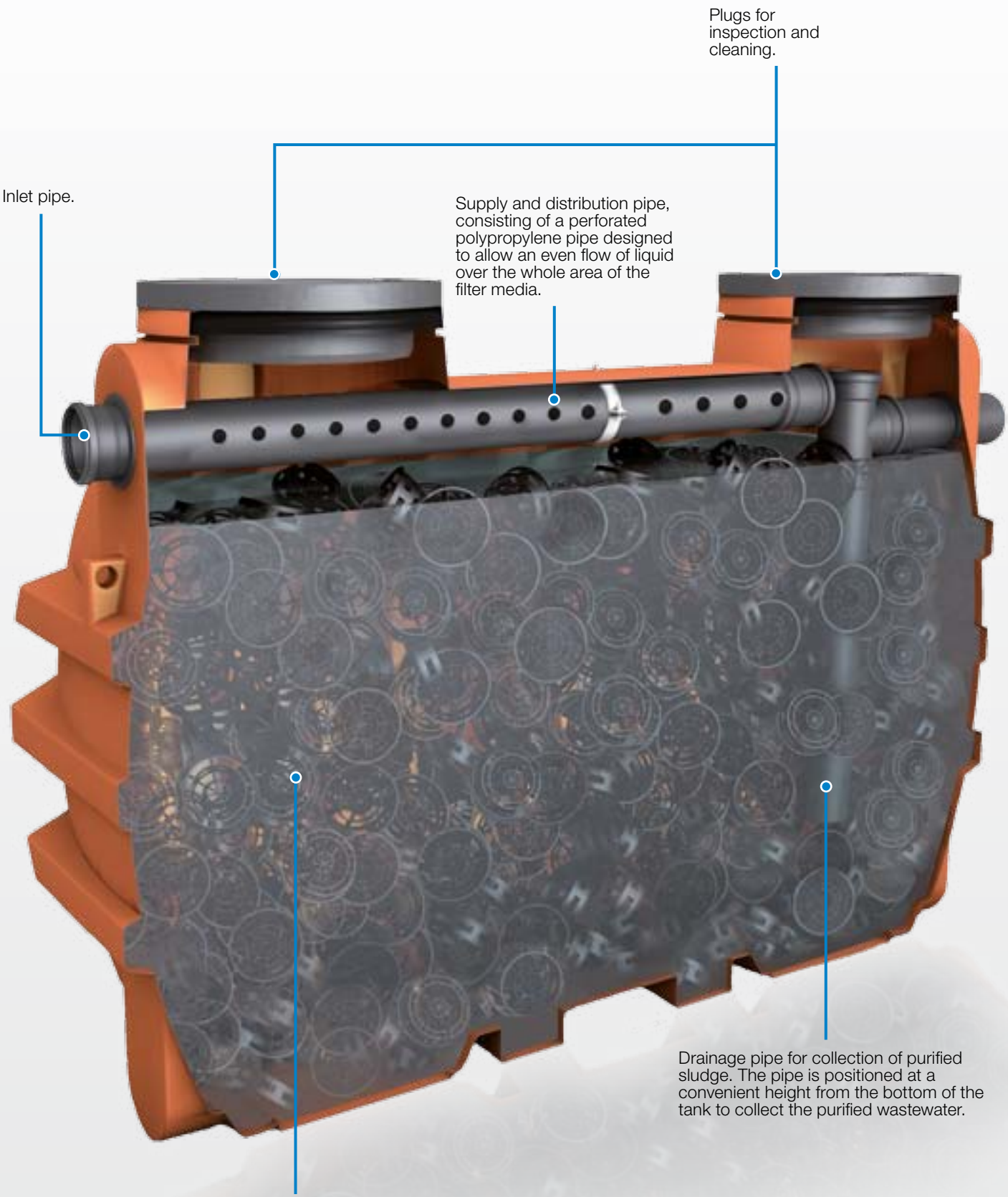
The adoption of a secondary treatment plant is generally preceded by one or more primary treatment units (grease separator, Imhoff, septic tank) aimed at the removal of the solid and coarse floating materials that could otherwise interfere with the correct performance of the biological reactions and with the transfer of oxygen (for aerobic type plants), as well as clogging the pipes and hydraulic connections.

## Treatment plants with percolating filter

This type of plant makes use of a microbial biofilm that grows on the surface of a solid support consisting of filling bodies in plastic. Ideal filter medium optimizes surface area for microbial attachment (expressed in terms of $m^2$ of surface over $m^3$ of filling medium). The bacteria needed for the assimilation of the organic substances grow on the support forming a film the thickness of which increases gradually. The dead bacterial film sloughs off into the liquid flow and subsequently forms part of the secondary sludge.

The following percolating filters are available:

- Anaerobic percolating filter.
- Aerobic percolating filter with natural convection of air.
- Aerobic percolating filter with forced air.


Plugs for inspection and cleaning.
Inlet pipe.
Supply and distribution pipe, consisting of a perforated polypropylene pipe designed to allow an even flow of liquid over the whole area of the filter media.
Drainage pipe for collection of purified sludge. The pipe is positioned at a convenient height from the bottom of the tank to collect the purified wastewater.
Filtering mass consisting of a series of filter media, suitably shaped, made of plastic. The filter media are plastic and are designed to promote the growth of a bacterial film on the surface required for the purification of the water.

# ANAEROBIC PERCOLATING FILTER

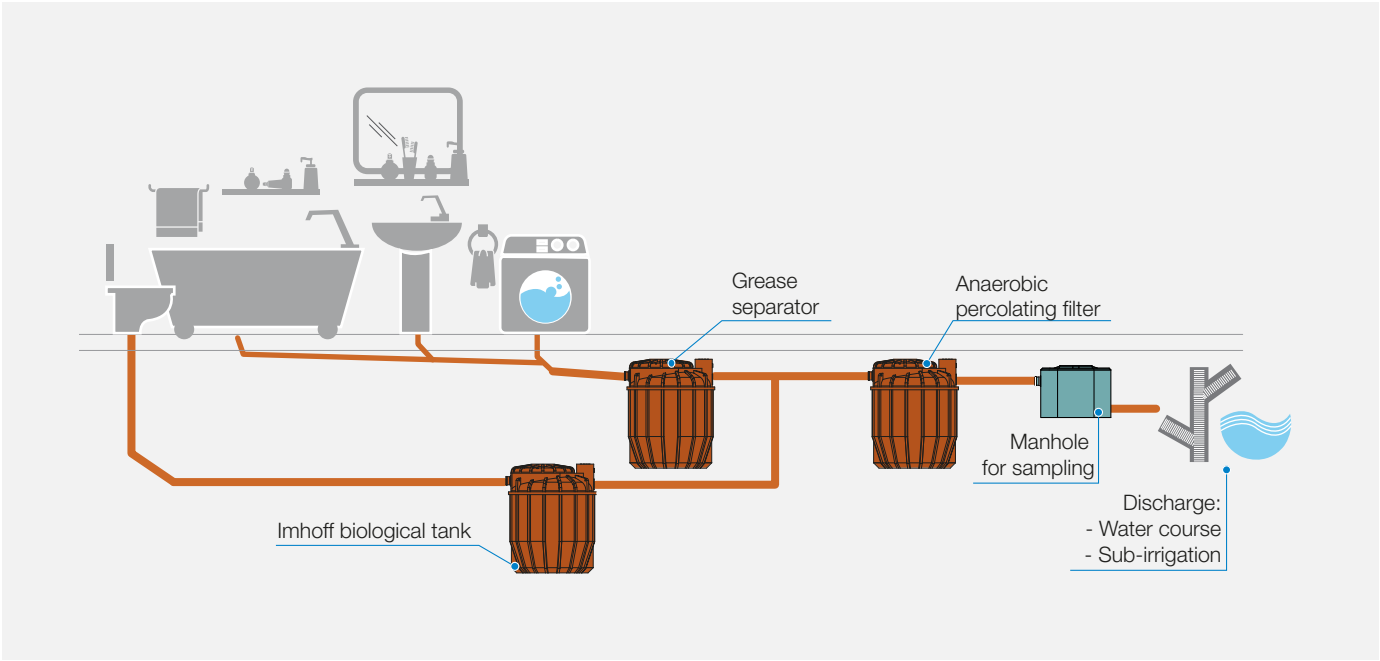
The anaerobic percolating filter is an extremely simple but effective biological purification system (it is completely free of electromechanical elements), which reaches such a high degree of purification that the treated wastewater, predominantly of a domestic or similar origin, can be discharged directly into a surface body of water.

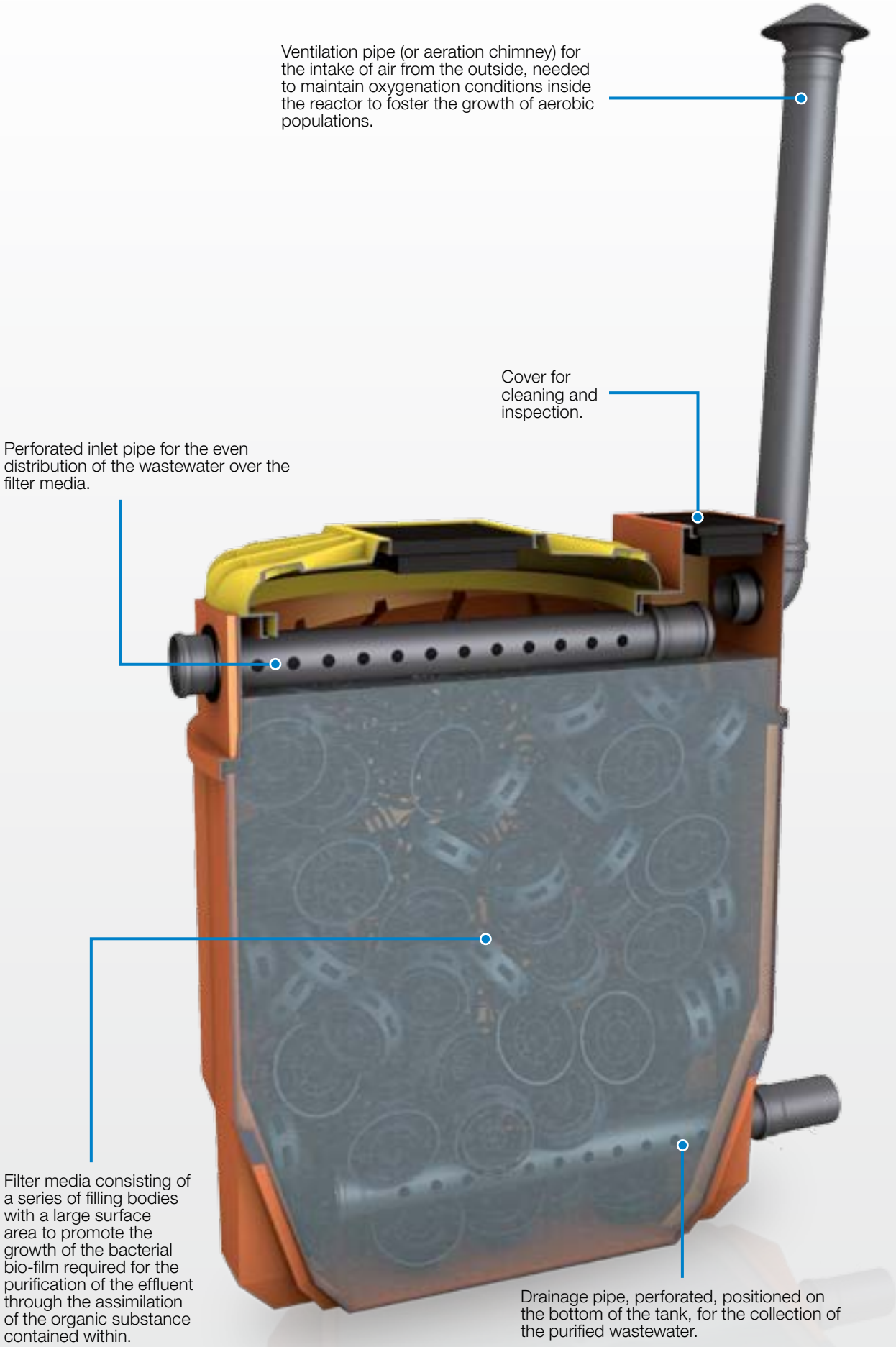
The anaerobic percolating filter is generally installed downstream of an Imfoff tank (to remove the coarse solids that otherwise would obstruct the product by blocking the flow of sewage through the plastic media).

The wastewater enters through a horizontal perforated pipe designed to allow an even flow of liquid over the whole area of filter media, and trickles down through the filter media on top of which a bio-film tends to develop. Inside the reactor, anaerobic type conditions are created (absence of oxygen).

The purified water is drained through a pipe that draws from inside the tank (at an intermediate height between the bottom and the surface).
The combined purification performance (Imhoff - anaerobic percolating filter) is such as to allow the wastewater to be discharged into a surface body of water.

Product range:
- Vertical tanks with a 900 to 12,000 liter capacity, population equivalent (P.E.) from 4 to 64.
- Horizontal tanks with a 1,500 to 5,000 liter capacity, population equivalent (P.E.) from 9 to 31.




Ventilation pipe (or aeration chimney) for the intake of air from the outside, needed to maintain oxygenation conditions inside the reactor to foster the growth of aerobic populations.
Cover for cleaning and inspection.
Perforated inlet pipe for the even distribution of the wastewater over the filter media.
Filter media consisting of a series of filling bodies with a large surface area to promote the growth of the bacterial bio-film required for the purification of the effluent through the assimilation of the organic substance contained within.
Drainage pipe, perforated, positioned on the bottom of the tank, for the collection of the purified wastewater.

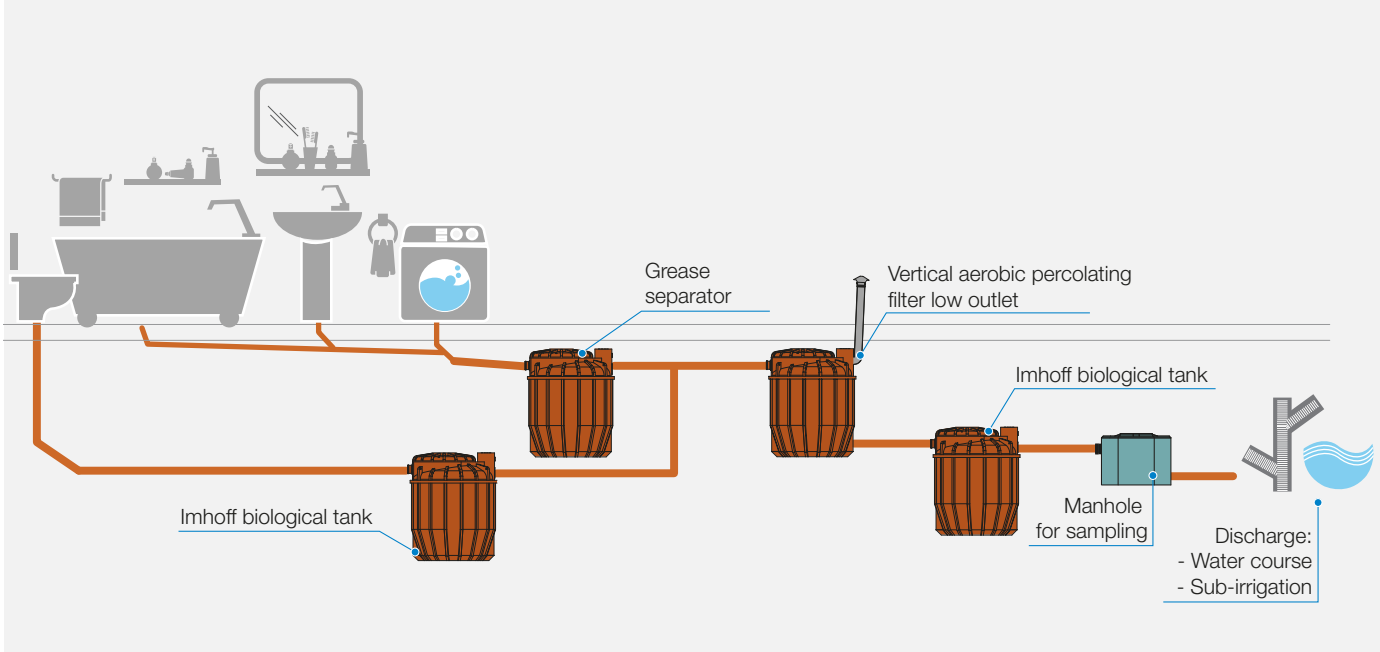
# AEROBIC PERCOLATING FILTER WITH NATURAL CONVECTION OF AIR

The aerobic percolating filter with natural convection of air is an extremely simple biological purification system, free of electromechanical elements, which reaches such a high degree of purification that the treated wastewater, predominantly of a domestic or similar origin, can be discharged directly into a surface body of water. The aerobic percolating filter is generally installed downstream of a grease separator and an Imfoff tank.

The combined purification performance of the system (Imhoff - aerobic percolating filter - Imhoff) is such as to allow the wastewater to be discharged into a surface body of water.

Product range:

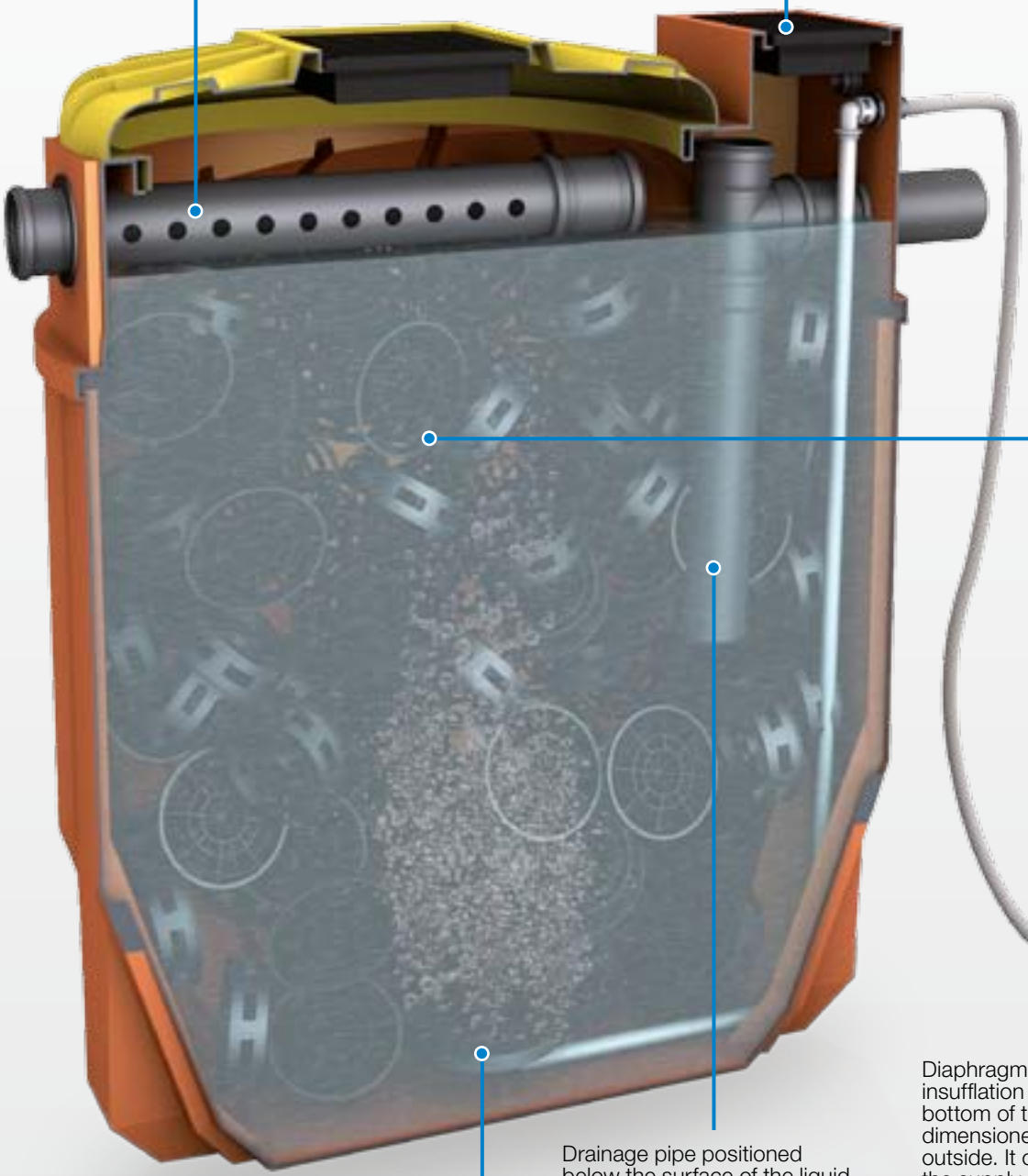
- Vertical tanks with a 900 to 3,700 liter capacity, population equivalent (P.E.) from 2 to 20.
- Horizontal tanks with a 1,500 to 5,000 liter capacity, population equivalent (P.E.) from 9 to 31.



Perforated inlet pipe for the even distribution of the wastewater over the filter media.

Cover for cleaning and inspection.

Filter media consisting of a series of filling bodies suitably shaped to promote the growth of the bacterial bio-film required for the purification of the effluent through the assimilation of the organic substances contained within.



Diaphragm blower for the insufflation of air on the bottom of the tank, suitably dimensioned and positioned outside. It conveys air through the supply pipe inside the tank.

Drainage pipe positioned below the surface of the liquid for collection of the purified wastewater.

Diffusor of micro-bubbles for the delivery of blown air below the filter media.
It consists of a plastic plate (EPDM) with high deformability and a high transfer efficiency of oxygen to the liquid mass.

# AEROBIC PERCOLATING FILTER WITH AIR INSUFFLATION

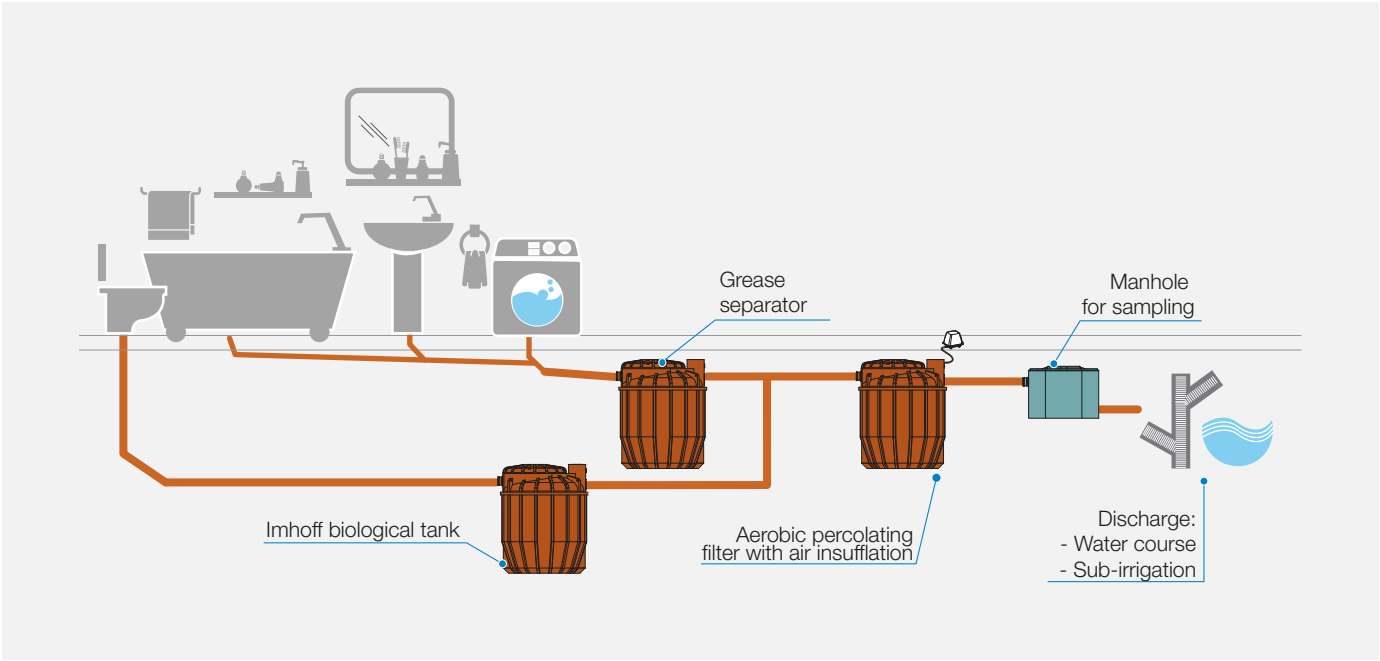
The aerobic percolating filter with forced air is a biological purifying system that reaches such a high degree of purification that the treated wastewater, predominantly of a domestic or similar origin, can be discharged directly into a surface body of water.

The aerobic conditions of the filter media are guaranteed by the insufflation of external air using a volumetric blower.

The aerobic percolating filter with forced air is generally installed downstream of an Imfoff tank. The combined purification performance of the system (Imhoff - aerobic percolating filter with forced air) is such as to allow the wastewater to be discharged into a surface body of water.

Product range:

- Vertical tanks with a 900 to 12,000 liter capacity, population equivalent (P.E.) from 2 to 64.
- Horizontal tanks with a 1,500 to 5,000 liter capacity, population equivalent (P.E.) from 9 to 31.



Drainage pipe positioned just below the surface of the liquid for collection of the purified wastewater.

Inlet pipe.

Cover for cleaning and inspection.

Diaphragm blower for the insufflation of air on the bottom of the tank. The electrical blower, of suitable dimensions and capacity, is positioned outside and conveys air through the supply pipe into the tank.

Oxygenation area in which the sewage is oxygenated and mixed in order to achieve the assimilation of the organic substance contained within it.

Micro-bubble diffusor for the delivery of the flow of air blown onto the bottom of the tank. It consists of a highly deformable plastic plate (EPDM) with a high transfer efficiency of the oxygen to the liquid mass.

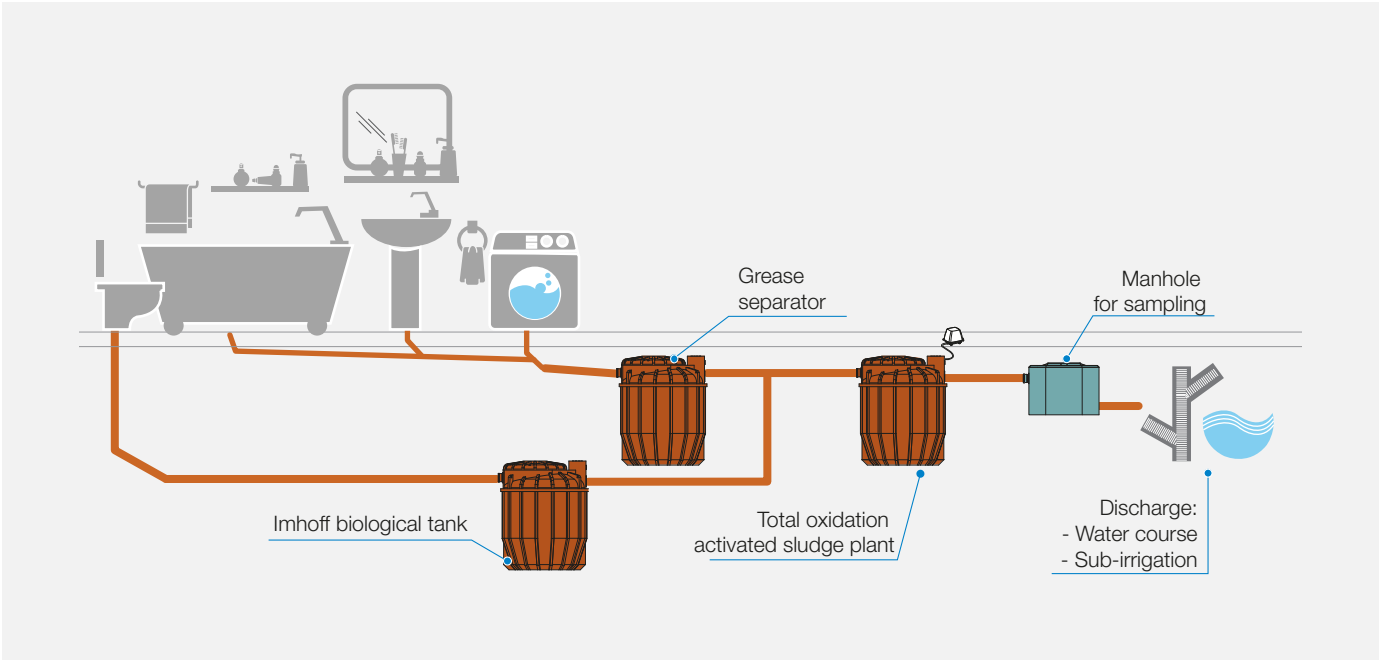
# TOTAL OXIDATION ACTIVATED SLUDGE PLANT

The total oxidation activated sludge plants are complete systems for the treatment of wastewater for small communities used to create the conditions needed for the assimilation and removal of the organic substances and the almost compete oxidation of the biomass produced.
The purified wastewater can be discharged directly into a receiving body of water.

The insufflation of air from the bottom of the tank using porous fine-bubble diffusers fed by an external source (blower) allows the development and acclimatization of the bacterial populations capable of synthetizing the organic substances dissolved in the sludge.

The total oxidation activated sludge plant is generally installed downstream of a grease separator.
For the removal of coarse and non-biodegradable solids, it may be convenient to install an Imhoff tank upstream of the entrance to the oxidation compartment.

Product range:
- Vertical tanks with a 900 to 12,000 liter capacity, population equivalent (P.E.) from 2 to 41.
- Horizontal tanks with a 1,500 to 5,000 liter capacity, population equivalent (P.E.) from 6 to 20.




Bypass gully
Sand trap
Coalescence filter
Inspection chamber
Sewer pipe

# APPLICATIONS FOR NON RESIDENTIAL USES

The modular treatment tanks manufactured by us can be used by non-residential users such as workshops, service stations, car washes, for the treatment of stormwater from car parks, yards, and sealed surfaces.

The wastewater coming from these buildings and areas is characterised by the presence of oil and hydrocarbons, as well as heavy solids such as sand and gravel.
According to the type of user being served, residues of detergents and suspended solids can also be found.
The requirements of the managing bodies of the sewer networks and the regional regulations require the adoption of a preliminary treatment for the removal of oil and floating substances present in the stormwater from car parks and waterproof yards.

For the treatment of wastewater from this type of source, plant schemes are necessary that substantially involve oil extraction treatments for the removal of hydrocarbon films and floating substances and sand removal treatments for the removal of sands and sedimentable suspended solids.

The systems are differentiated according to the type of discharge envisaged: discharge into a sewer, drainage into a receiving body of water, dispersion onto land, the possible re-use of the treated water.

## First rainfall (car parks, petrol stations)

The water from first rainfalls consists of stormwater collected and conveyed from yards and waterproof surfaces during the first phases of rainfall (water from the first rainfall is defined as the first 5 mm of rainfall that conventionally is assumed to be collected during the initial 15 minutes of the downpour).


Cover for inspection and cleaning.
Inlet pipe.
Outlet pipe.
The elements (sand) having a specific weight greater than that of the liquid settle on the bottom of the tank by sedimentation.

# SAND TRAP

The sand trap is essential in the treatment of storm and rainwater containing coarse solid particles that settle easily by gravity, such as soil, gravel, solid particulate.

A sand trap must always be installed upstream of an oil separating system with a coalescence filter. This system is used for the collection of stormwater from uncovered car parks and/or yards. The coarse particles contained in the stormwater must be gathered in the sand trap to avoid interference with the correct functioning of the coalescence filter.

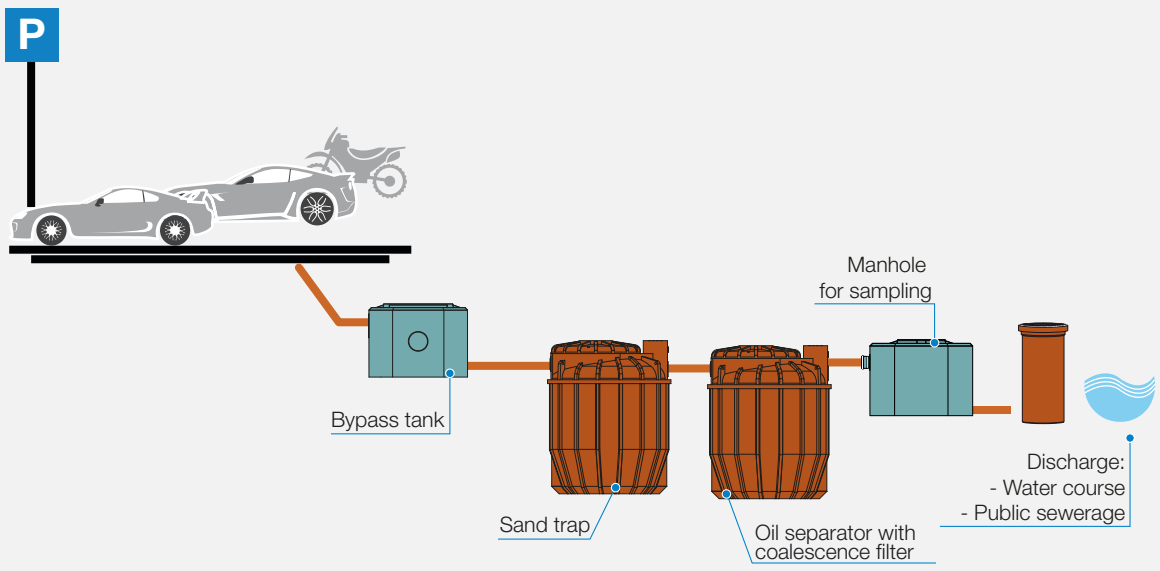
The polyethylene container incorporates an inlet and outlet system of the wastewater that is suitable for the setting of the heavy substances; there is also a reduction of the oil content, which gathers forming a film on the surface.

This product exploits the principle of static settling for the removal of suspended solids that have a specific weight greater than that of the water and the flotation of light materials that gather on the surface.

This treatment can be intended as a single stage or as the initial phase of a more articulated system aimed at the purification of the water.

Product range:

- Vertical tanks with a 900 to 12,000 liter capacity, and a treated surface of 280 to 10,100 $m^2$.
- Horizontal tanks with a 1,500 to 4,700 liter capacity, and a treated surface of 800 to 5,000 $m^2$.



Calming and oil accumulation area; immediately following inlet into the tank, thanks to its particular conformation, the wastewater is smooth and this facilitates the flotation of floating materials that gather on the surface of the water.

Cover for inspection and cleaning.

Inlet pipe.

Outlet pipe that draws from the centre of the tank at an appropriate height both away from the layer of floating substances on the surface and from the bottom where the settling sludge is gathered.

Sludge and sediment accumulation area. The sludge and settled coarse solids accumulate on the bottom where they must be flushed out periodically.

# CLASS 2 GRAVITY OIL SEPARATOR

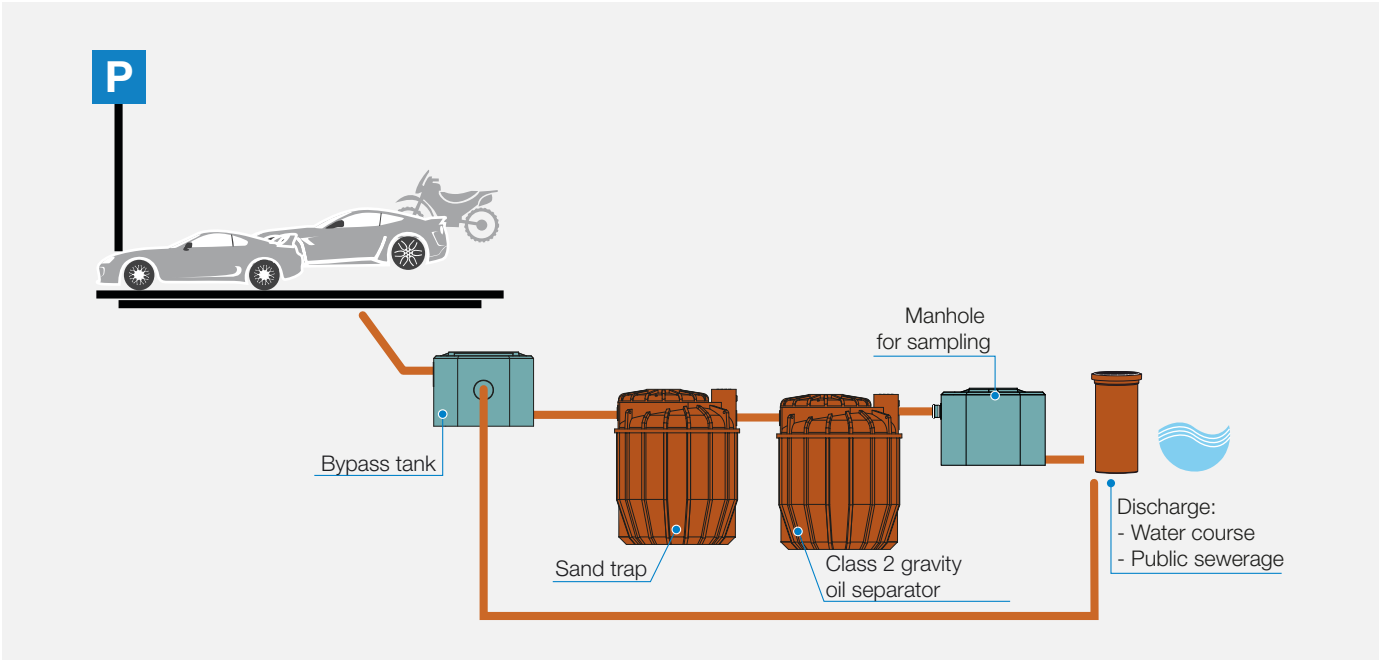
It consists of a simple polyethylene tank for accumulation and calming with a suitably shaped septum inside to facilitate the settling of the heavier solids.

The static oil separator is a de-oiling gravity system that allows the treatment and elimination of non-emulsified oil and hydrocarbons having a specific weight lower than 0.85 g/cm$^3$ from the waste water effluent, by means of a static separation with an efficiency of > 90%.

The system is used in the treatment of water coming from uncovered yards, car parks, workshops, car washes, service stations.

The water collected by the drainage network is discharged directly into the oil separating tank; once the oil and sedimentable materials are separated, the purified water is discharged into the sewer.
A gully is fitted downstream for sampling (by the regulatory bodies) and verification of quality standards before it is discharged into the sewer system.

Product range:
- Vertical tanks with a 900 to 12,000 liter capacity, and a treated surface of 180 to 8,500 m$^2$.
- Horizontal tanks with a 1,500 to 5,000 liter capacity, and a treated surface of 480 to 4,110 m$^2$.

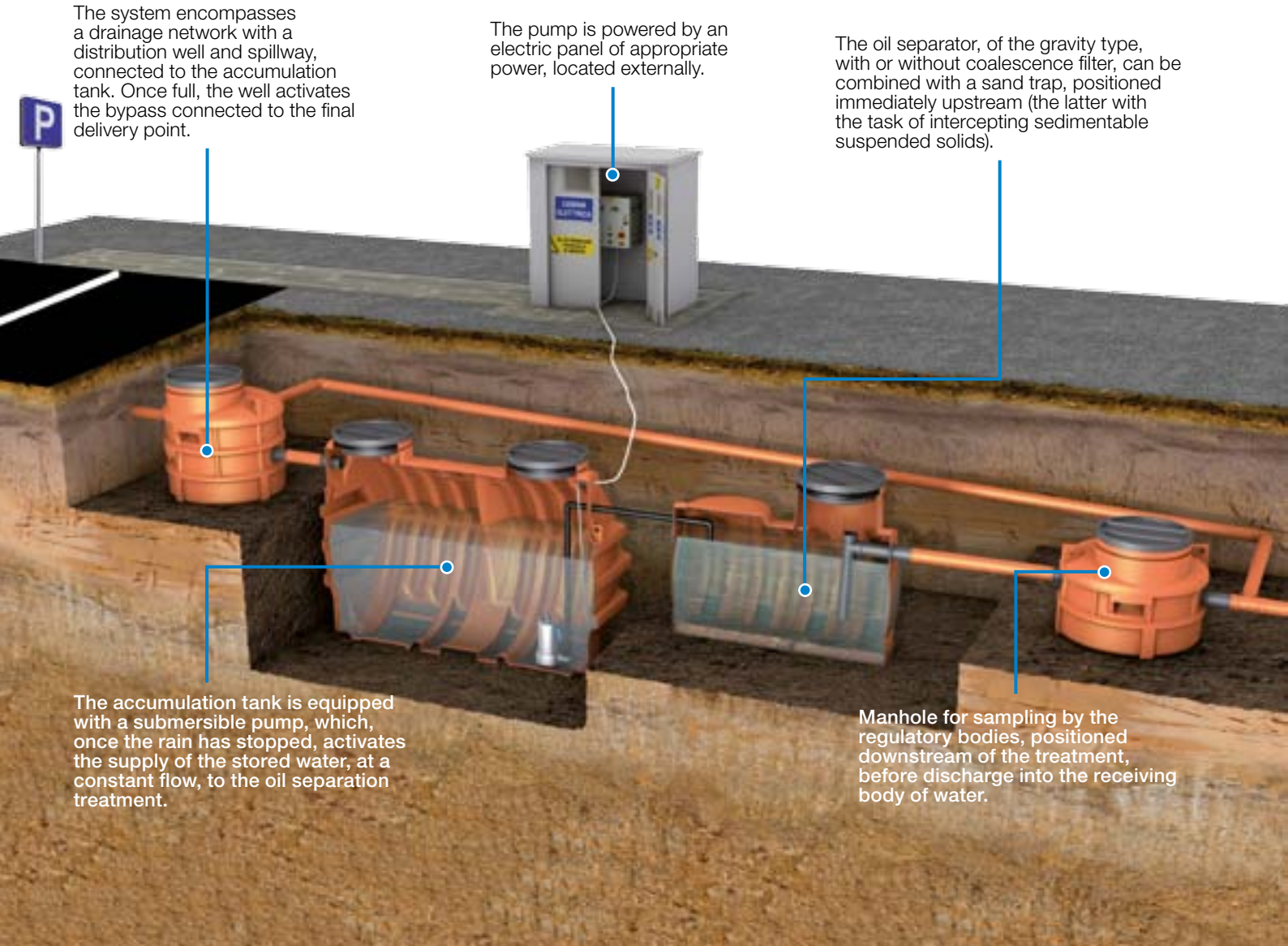


# OIL SEPARATOR WITH SAND TRAP AND TANK

This plant scheme involves the combination of a common oil separator/sand trap with an accumulation tank, suitably dimensioned and positioned immediately upstream of the oil separator.

The purpose is to create, especially in the case of vast drainage areas, a storage tank to hold the water so that the oil separator can be dimensioned without having to take into account the value of the instantaneous flow of rainwater, this avoiding the selection of an excessively large product.

The accumulation tank allows the storage of the first rainfall: normally a storage volume is calculated equal to the first 5 mm of rainfall that is drained in 15 minutes from the waterproofed surface.



# TANKS FOR WATER COLLECTION

The tanks include a series of products in polyethylene, of various shapes and sizes, used for the collection and storage of rainwater.
The entire range includes tanks for installation above ground and underground. The rainwater that is collected can be used for irrigation purposes, for feeding non potable dual networks (e.g. flush cisterns), or as a fire-fighting reserve.

The tanks for underground installation are ribbed to guarantee greater seal and resistance.

Product range:
- External:
  - Horizontal cylindrical with storage volume between 500 and 12,600 liters.
  - Vertical cylindrical with storage volume between 500 and 5,250 liters.
  - Cubic with storage volume between 200 and 500 liters.
- Underground installation with storage volume between 1,500 and 12,000 liters.

Tanks for the collection of rainwater.

# CUSTOMER SERVICE

## Technical support

Valsir provides complete support during design and on site, thanks to a high-level technical department that consists of a team of engineers with international experience that are capable of providing solutions to all installation needs.



## Valsir Academy

Valsir has an important training facility - **Valsir Academy** - dedicated to clients, distributors, plumbers and planners that provides perfectly equipped courses, theoretical and practical courses on the use and the design of plumbing and heating systems. Courses are provided both inside the training facility and on customers' premises.

# QUALITY AND ENVIRONMENT

## Quality

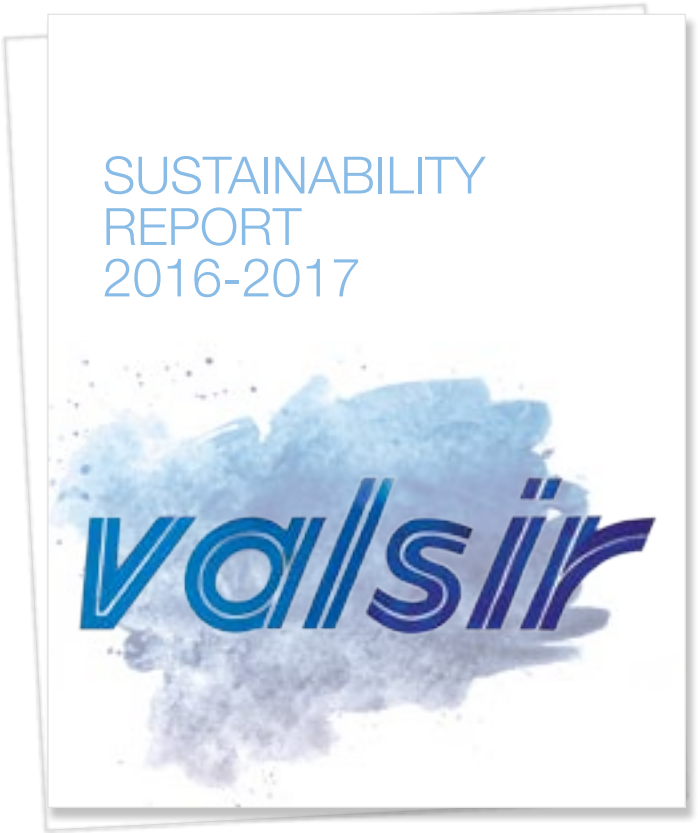
The ongoing commitment of Valsir to the creation of high quality products is demonstrated by over **200 product approvals** obtained around the world from the most strict certification bodies (figure updated on 01/02/2019), by the Quality Management System that is certified in compliance with **UNI EN ISO 9001:2008** and the Energy Management System that is certified in compliance with International Standard **UNI EN ISO 50001:2011**.
Valsir S.p.A. further demonstrates its commitment to the environment obtaining the **ISO 14001:2015** certificate to the productive site in Vestone.

## Sustainability

Efficient processes and reliable products are no longer the only parameters used to perform an assessment of the quality of a company's conduct: the capacity of the company and its management to design and implement production process that are sustainable from an environmental point of view is of equal importance.

Valsir has started a project of Corporate Social Responsibility and has published its 2nd Sustainability Report that gathers facts and figures relating to the daily commitment of Valsir in terms of social, economic and environmental responsibility.

For more information, download here the 2nd Sustainability Report.

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