



DOMESTIC SEWAGE TREATMENT SYSTEMS

50 Hz



DEPURBOX SERIES

EDITION 03-2005

Lowara



ITT Industries
Engineered for life

Domestic sewage treatment systems

DEPURBOX Series



MARKET SECTORS

RESIDENTIAL

APPLICATIONS

- Disposal of domestic sewage where a public sewer system is not accessible.



SPECIFICATIONS

- Depurbox is a range of compact, **activated sludge** treatment systems that enable discharge of domestic wastewater (greywater and blackwater) in accordance with EEC Directive 91/271. The treated effluent can be discharged directly into the **sewer system** or into **surface water** or the **ground** (subsequent to optional tertiary treatment).
- The system consists of:
 - a one-piece basin made of **fibreglass-reinforced polyester resin**;
 - three separate chambers corresponding to the three stages of the treatment process: **primary settlement, oxygenation** and **secondary settlement**;
 - a **Domo 7 VX single-phase electric pump** with Vortex impeller for effluent handling and oxygenation;
- a **Venturi** oxygenation system which, together with the electric pump, ensures a typical treatment efficiency of **90%**;
- a **timer** for setting the required operating cycles;
- DN 100 inlet and outlet piping made of PVC
- Three sizes available:
 - Basic Depurbox**, for population equivalent of up to 5 people;
 - Maxi Depurbox**, for population equivalent of up to 10 people, featuring a separate primary settlement tank;
 - Depurbox Duo**, for population equivalent of up to 20 people, with separate double tank and primary settler.
- **Quick and easy installation:** just prepare the excavation, position Depurbox, make the hydraulic and electrical connections (single-phase), then complete the installation and by positioning the external air intake and inspection accesses.
- **Easy maintenance:** just check the condition of the sludge at periodic intervals and, if necessary, empty the basin.

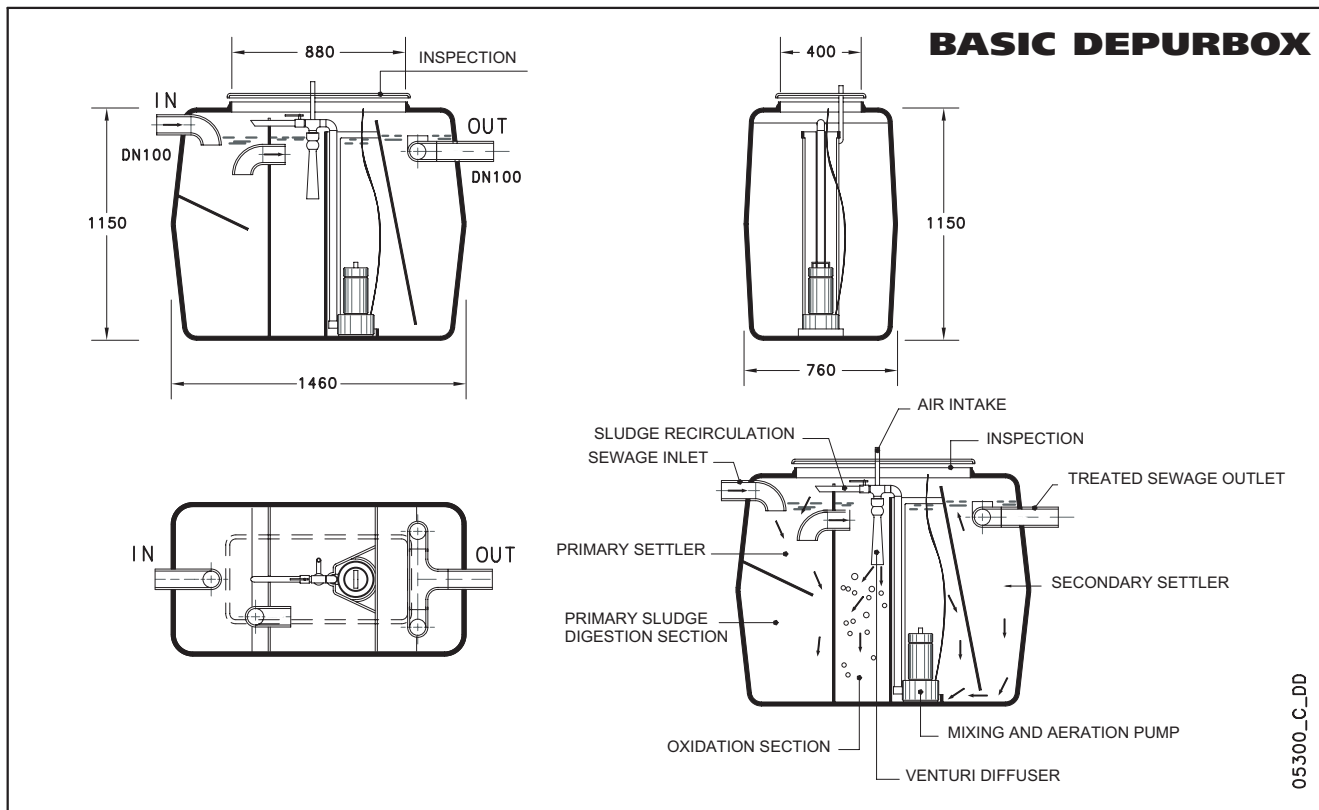
DEPURBOX SERIES SPECIFICATIONS

OPERATING PARAMETERS	Unit of measurement	MODEL		
		BASIC	MAXI	DUO
Type of premises		RESIDENTIAL		
Number of inhabitants (Population Equivalent)	up to	5	10	20
Per capita water supply	litres/head/day	200		
Daily discharge volume	m ³	1	2	4
Total useful volume	litres	1150	2050	3770
Primary settlement volume	litres	200	900	1470
Oxidation-nitrification volume	litres	750	950	1900
Secondary settlement volume	litres	200	200	400
Primary settlement time	hours	~ 1	~ 2	~ 2
Secondary settlement time	hours	> 2		
Settlement rising speed	m/h	0,3		
Average flow per hour	l/h	60	125	250
Maximum flow per hour	l/h	120	250	500
Pump power	W	550	550	1100
Daily organic load	kgBOD ₅ /day	0,3	0,6	1,2
Volumetric organic load	kgBOD ₅ /m ³ day	0,4	0,63	0,63
Supplied oxygen factor	kgO ₂ /kgBOD ₅	> 2,5		
Organic pollution	gBOD ₅ /head/day	60		
BOD ₅ concentration (outlet)	mg/l	< 30		
Treatment efficiency	%	90		

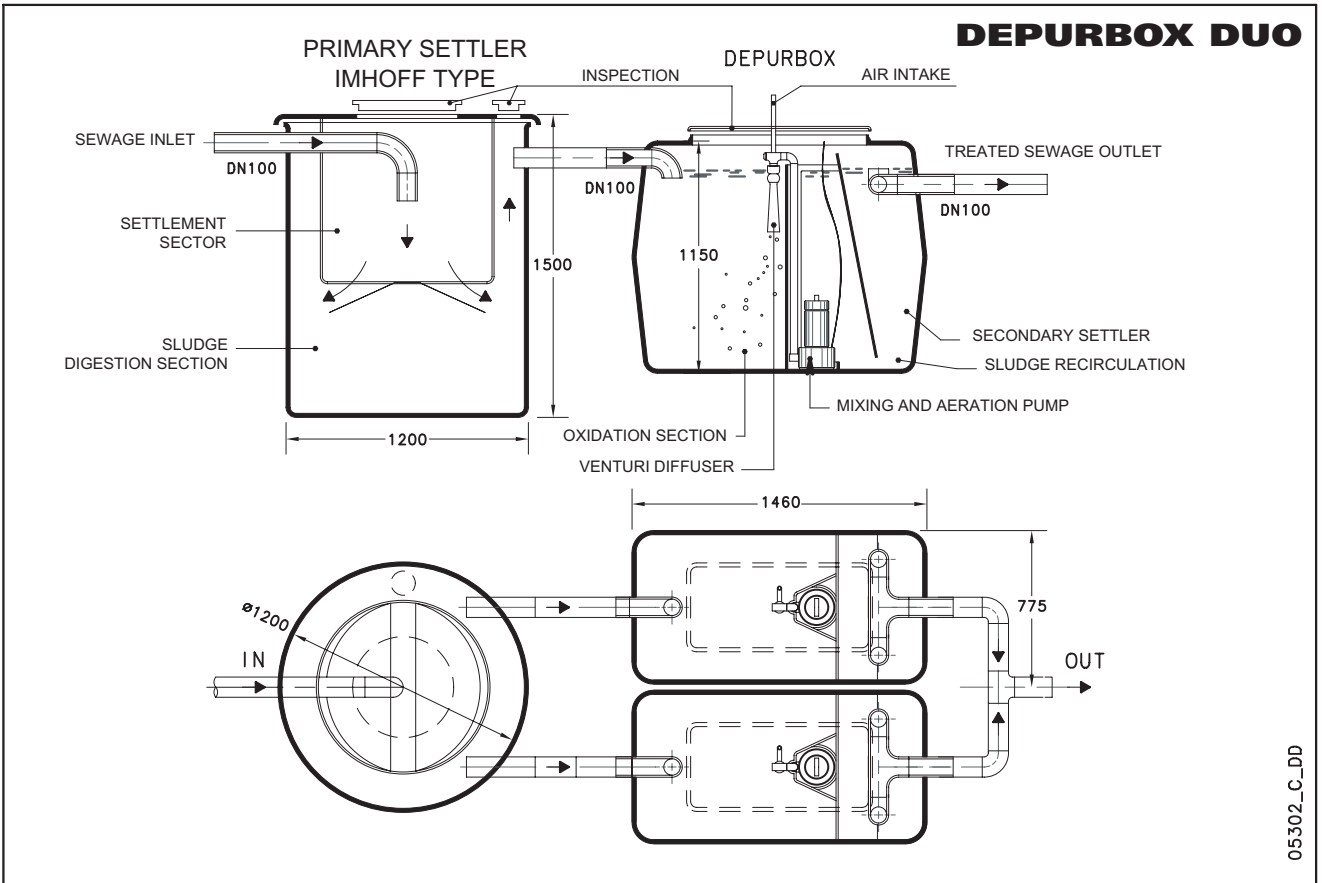
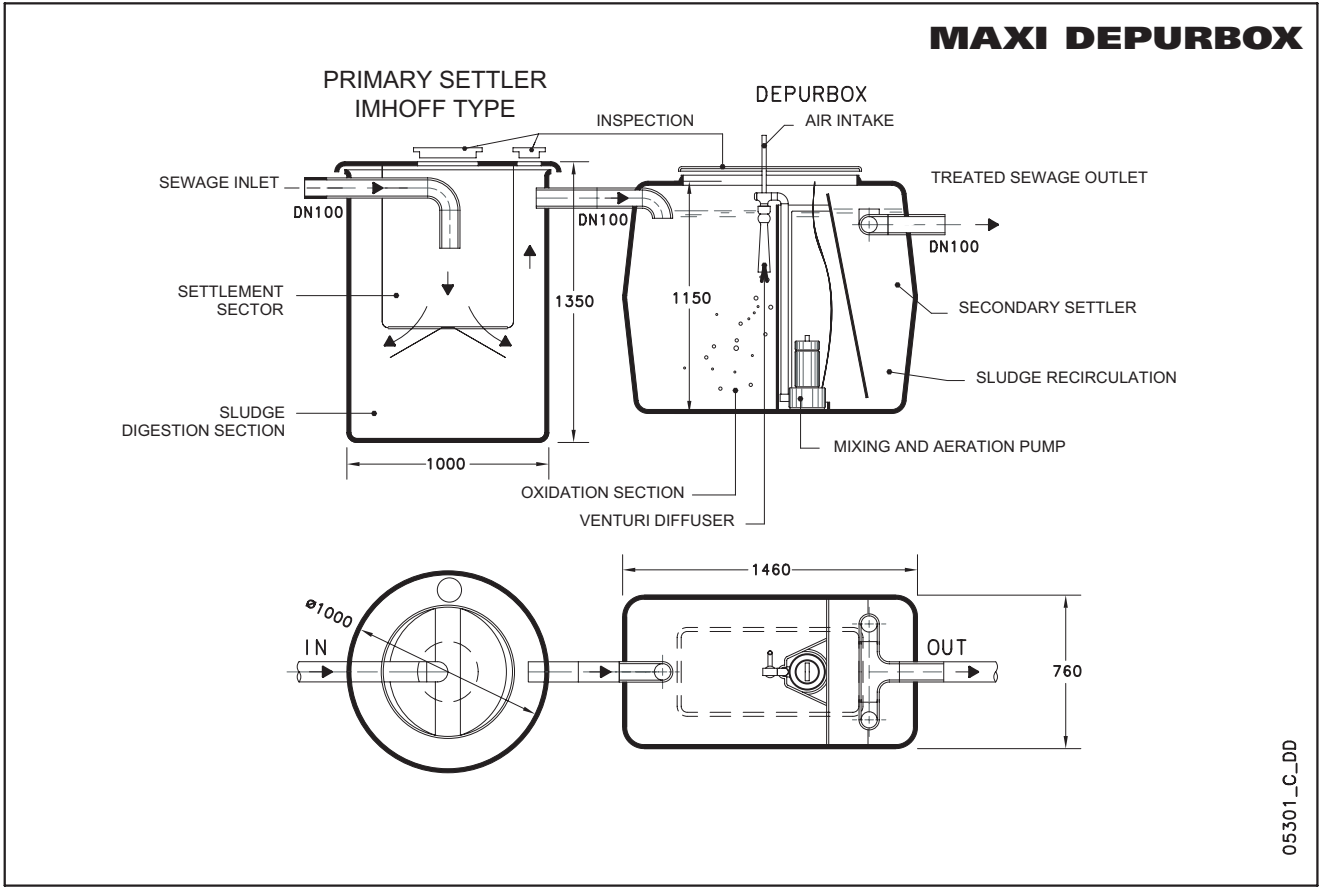
SUBSTANCE	MAXIMUM ADMISSIBLE CONCENTRATION IN WASTEWATER	
Ammonia nitrogen	mg/l	25
Nitric nitrogen	mg/l	25
Inlet BOD ₅ concentration	mg/l	300
Inlet COD concentration	mg/l	600
Phosphorus	mg/l	10
Fats	mg/l	20÷30
pH	-	6 - 8
Total suspended solids	mg/l	300
Total surface-active agents	mg/l	10

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DIMENSIONS AND VERSIONS



**DEPURBOX SERIES
DIMENSIONS AND VERSIONS**



DEPURBOX SERIES DESCRIPTION OF TREATMENT PROCESS

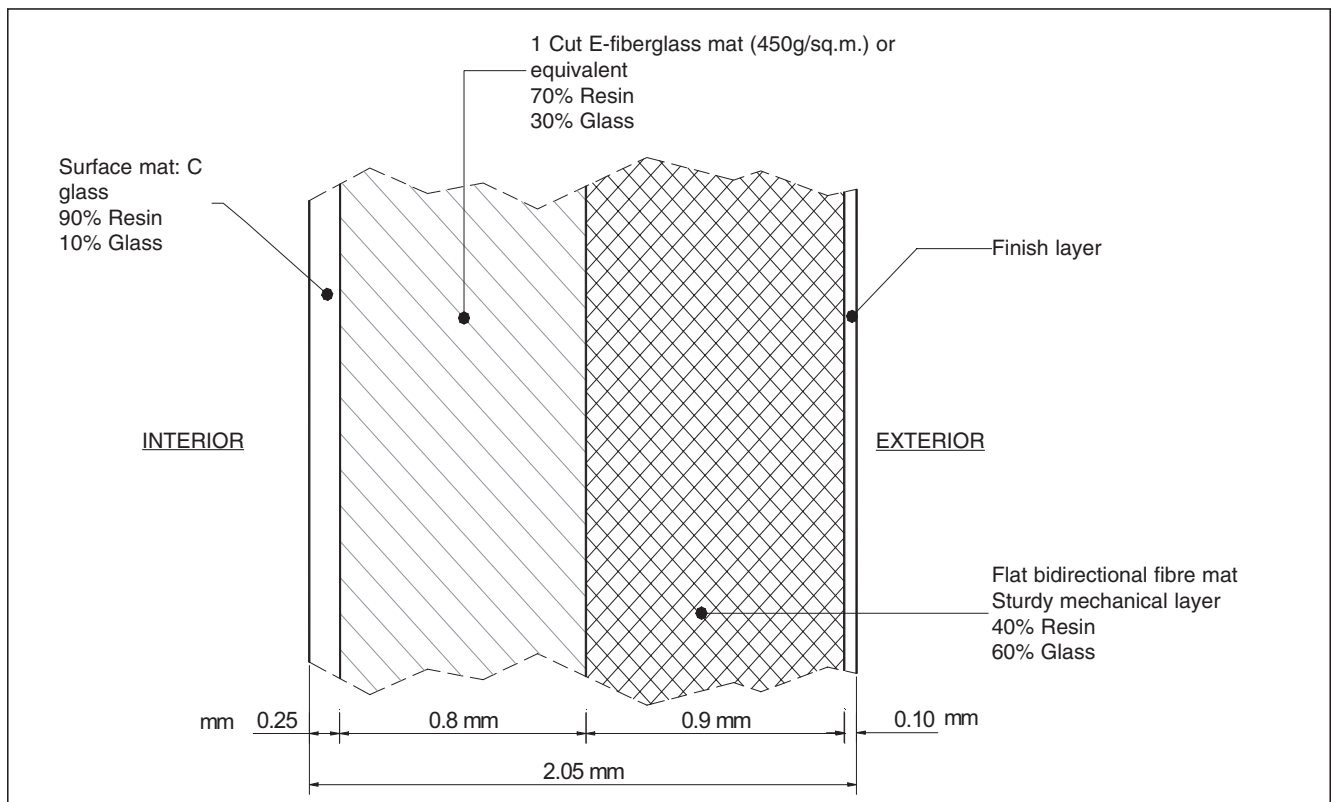
CHAMBER	PROCESS STAGE	REMARKS
1 st : Imhoff tank	Primary settlement	Suspended solids settle and accumulate on the bottom (sludge digestion)
	Anaerobic sludge digestion	Sludge accumulates on the bottom and undergoes a slow process of anaerobic mineralization
2 nd : biological reactor	Biological treatment, oxidation and nitrification	The sewage oxidation and nitrification processes takes place simultaneously through the inlet of atmospheric air via a Venturi system combined with the Domo 7 VX electric pump: the pump recirculates the sewage in the tank, sucking in air from the outside and putting it into contact with the liquid to be treated. This way no mechanical parts need to be installed on the outside of the product.
	Biological treatment, denitrification	During the stages when the electric pump is off, anoxia conditions are induced, enabling the denitrification process
3 rd : settler	Secondary settlement and activated sludge recirculation	The activated sludge produced in the biological reactor settle: the funnel-shaped chamber promotes the concentration of the sludge on the bottom: from there the sludge is returned to the oxidation tank through free-fall and thanks to the sucking effect of the submersed pump

MAIN CHEMICAL REACTIONS

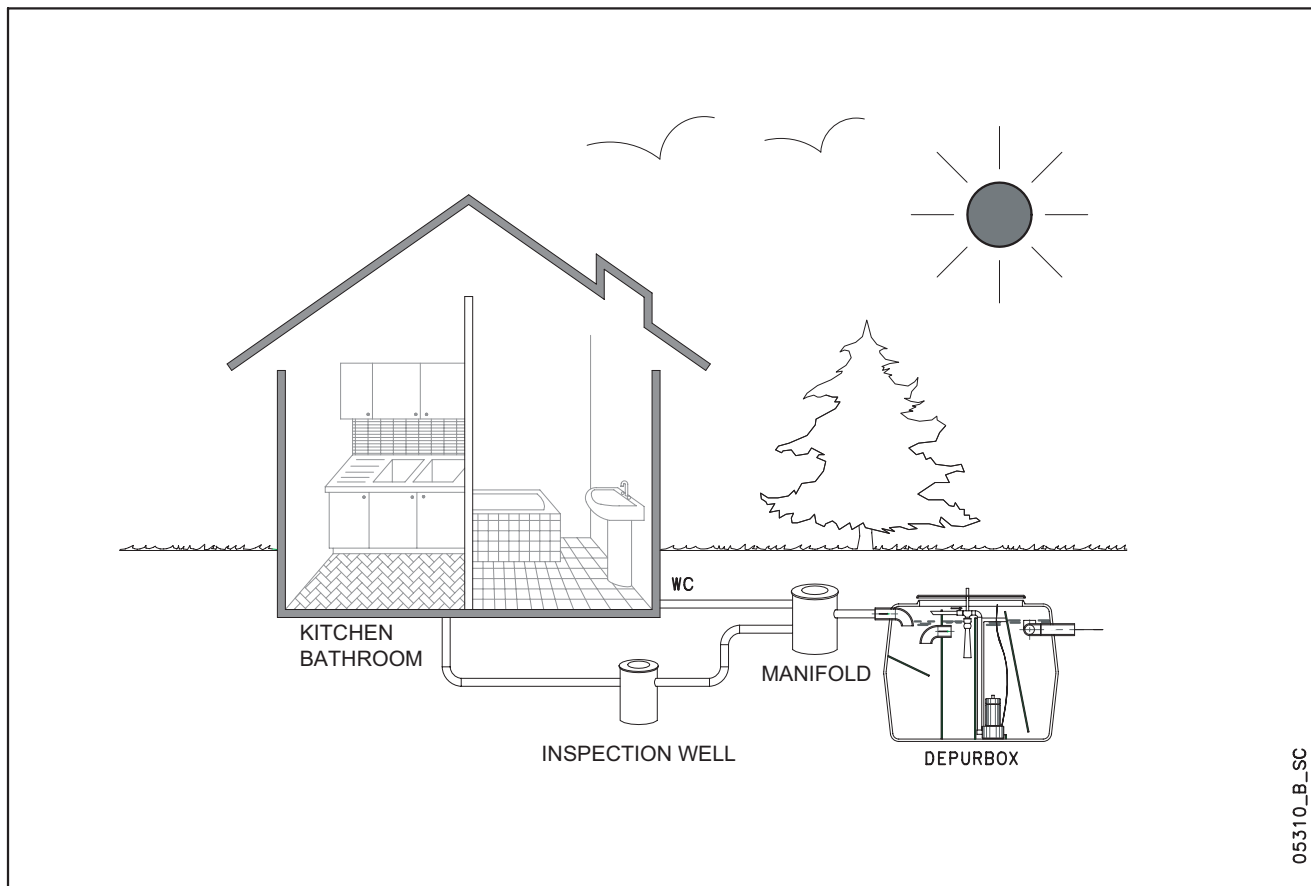
- Oxidation** of the organic and non-organic substances (measured by COD);
- Oxidation** of the organic carbon fraction (measured by BOD₅);
- Nitrification:** oxidation of ammonia nitrogen molecules into nitrites and nitrates (measured by NH₄);
- Denitrification:** reduction of nitrites and nitrates to molecular nitrogen in the absence of oxygen (measured by NO₂ and NO₃).

The reactions take place under conditions of fluid aeration (1, 2 and 3) and under conditions of anoxia (4), as regulated by the timer.

BASIN STRUCTURE



DEPURBOX SERIES INSTALLATION EXAMPLE



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NOTES:

- Adequate structure must be provided if the installation is to withstand foot traffic.
- If necessary, a Singlebox or Doublebox-type lifting station can be installed downstream or upstream of the system.

DEPURBOX GLOSSARY

TERM	DEFINITION
Population Equivalent (g BOD₅ /head day)	Amount of biodegradable organic substances that are discharged in one day, resulting from the normal activities of a person, such as the use of bathroom and kitchen. It is measured indirectly based on the quantity of oxygen needed to enable the bacteria to modify the biodegradable organic substances contained in the wastewater and render them harmless within a time span of five days (Biological Oxygen Demand 5 = BOD ₅). On the average, the reference value is 60 grams of oxygen per day.
Daily organic load (kgBOD₅/day)	It represents the kilograms of BOD ₅ that reach the system daily. It is obtained by multiplying the 60 grams of oxygen per day by the population equivalent.
Volumetric organic load (kgBOD₅/m³day)	It represents the ratio between the daily organic load and the oxidation volume.
Inlet BOD₅ concentration (mg/litre O₂)	It represents the ratio between the daily organic load and the daily discharge volume. In order to obtain the mg/litre value, the result of the division must be multiplied by 1000.
Outlet BOD₅ concentration (mg/litre O₂)	It represents the residual quantity in the discharged effluent
Inlet COD concentration (mg/litre O₂)	Amount of organic and inorganic substances that are discharged in one day, resulting from the normal activities of a person, such as use of bathroom and kitchen. It is measured indirectly based on the quantity of oxygen needed to oxidize the organic and inorganic substances found in the wastewater and render them harmless (Chemical Oxygen Demand = COD).
Per capita water supply to discharge (litres/head/day)	Estimated daily per-head water consumption. The value is commonly 200 litres a day.
Supplied oxygen factor (kgO₂/kgBOD₅)	Oxygen intake needed to eliminate one kg of BOD ₅ .
Number of inhabitants (PE)	For residential applications, this coincides with the number of residents
Maximum flow per hour (l/h)	This is twice the average flow per hour.
Average flow per hour (l/h)	This is the daily discharge volume divided by 16 hours, supposing that the water users are used only for two-thirds of the day.
Treatment efficiency (%)	It indicates by how much the BOD ₅ value is reduced during the treatment
Primary settlement time (hours)	Minimum interval of time required for the completion of the settlement process. It can be calculated by dividing the primary settlement volume by the average flow per hour.

TERM	DEFINITION
Secondary settlement time (hours)	Minimum interval of time required for the completion of the settlement process. It can be calculated by dividing the secondary settlement volume by the average flow per hour.
Settlement rising speed (m/h)	Maximum speed of liquid passage through the settlement compartments or tanks in order to avoid any entrainment of sludge to the next compartment or tank. It is normally calculated by dividing the average flow per hour by the area of the settlement compartment or tank.
Sludge digestion volume (litres)	Volume of that part of the system where the mineralization of the coarse solid particles takes place under conditions of inadequate air supply (anaerobic process).
Oxidation/nitrification/de-nitrification volume (litres)	Volume of that part of the system where the oxidation and nitrification of the liquor take place under conditions of abundant air supply (pump running), and denitrification takes place when the air supply is scarce (pump off).
Daily discharge volume (m³)	The number of inhabitants (PE) multiplied by the per capita water supply to discharge.
Primary settlement volume (litres)	Volume of that part of the system where the coarse solid particles are separated from the liquid and precipitate to the bottom.
Secondary settlement volume (litres)	Volume of that part of the system where the activated sludge is separated from the liquid and precipitates to the bottom.
Total useful volume (litres)	It is the sum of the primary settlement, sludge digestion and oxidation/nitrification/denitrification volumes.



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