1. SECONDARY TREATMENT OR SUBSURFACE DISCHARGE
2. DISCHARGE TO PUBLIC SEWER

TECHNICAL CHARACTERISTICS

Crude sewage is subjected to a mechanical type pre-treatment process to eliminate materials that, due to their size and characteristics, would create difficulties for the subsequent treatment phases. In a domestic discharge, 60-70% of the suspended solids are sedimentable and, therefore, can be removed through primary sedimentation. This type of treatment also allows the simultaneous removal of 25-30% of the organic content, in terms of BOD_5. Imhoff tanks consist of two overlapping and hydraulically communicating compartments.

In the upper compartment, the sedimentable solids gravitate to the bottom of the sedimentation chamber, which has a suitable inclination to allow the sludge to pass to the lower compartment where it is digested. This type of plant makes use of the combined actions of a mechanical sedimentation process and a biological treatment of cold anaerobic digestion.

Rototec Imhoff tanks consist of a container and a sedimentation chamber in one-piece polyethylene with PVC inlet and outlet pipes. The tanks are sized to satisfy different treatment requirements: for delivery to public sewers, the limits specified in Table 3 of Law Decree 152/06 are generally satisfied using a balancing and sedimentation treatment. In these cases, a retention time of 2-3 hours in the sedimentation compartment at mean flow rate is sufficient. For isolated residential complexes, the final effluent can be discharged to land in accordance with the design criteria laid down by the Interministerial Committee resolution of 4th February 1977. In particular, for Imhoff tanks, the requirements are for sedimentation times of 4-6 hours for peak flows, with mean volumes of 40-50 l/habitant and minimum capacity 250 l. For the digestion compartment, the requirement is for a volume of 100-120 l per capita in the case of two sludge removal operations per year and 180-200 l in the case of one removal operation.
Imhoff tanks are certified in accordance with UNI EN 12566-3 norm.

USE AND MAINTENANCE

An excessive accumulation of sedimentable material in the sludge compartment can cause uncontrolled anaerobic digestion phenomena, leading to an over-production of biogas and malodorous emissions. Furthermore, the reduction in the volume available in the digestion compartment and the excessive production of gas bubbles will cause the settled material to rise, thus causing deterioration in the quality of the treated effluent. The use of the Rototec BIO-ACTIVATOR is highly recommended for rendering the initiation of the biological processes more rapid, thus limiting the number of sludge removal operations and reducing the risk of malodorous emissions. The Imhoff tanks are designed to provide primary sludge storage for a period of 6-8 months of plant operation. When sizing plant for Sensitive Areas, the frequency of sludge emptying operations is reduced to once every 12-14 months. A minimum of 1-2 inspections per year by qualified personnel and eventual emptying operations must be programmed according to the loads fed to the tank.

Once the settled sludge has been removed, the internal surfaces of the tank must be cleaned in order to eliminate any material obstructing the effluent inlet and outlet pipes and the outlet of the sedimentation chamber.

SPECIFICATION ITEMS

Imhoff biological tank for primary treatment of wastewater coming from residential buildings or similar, polyethylene (PE) one-piece structure, manufactured in **ISO 9001/2008 certified company**, certified in accordance with **UNI EN 12566-3 norm** and with Legislative Decree n°152/2006 and with Interministerial Committee resolution of 04/02/1977, for undergroud installation, fitted with: sedimentation chamber, inlet pipe with 90° elbow in PVC with watertight gasket in NBR rubber, outlet pipe with deflector T in PVC with watertight gasket in NBR rubber, biogas vent, threaded covers in polypropylene (PP) for inspection, emptying and cleaning purposes; optional threaded extensions;
Imhoff biological tank mod.....sedimentation volume.....lt, digestion volume.....lt, dimensions .....x.....x.....cm

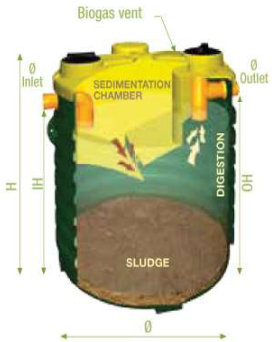
N.B.: Underground installation instructions on page 107

1. Imhoff
Secondary treatment or subsurface discharge

Certification UNI - EN 12566-3 CE (only corrugated tanks)

Sizing Defined by the Interministerial Committee resolution on safeguarding water resources against pollution, appendix 5 of 4/2/1977, for the discharge of domestic sewage from isolated residential complexes of less than 50 PE, with subsoil discharge and discharge to public sewers in cases where the Regional Authority, Arpa or the controlling body require its application.

Use Primary treatment for discharge other than to public sewers or biological treatment, ideal for: isolated residential buildings, public offices, industrial or commercial activities, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, service stations, railway stations, airports.



Corrugated Imhoff tank*

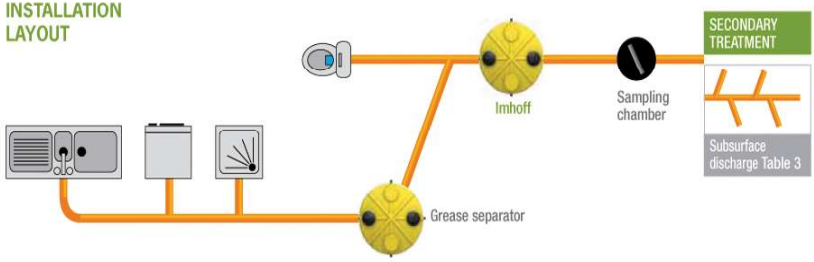
Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Sedimen. lt.	Digest. lt.	Organic load Kg BOD_5/d	Hydraulic load m^3/d	P.E.
NIM 1000	1150	1220	880	860	110	CC455-CC255	PP45-PP30	243	607	0,36	1,2	6
NIM 1500	1150	1720	1360	1340	110	CC455-CC255	PP45-PP30	362	906	0,54	1,8	9
NIM 2000	1150	2280	1985	1965	110	CC455-CC255	PP45-PP30	460	1381	0,66	2,2	11
NIM 2600	1710	1350	1000	980	125	CC455-CC355	PP45-PP35	629	1432	0,78	2,6	13
NIM 3200	1710	1625	1240	1220	125	CC455-CC355	PP45-PP35	760	1765	1,02	3,4	17
NIM 3800	1710	1855	1490	1470	160	CC455-CC355	PP45-PP35	965	2139	1,26	4,2	21
NIM 4600	1710	2125	1710	1690	160	CC455-CC355	PP45-PP35	1085	2713	1,62	5,4	27
NIM 7000	2250	2367	1850	1830	160	CC600-CC455	PP65-PP45	1460	5474	2,16	7,2	36
NIM 9000	2250	2625	2070	2050	160	CC600-CC455	PP65-PP45	2020	5803	3	10	50

Smooth Imhoff tank*

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Sedimen. lt.	Digest. lt.	Organic load Kg BOD_5/d	Hydraulic load m^3/d	P.E.
IM 500	790	790	620	600	110	CC255-CC140	PP30	87	218	0,12	0,4	2
IM 800	1480 x630	1090	870	850	110	CC255-CC255	PP30-PP30	131	601	0,18	0,6	3
IM 1000	1160	1140	910	890	110	CC255-CC255	PP30-PP30	205	712	0,3	1	5
IM 1500	1160	1610	1390	1370	110	CC255-CC255	PP30-PP30	282	1125	0,42	1,4	7
IM 2000	1160	2075	1810	1790	125	CC255-CC255	PP30-PP30	402	1501	0,6	2	10
IM 3000	1450	1940	1650	1630	125	CC255-CC255	PP30-PP30	644	1998	0,96	3,2	16

* On request, it's possible to supply the Imhoff tank with a housing for a chlorine tablet inserted in the outlet pipe

INSTALLATION LAYOUT



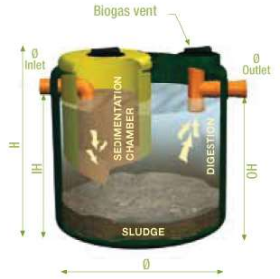
2. Imhoff
Discharge to public sewer

Sizing Defined by the Interministerial Committee resolution on safeguarding water resources against pollution, appendix 5 of 4/2/1977, less restrictive and applicable to domestic discharges or those assimilable to domestic sewage with medium-low organic loads: Feed flow 200 l/dP.E. - BOD_5 concentration less than 300 mg/l - Suspended solids content less than 400 mg/l.

Use Primary treatment for discharge to public sewers, ideal for: isolated residential buildings, public offices, industrial or commercial activities, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, service stations, railway stations, airports.

Corrugated Imhoff tank*

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Sedimen. lt.	Digest. lt.	Organic load Kg BOD_5/d	Hydraulic load m^3/d	P.E.
NIM 1000	1150	1220	880	860	110	CC455-CC255	PP45-PP30	243	607	0,48	1,6	8
NIM 1500	1150	1720	1360	1340	110	CC455-CC255	PP45-PP30	362	906	0,84	2,8	14
NIM 2000	1150	2280	1985	1965	110	CC455-CC255	PP45-PP30	460	1381	1,08	3,6	18
NIM 2600	1710	1350	1000	980	125	CC455-CC355	PP45-PP35	629	1432	1,2	4	20
NIM 3200	1710	1625	1240	1220	125	CC455-CC355	PP45-PP35	760	1765	1,5	5	25
NIM 3800	1710	1855	1490	1470	160	CC455-CC355	PP45-PP35	965	2139	1,86	6,2	31
NIM 4600	1710	2125	1710	1690	160	CC455-CC355	PP45-PP35	1085	2713	2,4	8	40
NIM 7000	2250	2367	1850	1830	160	CC600-CC455	PP65-PP45	1460	5474	3,6	12	60
NIM 9000	2250	2625	2070	2050	160	CC600-CC455	PP65-PP45	2020	5803	4,8	16	80

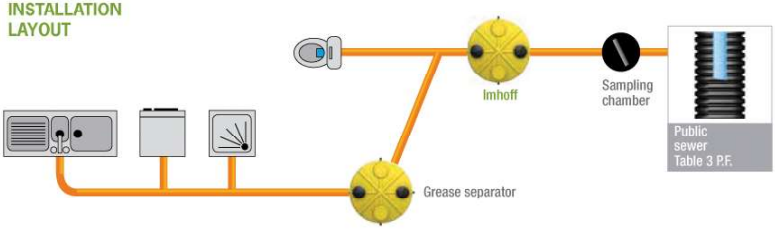


Smooth Imhoff tank*

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Sedimen. lt.	Digest. lt.	Organic load Kg BOD_5/d	Hydraulic load m^3/d	P.E.
IM 500	790	790	620	600	110	CC255-CC140	PP30	87	218	0,18	0,6	3
IM 800	1480 x630	1090	870	850	110	CC255-CC255	PP30-PP30	131	601	0,42	1,4	7
IM 1000	1160	1140	910	890	110	CC255-CC255	PP30-PP30	205	712	0,54	1,8	9
IM 1500	1160	1610	1390	1370	110	CC255-CC255	PP30-PP30	282	1125	0,84	2,8	14
IM 2000	1160	2075	1810	1790	125	CC255-CC255	PP30-PP30	402	1501	1,14	3,08	19
IM 3000	1450	1940	1650	1630	125	CC255-CC255	PP30-PP30	644	1998	1,62	5,4	27

* On request, it's possible to supply the Imhoff tank with a housing for a chlorine tablet inserted in the outlet pipe

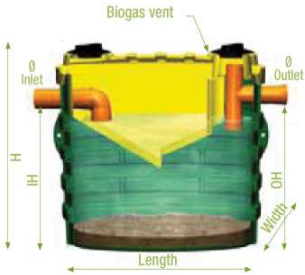
INSTALLATION LAYOUT



ELIPSE Imhoff tank

Ideal for underground installation in tight spaces

The Elipse model corrugated tanks have been specially designed for more difficult installation conditions. In fact, they guarantee lightness and watertightness while possessing a form that allows easy transport through confined spaces and subsequent underground installation under cellars, basements and pavements. Furthermore, their elongated shape improves the separation efficiency of sedimentable solids and floating matter, resulting in a high-performance treatment. Elipse is the Rototec solution.



ELIPSE Imhoff tank Subsurface discharge*

Articolo	Lunghezza mm	Larghezza mm	H mm	HE mm	HU mm	Ø E/U mm	Tappo	Prolunghe	Sedimen. lt.	Digest. lt.	Carico organico Kg BOD_5/d	Carico idraulico m^3/d	A.E.
NIM 1200	1900	708	1630	1250	1230	110	CC455-CC355	PP45-PP35	290	910	0,42	1,4	7
NIM 1700	1900	708	2140	1760	1740	110	CC455-CC355	PP45-PP35	412	1363	0,6	2	10

ELIPSE Imhoff tank Discharge to public sewer*

Articolo	Lunghezza mm	Larghezza mm	H mm	HE mm	HU mm	Ø E/U mm	Tappo	Prolunghe	Sedimen. lt.	Digest. lt.	Carico organico Kg BOD_5/d	Carico idraulico m^3/d	A.E.
NIM 1200	1900	708	1630	1250	1230	110	CC455-CC355	PP45-PP35	290	910	0,72	2,4	12
NIM 1700	1900	708	2140	1760	1740	110	CC455-CC355	PP45-PP35	412	1363	0,96	3,2	16

* On request, it's possible to supply the Imhoff tank with a housing for a chlorine tablet inserted in the outlet pipe

1. SEPTIC TANK
2. TWO-CHAMBER SEPTIC TANK
3. THREE-CHAMBER SEPTIC TANK

TECHNICAL CHARACTERISTICS

Septic tanks constitute a reliable device for the primary treatment of sewage. The treatment systems are passive, extremely stable, simple and inexpensive. They are used, above all, for treating domestic sewage from small communities. The configuration of the tank forces the sewage to pass through the liquid mass contained in it. The slowing down of the flow allows sedimentable solids and substances of specific weight less than that of the water to separate. Furthermore, an anaerobic fermentation process is triggered with the resulting solubilisation and synthesis of part of the suspended solids. In this way, the effluent leaving the tank is conditioned, i.e. it has a limited concentration of solids, transformed for the most part into dissolved and colloidal solids. Septic tanks are nothing more than stilling tanks in which the following processes take place:

- separation of sedimentable solids, coarse material, sands/grits, oils and greases present in the sewage;
- reduction of a fraction of the accumulated organic substances by decomposition
- accumulation and prolonged storage of the separated materials.

Compartmentation, i.e. the division of the system into chambers, significantly influences the efficiency of the treatment process. With this configuration, a large part of the suspended solids accumulate in the first compartment and only pass to the next chamber with great difficulty. Compartmentation is particularly effective when high levels of purification are required, in particular for separating suspended solids. Septic tanks are sized to achieve a high purification performance and to obtain liquefaction of the sludge, reducing its formation and thus minimising disposal costs.

For populations of up to 50 P.E., the sizing, which is not applicable to new installations, follows the guidelines provided for by the resolution of 4/2/77, in which a minimum retention time of 12 hours is required for the daily flow discharged (150-200 l/P.E.) and at least 50 l per capita for the sludge storage, for a total of 125-150 l/P.E.
Septic tanks are certified in accordance with UNI EN 12566-1 norm.

USE AND MAINTENANCE

An excessive accumulation of putrescible material at the bottom of the tank can cause uncontrolled anaerobic digestion phenomena, leading to an over-production of biogas and the development of malodorous emissions. Furthermore, the reduction in the volume available in the digestion compartment and the excessive production of gas bubbles will cause the settled material to rise, thus causing deterioration in the quality of the treated effluent. For this reason, 1 to 4 inspections per year by qualified personnel and eventual removal of the surface crust and accumulated sludge must be programmed in accordance with the loads fed to the tank. Once the settled sludge has been removed, the internal surfaces of the tank must be cleaned in order to eliminate any material that could obstruct the effluent inlet and outlet pipes. It is occasionally recommended that not all the deposited sludge is removed and that approximately 1/10 of the sludge deposited is left in the tank, as this will accelerate the restart of the biological processes. The use of the Rototec BIO-ACTIVATOR is highly recommended for rendering the initiation of the biological processes more rapid, thus limiting the number of sludge removal operations and reducing the risk of malodorous emissions.

SPECIFICATION ITEMS

Biological septic tank for primary treatment of wastewater coming from residential buildings or similar, polyethylene (PE) one-piece structure, manufactured in **ISO 9001/2008 certified company**, certified in accordance with **UNI EN 12566-1 norm** and with Legislative Decree n°152/2006 and with Interministerial Committee resolution of 04/02/1977, for undergroud installation, fitted with: inlet pipe with 90° elbow in PVC with watertight gasket in NBR rubber for dampening and distributing the flow, outlet pipe with deflector T in PVC with watertight gasket in NBR rubber, biogas vent, threaded covers in polypropylene (PP) for inspection, emptying and cleaning purposes; optional threaded extensions;
Biological septic tank mod.....useful volume.....lt, dimensions .....x.....x.....cm

N.B.: Underground installation instructions on page 107

Certification UNI - EN 12566-1

Sizing Sized in line with Interministerial Committee resolution 4/2/1977 on safeguarding water resources against pollution.

Use Primary treatment for discharge to public sewers, biological treatment or discharge to a soil absorption system, ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc.

Corrugated septic tank

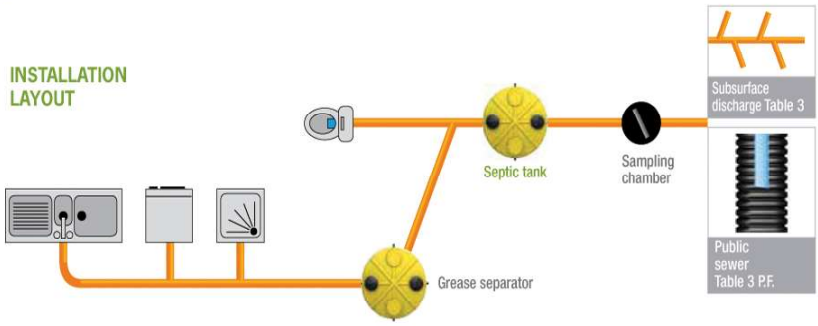
Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Useful vol. lt.	P.E.
NSE 1000	1150	1220	880	860	110	CC455-CC255	PP45-PP30	850	7
NSE 1200*	1900x708	1630	1250	1230	110	CC455-CC355	PP45-PP35	1200	9
NSE 1500	1150	1720	1360	1340	110	CC455-CC255	PP45-PP30	1268	11
NSE 1700*	1900x708	2140	1760	1740	110	CC455-CC355	PP45-PP35	1775	13
NSE 2000	1150	2280	1985	1965	110	CC455-CC255	PP45-PP30	1841	15
NSE 2600	1710	1350	1000	980	125	CC455-CC355	PP45-PP35	2061	16
NSE 3200	1710	1625	1240	1220	125	CC455-CC355	PP45-PP35	2525	20
NSE 3800	1710	1855	1525	1505	125	CC455-CC355	PP45-PP35	3175	24
NSE 4600	1710	2125	1745	1725	125	CC455-CC355	PP45-PP35	3835	30
NSE 7000	2250	2367	1850	1830	160	CC600-CC455	PP65-PP45	6934	55
NSE 9000	2250	2625	2070	2050	160	CC600-CC455	PP65-PP45	7823	70

* Elipse tank with rectangular base

Smooth septic tank

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Useful vol. lt.	P.E.
SE 500	790	790	620	600	110	CC455-CC140	PP45	305	2
SE 800	1480x630	1090	870	850	110	CC455-CC255	PP45-PP30	732	6
SE 1000	1160	1140	910	890	110	CC455-CC255	PP45-PP30	917	7
SE 1500	1160	1610	1390	1370	110	CC455-CC255	PP45-PP30	1407	11
SE 2000	1160	2075	1810	1790	125	CC455-CC255	PP45-PP30	1903	14
SE 3000	1450	1940	1650	1630	125	CC455-CC255	PP45-PP30	2642	20

INSTALLATION LAYOUT



2. Two-chamber septic tanks

Sizing Sized in line with Interministerial Committee resolution 4/2/1977 on safeguarding water resources against pollution.

Use Primary treatment for discharge to public sewers, biological treatment or discharge to a soil absorption system, ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc.

Corrugated two-chamber septic tank

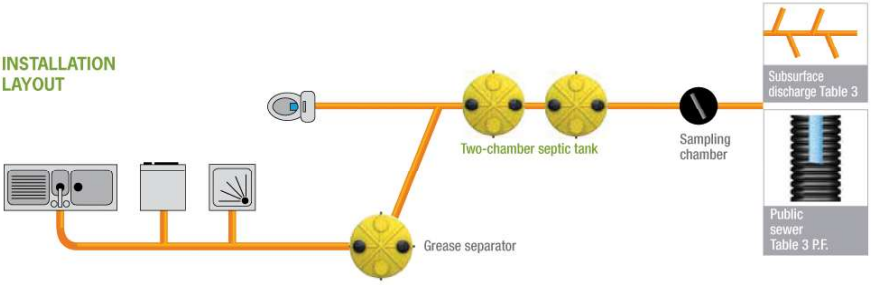
Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Useful vol. lt.	P.E.
NSEB 1000x2	1150	1220	880	860	110	CC455-CC255	PP45-PP30	1700	14
NSEB 1200x2*	1900x708	1630	1250	1230	110	CC455-CC355	PP45-PP35	2400	18
NSEB 1500x2	1150	1720	1360	1340	110	CC455-CC255	PP45-PP30	2536	22
NSEB 1700x2*	1900x708	2140	1760	1740	110	CC455-CC355	PP45-PP35	3550	26
NSEB 2000x2	1150	2280	1985	1965	110	CC455-CC255	PP45-PP30	3682	30
NSEB 2600x2	1710	1350	1000	980	125	CC455-CC355	PP45-PP35	4122	32
NSEB 3200x2	1710	1625	1240	1220	125	CC455-CC355	PP45-PP35	5050	40
NSEB 3800x2	1710	1855	1525	1505	125	CC455-CC355	PP45-PP35	6350	48
NSEB 4600x2	1710	2125	1745	1725	125	CC455-CC355	PP45-PP35	7670	60
NSEB 7000x2	2250	2367	1850	1830	160	CC600-CC455	PP65-PP45	13868	110
NSEB 9000x2	2250	2625	2070	2050	160	CC600-CC455	PP65-PP45	15646	140

* Elipse tank with rectangular base

Smooth two-chamber septic tank

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Useful vol. lt.	P.E.
SEB 500x2	790	790	620	600	110	CC455-CC140	PP45	610	4
SEB 800x2	1480x630	1090	870	850	110	CC455-CC255	PP45-PP30	1464	12
SEB 1000x2	1160	1140	910	890	110	CC455-CC255	PP45-PP30	1834	14
SEB 1500x2	1160	1610	1390	1370	110	CC455-CC255	PP45-PP30	2814	22
SEB 2000x2	1160	2075	1810	1790	125	CC455-CC255	PP45-PP30	3806	28
SEB 3000x2	1450	1940	1650	1630	125	CC455-CC255	PP45-PP30	5284	40

INSTALLATION LAYOUT



3. Three-chamber septic tanks

Sizing Sized in line with Interministerial Committee resolution 4/2/1977 on safeguarding water resources against pollution.

Use Primary treatment for discharge to public sewers, biological treatment or discharge to a soil absorption system, ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc.

Corrugated three-chamber septic tank

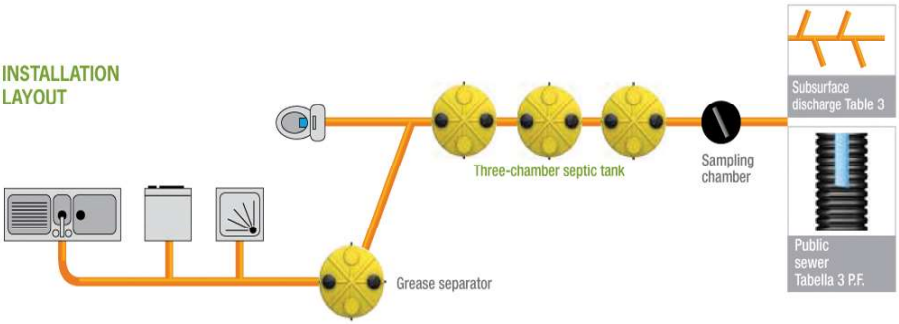
Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Useful vol. lt.	P.E.
NSET 1000x3	1150	1220	880	860	110	CC455-CC255	PP45-PP30	2550	21
NSET 1200x3*	1900x708	1630	1250	1230	110	CC455-CC355	PP45-PP35	3600	27
NSET 1500x3	1150	1720	1360	1340	110	CC455-CC255	PP45-PP30	3804	33
NSET 1700x3*	1900x708	2140	1760	1740	110	CC455-CC355	PP45-PP35	5325	39
NSET 2000x3	1150	2280	1985	1965	110	CC455-CC255	PP45-PP30	5523	45
NSET 2600x3	1710	1350	1000	980	125	CC455-CC355	PP45-PP35	6183	48
NSET 3200x3	1710	1625	1240	1220	125	CC455-CC355	PP45-PP35	7575	60
NSET 3800x3	1710	1855	1525	1505	125	CC455-CC355	PP45-PP35	9525	72
NSET 4600x3	1710	2125	1745	1725	125	CC455-CC355	PP45-PP35	11505	90
NSET 7000x3	2250	2367	1850	1830	160	CC600-CC455	PP65-PP45	20802	165
NSET 9000x3	2250	2625	2070	2050	160	CC600-CC455	PP65-PP45	23619	210

* Elipse tank with rectangular base

Smooth three-chamber septic tank

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Useful vol. lt.	P.E.
SET 500x3	790	790	620	600	110	CC455-CC140	PP45	915	6
SET 800x3	1480 x 630	1090	870	850	110	CC455-CC255	PP45-PP30	2196	18
SET 1000x3	1160	1140	910	890	110	CC455-CC255	PP45-PP30	2751	21
SET 1500x3	1160	1610	1390	1370	110	CC455-CC255	PP45-PP30	4221	33
SET 2000x3	1160	2075	1810	1790	125	CC455-CC255	PP45-PP30	5709	42
SET 3000x3	1450	1940	1650	1630	125	CC455-CC255	PP45-PP30	7926	60

INSTALLATION LAYOUT



1. LOW LOAD (downstream of the Imhoff and grease separator)
2. TOTAL OXIDATION (downstream of the grease separator)

ACTIVATED SLUDGE PLANTS

TECHNICAL CHARACTERISTICS

Activated sludge plants are secondary treatment systems that make use of the action of the bacterial colonies that, remaining in suspension in the sewage, consume the biodegradable organic material, using it as a nutrient to obtain the necessary energy and the material required for the synthesis of new cells. In this manner, increasingly stable compounds are formed leading to the total degradation of the organic load. Very high concentrations of aerobic type bacteria are developed inside activated sludge plants, sufficient, that is, to absorb the dissolved oxygen in the water in order to consume the biodegradable material. To guarantee the concentration of oxygen necessary for the development of the biological reaction, an aeration system is adopted consisting of submerged diffusers which, from the bottom of the tank, disperse a flow of fine air bubbles. This also guarantees sufficient mixing to keep the high concentrations of solids present in the tank in suspension. In the oxygen rich environment of the aeration tank, a number of different processes are set in motion:

- Chemical, i.e. the oxidation of malodorous compounds (hydrogen sulphide, sulphites...).
- Physical, i.e. the removal of sewage solids trapped by the dispersion of bacteria.
- Biological, i.e. direct assimilation of the organic substances dissolved in the sewage.

The sizing of the activated sludge plants is performed on the basis of the sludge load (or organic load factor) expressed as the ratio between the organic load (BOD_t) and the micro-organisms; the lower this ratio, the more intensely the organic load is consumed, at the same time reducing the production of excess sludge. Rototec activated sludge plants are sized to have sludge loads of less than 0.08 KgBOD/KgSSd with retention times of more than 24 hours at mean flows and volumetric loads of less than 0.25 KgBOD/m^3d in the prolonged aeration (or total oxidation) configuration and sludge loads of less than 0.15 KgBOD/KgSSd and volumetric loads less than 0.5 KgBOD/m^3d in the low-load configuration.
Low load activated sludge plants are certified in accordance with UNI EN 12566-3 norm.

USE AND MAINTENANCE

The small user activated sludge plant is designed with the sedimentation compartment inside the oxidation tank in order to provide sewage settlement as well as sludge recirculation. This however leads to a build-up of solids in the oxidation chamber. In order to avoid an excessively turbid discharge it is advisable to inspect the plant and remove any excess sludge at least once a year.

These operations are normally carried out as part of the Imhoff tank inspection and emptying operations. Cleaning is effected by removing a part of the excess sludge, paying particular attention to removing accumulations at the inlet and outlet pipes and cleaning the air diffusers to prevent blockages. It should also be remembered that in order to ensure the correct operation of a low-load activated sludge plant, a grease separator and Imhoff tank or similar should be installed upstream of the reactor itself. Furthermore, the aeration should be continuous during the period of use of the plant and any discharge of disinfectants, bleaches, strong acids or bases should be minimised as much as possible to prevent possible deactivation of the biomass. The plant needs 10-15 days in order to reach normal operation, this time can be reduced however by adding biomass activators (ROTOTEC BIO ACTIVATOR) directly to the sewage.

SPECIFICATION ITEMS

Activated sludge plant for secondary treatment of wastewater coming from residential buildings or similar, polyethylene (PE) one-piece structure, manufactured in **ISO 9001/2008 certified company**, certified in accordance with **UNI EN 12566-3 norm** and with Legislative Decree n°152/2006 for final discharge to a soil absorption system or surface watercourse, fitted with: inlet pipe with 90° elbow in PVC with watertight gasket in NBR rubber, sedimentation chamber, outlet pipe with deflector T and housing for chlorine tablet in PVC with watertight gasket in NBR rubber; supply with an aeration system with diaphragm blower, rubber pipe and plate diffuser/s in microbored rubber; fitted also with biogas vent, threaded covers in polypropylene (PP) for inspection, emptying and cleaning purposes; optional threaded extensions;
Activated sludge plant mod.....useful volume..... lt, dimensions .....x.....x.....cm

Total oxidation activated sludge plant for primary treatment (downstream of a grease separator) of wastewater coming from residential buildings or similar, polyethylene (PE) one-piece structure, manufactured in **ISO 9001/2008 certified company**, in accordance with Legislative Decree n°152/2006 for final discharge to a soil absorption system or surface watercourse, fitted with: inlet pipe with 90° elbow in PVC with watertight gasket in NBR rubber, outlet dispersion pipe with housing for chlorine tablet in PVC with watertight gasket in NBR rubber; supply with an aeration system with diaphragm blower, rubber pipe and plate diffuser/s in microbored rubber; fitted also with biogas vent, threaded covers in polypropylene (PP) for inspection, emptying and cleaning purposes; optional threaded extensions;
Totale oxidation activated sludge plant mod.....useful volume.....lt, dimensions .....x.....x.....cm

N.B.: Underground installation instructions on page 107

1. Low load activated sludge plants

Certification UNI-EN 12566 - 3 CE

Sizing This configuration is recommended in the presence of primary sedimentation and allows removal of suspended solids and organic load in accordance with the tabled requirements of Law Decree 152/06 and subsequent amendments. The plants are designed for a daily organic load per capita of 48 $gBOD_5$/P.E. (downstream of an Imhoff or septic tank type primary sedimentation and grease separator) and for a mean daily flow of 200 l/P.E.

Use As secondary treatment downstream of primary treatments (Imhoff, grease separator), for final discharge to a soil absorption system or surface watercours, ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc. .

Corrugated activated sludge plant

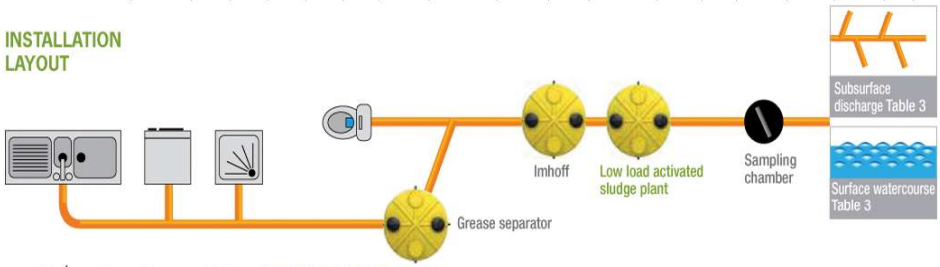
Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Aerated vol. l	Sed. vol. l	Volumetric load kgBOD/m³	Retention time Aerat. H	Retention time Sed. H	Blower	OC kg O_2 kgBOD	Diffuser plates n°	P.E.
NIFA 1000	1150	1220	880	860	110	CC455-CC255	PP45-PP30	607	243	0,383	15	5,9	HP40	3	1	5
NIFA 1200*	1900 x708	1630	1250	1230	110	CC455-CC355	PP45-PP35	910	290	0,317	18	4,9	HP40	3	1	6
NIFA 1500	1150	1720	1360	1340	110	CC455-CC255	PP45-PP30	906	362	0,379	15,2	5,7	HP40	3	1	8
NIFA 1700*	1900 x708	2140	1760	1740	110	CC455-CC355	PP45-PP35	1363	412	0,308	18,6	4,9	HP40	3	1	9
NIFA 2600	1710	1350	1000	980	125	CC455-CC355	PP45-PP35	1432	629	0,42	13,7	4,9	HP80	2,5	2	13
NIFA 3200	1710	1625	1240	1220	125	CC455-CC355	PP45-PP35	1765	760	0,414	13,9	5,1	HP80	2,5	2	16
NIFA 3800	1710	1855	1525	1505	125	CC455-CC355	PP45-PP35	2139	965	0,421	13,7	5	HP80	2,5	2	20
NIFA 4600	1710	2125	1710	1690	160	CC455-CC355	PP45-PP35	2713	1085	0,419	13,7	5,3	HP80	2,5	2	25
NIFA 7000	2250	2367	1850	1830	160	CC600-CC455	PP65-PP45	5474	1460	0,343	16,7	4,3	HP150	3	2	40
NIFA 9000	2250	2625	2070	2050	160	CC600-CC455	PP65-PP45	5803	2020	0,397	14,5	4,8	HP150	3	2	50

* Elipse tank with rectangular base

Smooth activated sludge plant

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	Aerated vol. l	Sed. vol. l	Volumetric load kgBOD/m³	Retention time Aerat. H	Retention time Sed. H	Blower	OC kg O_2 kgBOD	Diffuser plates n°	P.E.
IFA 800	1480 x630	1090	870	850	110	CC255-CC255	PP30-PP30	601	131	0,333	17	5	HP40	3	1	3
IFA 1000	1160	1140	910	890	110	CC255-CC255	PP30-PP30	712	205	0,333	17,3	5,2	HP40	3	1	5
IFA 1500	1160	1610	1390	1370	110	CC255-CC255	PP30-PP30	1125	282	0,384	15	3,8	HP40	2,6	1	9
IFA 2000	1160	2075	1810	1790	125	CC255-CC255	PP30-PP30	1501	402	0,35	16,5	4,4	HP40	2,9	1	11
IFA 3000	1450	1940	1650	1630	125	CC255-CC255	PP30-PP30	1998	644	0,421	13,7	4,3	HP80	3	2	18

INSTALLATION LAYOUT



2. Total oxidation activated sludge plants

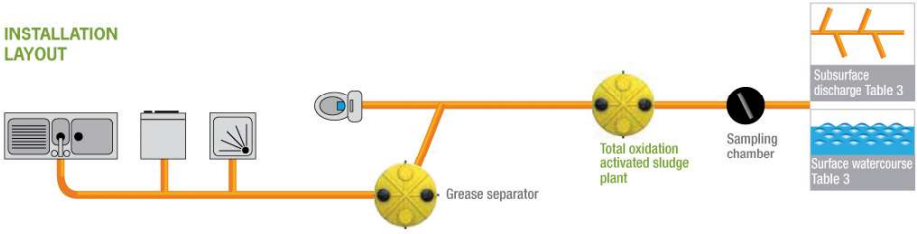
Sizing This plant configuration guarantees a highly efficient removal of the biological load and reduced production of excess sludge, including in the absence of primary sedimentation. The daily organic load per capita used for sizing the plant is 60 $gBOD_5$/P.E. with a daily inflow of 200 l/P.E.

Use As primary and secondary treatment of foul sewage downstream of a grease separator, for final discharge to a soil absorption system or surface watercourse, ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc. .

Corrugated activated sludge plant

Item	Ø mm	H mm	IH mm	OH mm	ØI/O mm	Cover	Extensions	Aerated vol. l	Organic load kgBOD / m^3	Retention time Aeration H	Blower	OC kgO_2 kgBOD	Diffuser plates n°	P.E.
NIFAT 1000	1150	1220	880	860	110	CC455-CC255	PP45-PP30	850	0,191	37	HP40	6	1	2
NIFAT 1500	1150	1720	1360	1340	110	CC455-CC255	PP45-PP30	1268	0,178	40	HP40	4,8	1	4
NIFAT 2600	1710	1350	1000	980	125	CC455-CC355	PP45-PP35	2061	0,242	29	HP80	4,2	2	6
NIFAT 3200	1710	1625	1240	1220	125	CC455-CC355	PP45-PP35	2525	0,226	32	HP80	4	2	8
NIFAT 3800	1710	1855	1525	1505	125	CC455-CC355	PP45-PP35	3104	0,211	34	HP80	3,9	2	10
NIFAT 4600	1710	2125	1745	1725	125	CC455-CC355	PP45-PP35	3594	0,21	34	HP80	4,1	2	12
NIFAT 7000	2250	2367	1885	1865	125	CC600-CC455	PP65-PP45	6934	0,214	33,7	HP150	3	2	25
NIFAT 9000	2250	2625	2105	2085	125	CC600-CC455	PP65-PP45	7823	0,224	32	HP150	3	2	30

INSTALLATION LAYOUT



Accessories for activated sludge plants (included in the supply)

Blowers - Compressors

Company fits its Activated Sludge plants with diaphragm type air compressors which make use of the electromagnetic vibration of an actuator rod supported by rubber diaphragms. This system reduces energy consumption to a minimum by supplying constant air flows without any variations in working pressure. The blower does not have any moving parts in contact, and as such does not require any lubrication. Special attention is paid to the acoustic insulation and to the design of the vibrating section of the compressor in order to make it as silent as possible.

Item	Voltage V	Frequency Hz	Watt W	Ampere A	Flow rate l/min	Nominal pressure bar	Noise level db	Weight kg
HP 40	220	50	31	0,32	40	0,13	< 39	4,9
HP 60	220	50	61	0,6	70	0,15	< 48	6,9
HP 80	220	50	91	1	88	0,15	< 57	7
HP 150	220	50	106	1,2	114	0,2	< 52	11,8
HP 200	220	50	152	1,9	148	0,2	< 53	12

USE AND MAINTENANCE

the blower does not have any moving parts in contact, and as such does not require lubrication. Apart from the simple replacement of a few components (diaphragm) and cleaning of the air intake filter once every three months, its operation is long-term and does not require any other maintenance. It should, however, be installed in a suitable cabinet by qualified personnel. The cabinet must have the following characteristics:

- It must be positioned above ground at a maximum distance of 10 m from the treatment plant;
- The support must be solid, flat and located above the level of the tank in order to avoid a backflow of sludge in the case of an interruption in the air supply;
- It must ensure a sufficient air change to prevent overheating of the blower;
- The internal environment must be free of corrosive gases and must not be exposed to vibration;
- It must be equipped with an electric panel or an adequate number of power sockets (220V; 50Hz), including a service socket, and a manual switch (fused or thermomagnetic), all installed by specialised qualified personnel;
- The air pipes must be protected by ducts running from the cabinet to the tank (minimum diameter 80 mm), similarly for the electric wiring (minimum diameter 63 mm);
- The air supply to the compressor must be permanent. A prolonged state of anoxia (lack of oxygen) can kill the microorganisms that guarantee the effectiveness of the treatment.

INSTALLATION

- Connect one end of the air feed pipe supplied to the outlet of the blower using the appropriate clips;
- Connect the other end of the pipe to the coupling on the tank.

PRECAUTIONS DURING USE

Carry out all cleaning and/or part replacement operations with the power supply disconnected:

- Before carrying out any cleaning or part replacement operations, in order to avoid risks of burning, make sure that the compressor has cooled down sufficiently;
- When carrying out repairs, in order to guarantee the safety of the equipment, it is good practice to use original spare parts only;
- Maintenance operations requiring the presence of electricity, such as troubleshooting the blower, must be carried out by qualified personnel;
- Do not connect the compressor to a power supply other than that specified. In the case of doubt regarding making the connections, do not connect the equipment.

Accessories for activated sludge plants (included in the supply)

Diffuser plates

In its activated sludge plants, company uses diaphragm type diffusers in microbored rubber, constructed to provide a uniform distribution of air with bubbles of microscopic diameter designed to optimise the oxygenation of the effluent. The particular structure of the plates reduces the risk of blockages during operation to a minimum and eliminates the possibility of its separation during the inspection phase, thus guaranteeing a high air flow with minimum head loss.

Item	Diameter mm	Weight kg	Maximum air flow m^3/h	Diameter of bubbles mm	Oxygenation capacity go_2 / Nm^3 per meter head
IFADN	211	2,1	5	1 -3	18 -20

USE AND MAINTENANCE

The particular structure of the diffuser reduces the risk of blockages during operation (including intermittent) to a minimum and eliminates the possibility of separation during the inspection phase, thus guaranteeing a high air flow with minimum head loss. The rubber lining of the rigid air distributor provides protection against accidental damage to the system, which will maintain its original characteristics over time. It is nevertheless advisable to clean the diffuser with a jet of water each time sludge is removed from the tank. This will prevent any accumulation in the microbores, which could result in an insufficient delivery of air and a consequent reduction in the performance of the plant.

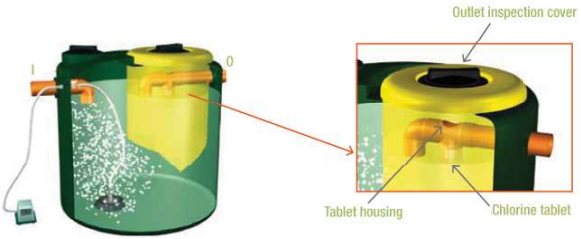
Chlorine tablets

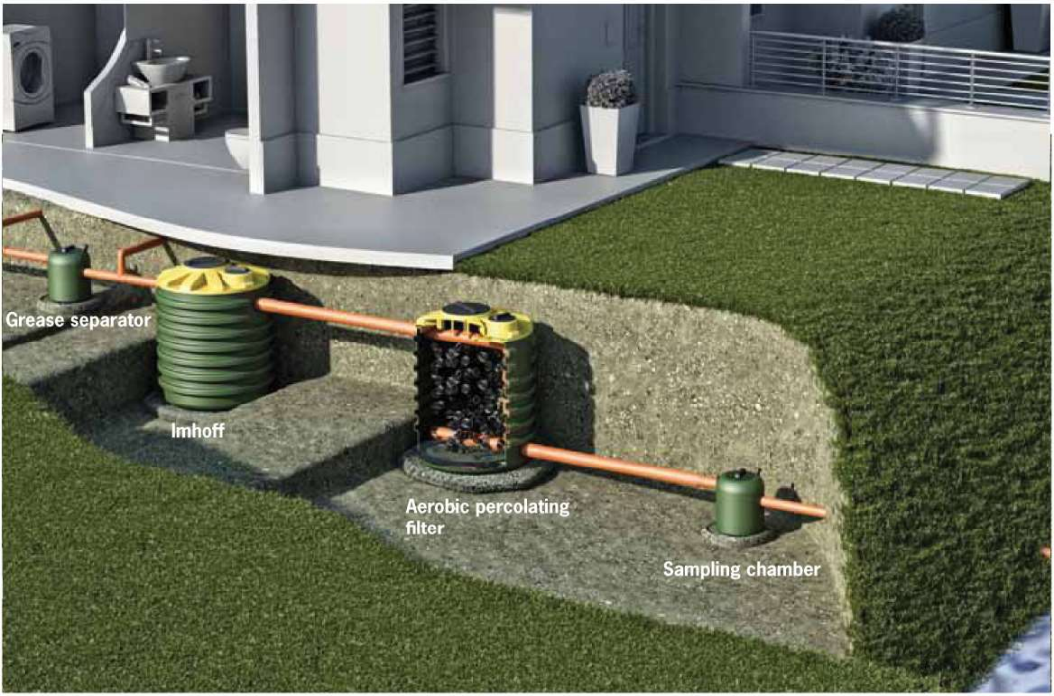
The Activated Sludge plants are constructed with a disinfection compartment inserted in the effluent discharge pipe. A chlorine tablet can be placed in the housing to produce a disinfected effect which will last for 30-60 days. This device was introduced to prevent the risk of a micro-biological presence in the discharge not complying with legal requirements.

Item	Weight mg	Diameter mm	Height mm
IFACC	200	75	25

PRECAUTIONS DURING USE

- Harmful when swallowed.
- Irritant for eyes and respiratory tract (in the case of contact with eyes, wash immediately and abundantly in water and seek medical help).
- Store out of reach of children.
- Keep away from humidity.
- In the case of fire and/or explosion, do not breathe in the fumes
- Can cause ignition of combustible raw materials
- Emits toxic gas on contact with acids.
- Highly toxic for aquatic organisms





1. ANAEROBIC PERCOLATING FILTER
2. AEROBIC PERCOLATING FILTER

PERCOLATING FILTERS

TECHNICAL CHARACTERISTICS

A percolating filter is a biological reactor, inside which the micro-organisms that purify the effluent develop on the surface of special bulk fill material (filter media). The uniform distribution of the effluent through the filter guarantees maximum contact between the organic material to purify and the biological film covering the spheres making up the fill material.

The spheres making up the filter media are manufactured in polypropylene and are designed to provide a large surface area available for bacterial micro-organisms to take root. In particular, the spheres used provide a surface area per unit volume of filter media of 140 m^2/m^3, much higher than the traditional stone fill material with voids accounting for 90%. This solution minimises the risk of clogging the bed and also guarantees an improved circulation of air through the filter bed of the aerobic filter. Percolating filters allow good purification performance without any energy overheads, with management costs limited to the occasional cleaning of the plant. The sizing of percolating filters for an average domestic effluent refers to the organic load factor ($kgBOD/m^3d$) with which the filter is fed. This parameter is the ratio between the organic load at the inlet ($kgBOD_5d$) and the volume of the filter bed

Rototec percolating filters are designed to operate with medium-low organic load factors ($kgBOD_5/m^3d$). This guarantees a good margin of safety, with respect to fluctuations in inlet flow, and a limited production of excess sludge.
The anaerobic percolating filters are certified in accordance with UNI EN 12566-3 norm.

USE AND MAINTENANCE

The filter is designed to ensure minimum clogging risk. However, the development of the films on the filter media can over time excessively dirty the filter, with the resulting risk of solids being discharged with the treated effluent. In order to avoid an excessively turbid discharge it is advisable to inspect and clean the filter at least once a year. These operations are normally carried out as part of the Imhoff tank inspection and emptying operations. Cleaning is performed by thoroughly washing the filter bed, backwashing where necessary, paying particular attention to remove any accumulations in the inlet and outlet pipes. It should be remembered that in order for the percolating filter to function correctly, the effluent must first be subjected to primary sedimentation treatment in an Imhoff tank or similar installed upstream of the filter. The use of Rototec BIO-ACTIVATORS is recommended for rendering the starting of the biological processes more rapid.

SPECIFICATION ITEMS

Percolating anaerobic filter for secondary treatment of wastewater coming from residential buildings or similar, polyethylene (PE) one-piece structure, manufactured in **ISO 9001/2008 certified company**, certified in accordance with **UNI EN 12566-3 norm** and with Legislative Decree n°152/2006 for final discharge to a soil absorption system or surface watercourse, fitted with: black isotactic polypropylene filter media with high specific surface area; inlet dispersion pipe in PVC with watertight gasket in NBR rubber for the distribution of the flow, outlet pipe in PVC with watertight gasket in NBR rubber and submerged pipe for the discharge of the effluent; fitted also with biogas vent, threaded covers in polypropylene (PP) for inspection, emptying and cleaning purposes; optional threaded extensions;
Percolating anaerobic filter mod.....filter volume..... mc, dimensions.....x.....x.....cm

Percolating aerobic filter for secondary treatment of wastewater coming from residential buildings or similar, polyethylene (PE) one-piece structure, manufactured in **ISO 9001/2008 certified company**, in accordance with Legislative Decree n°152/2006 for final discharge to a soil absorption system or surface watercourse, fitted with: black isotactic polypropylene filter media with high specific surface area; inlet dispersion pipe in PVC with watertight gasket in NBR rubber for the distribution of the flow, outlet pipe in PVC with watertight gasket in NBR rubber and submerged pipe for the discharge of the effluent from the bottom of the tank; fitted also with biogas vent, threaded covers in polypropylene (PP) for inspection, emptying and cleaning purposes; optional threaded extensions;
Percolating aerobic filter mod.....filter volume..... mc, dimensions.....x.....x.....cm

N.B.: Underground installation instructions on page 107

1. Anaerobic percolating filters

Certification UNI-EN 12566 - 3 CE

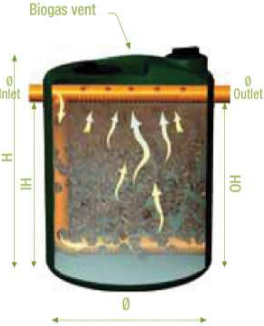
Sizing Sizing is based on an average domestic effluent flow, with a treatment efficiency of 70-80% for the organic load (BOD_5) in the presence of primary sedimentation (Imhoff tank). To improve the effluent treatment, the installation of a secondary sedimentation tank is recommended, Imhoff or septic tank type, downstream of the percolating filter. The proposed sizing refers to a domestic type effluent discharge of daily flow rate 200 l/P.E. and a daily organic load of 48 gBOD_5/P.E. after primary sedimentation.

Use As secondary treatment downstream of primary treatments (Imhoff, grease separator), for final discharge to a soil absorption system or surface watercours, ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc.

Corrugated percolating filter

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	S m^2	Filter vol. m^3	Organic load kgbod / m^3 d	P.E.
NAN 1000	1150	1220	880	860	110	CC455-CC255	PP45-PP30	1,04	0,85	0,3	6
NAN 1200*	1900 x708	1630	1250	1230	110	CC455-CC355	PP45-PP35	1,35	1,2	0,33	7
NAN 1500	1150	1720	1360	1340	110	CC455-CC255	PP45-PP30	1,04	1,26	0,26	9
NAN 1700 *	1900 x708	2140	1760	1740	110	CC455-CC355	PP45-PP35	1,35	1,77	0,31	10
NAN 2600	1710	1350	1000	980	125	CC455-CC355	PP45-PP35	2,3	2,06	0,3	14
NAN 3200	1710	1625	1240	1220	125	CC455-CC355	PP45-PP35	2,3	2,52	0,35	20
NAN 3800	1710	1855	1490	1470	160	CC455-CC355	PP45-PP35	2,3	3,10	0,33	23
NAN 4600	1710	2125	1710	1690	160	CC455-CC355	PP45-PP35	2,3	3,80	0,33	27
NAN 7000	2250	2367	1850	1830	160	CC600-CC455	PP65-PP45	3,98	6,93	0,31	45
NAN 9000	2250	2625	2070	2050	160	CC600-CC455	PP65-PP45	3,98	7,82	0,33	55

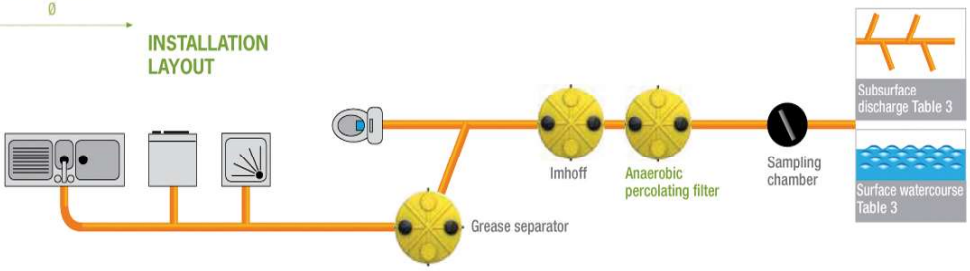
* Elipse tank with rectangular base



Smooth percolating filter

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	S m^2	Filter vol. m^3	Organic load kgbod / m^3 d	P.E.
AN 1000	1160	1140	910	890	110	CC455-CC255	PP45-PP30	1,06	0,91	0,31	6
AN 1500	1160	1610	1390	1370	110	CC455-CC255	PP45-PP30	1,06	1,4	0,31	9
AN 2000	1160	2075	1850	1810	125	CC455-CC255	PP45-PP30	1,06	1,9	0,32	13
AN 3000	1450	1940	1660	1635	125	CC455-CC255	PP45-PP30	1,65	2,64	0,32	18

INSTALLATION LAYOUT



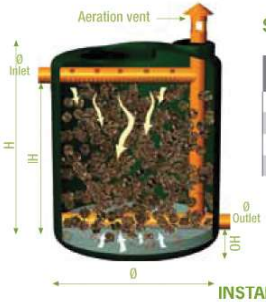
2. Aerobic percolating filters

Sizing Thanks to the aeration of the adhered biomass, the aerobic filter has a higher treatment performance than the anaerobic filter. The outlet from this type of plant is level with the bottom of the filter, and as such in the absence of any difference in level, the installation of a lifting system downstream of the filter itself is required. In order to reduce the discharge of solids, the installation of a secondary sedimentation tank is recommended, Imhoff or septic tank type, downstream of the percolating filter. The proposed sizing refers to a domestic type effluent discharge of daily flow rate 200 l/P.E. and a daily organic load of 48 $gBOD_5$/P.E. after primary sedimentation.

Use As secondary treatment downstream of primary treatments (Imhoff, grease separator), for final discharge to a soil absorption system or surface watercours, ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc.

Corrugated percolating filter

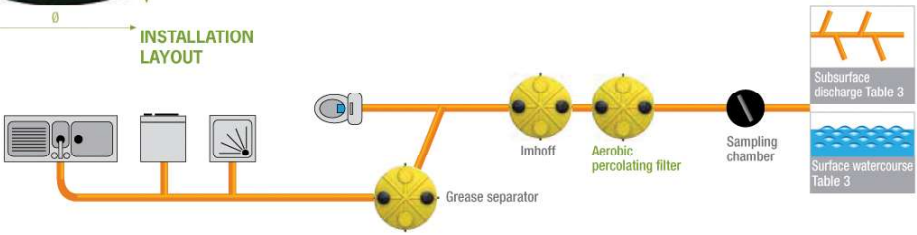
Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	S m^2	Filter vol. m^3	Organic load kgbod / m^3 d	P.E.
NAR 1000	1150	1220	880	40	110	CC455-CC255	PP45-PP30	1,04	0,85	0,3	6
NAR 1500	1150	1720	1360	40	110	CC455-CC255	PP45-PP30	1,04	1,26	0,26	9
NAR 2600	1710	1350	1000	40	125	CC455-CC355	PP45-PP35	2,3	2,06	0,3	14
NAR 3200	1710	1625	1240	40	125	CC455-CC355	PP45-PP35	2,3	2,52	0,35	20
NAR 3800	1710	1855	1525	40	125	CC455-CC355	PP45-PP35	2,3	3,17	0,33	23
NAR 4600	1710	2125	1745	40	125	CC455-CC355	PP45-PP35	2,3	3,83	0,33	27
NAR 7000	2250	2367	1885	40	125	CC600-CC455	PP65-PP45	3,98	6,93	0,31	45
NAR 9000	2250	2625	2105	40	125	CC600-CC455	PP65-PP45	3,98	7,82	0,33	55



Smooth percolating filter

Item	Ø mm	H mm	IH mm	OH mm	Ø I/O mm	Cover	Extensions	S m^2	Filter vol. m^3	Organic load kgbod / m^3 d	P.E.
AR 1000	1160	1140	910	40	110	CC455-CC255	PP45-PP30	1,06	0,91	0,31	6
AR 1500	1160	1610	1390	40	110	CC455-CC255	PP45-PP30	1,06	1,4	0,31	9
AR 2000	1160	2075	1825	40	125	CC455-CC255	PP45-PP30	1,06	1,9	0,32	13
AR 3000	1450	1940	1665	40	125	CC455-CC255	PP45-PP30	1,65	2,64	0,32	18

INSTALLATION LAYOUT



Filter media

BIO-ECO and WIND-ECO are modern types of bulk filter media developed especially for the construction of medium-load percolating filter beds treating biodegradable domestic or industrial sewage. The advantages of using this type of filter media are linked to the large specific surface area and the high void index, as a result of which it is also possible to obtain good treatment results for peak applied organic loads, minimising the risks of filter clogging while optimising the circulation of air. The lightweight nature of this type of fill material allows simpler and less expensive civil works to be constructed compared to the traditional stone or gravel. The use of synthetic filter media becomes even more advantageous when considering its ease of handling and the realisation of a plant that uses this type of support.

Item	Shape	Dimensions mm	Specific surface area m^2 / m^3	Void index %	Dry weight kg / m^3	Weight during service kg / m^3	Material
BIO-ECO	Spherical	70	140	approx. 95	47	approx. 350	Black isotactic polypropylene

Item	Shape	Dimensions mm	Specific surface area m^2 / m^3	Void index %	Dry weight kg / m^3	Weight during service kg / m^3	Material
WIND-ECO	Circular	170	120	approx. 95	38	approx. 350	Black isotactic polypropylene

Start-up of a percolating filter

1. DISCHARGE TO SURFACE WATERCOURSE OR SOIL ABSORPTION SYSTEM
2. TERTIARY TREATMENT

BEDS FOR CONSTRUCTED WETLANDS

TECHNICAL CHARACTERISTICS

Company horizontal subsurface-flow wetland treatment systems for domestic discharges are constructed using linear high density polyethylene beds (LLDPE) with a one-piece structure to guarantee maximum water tightness. Once filled with inert material, the beds allow the effluent to flow horizontally under continuous saturation conditions (plug-flow reactors). In this way, the effluent to treat is maintained in constant contact with the emergent rooted macrophytes that perform the purification. The effluent flow is maintained a few centimetres below ground level by a special hydraulic device. In this way, a prevalently anoxic environment is created, rich in aerobic microsites on the plant roots. This variety of potential redox conditions (reduction-oxidation) renders the system extremely elastic, versatile and efficient when faced with different types of effluent and variations in pollutant load. As the effluent passes through the filter media and the roots of the plants (which constitute the biofilm reactor) the organic material is decomposed by bacterial action and the nitrogen is denitrified, while the phosphorous and heavy metals are anchored to the filter media by adsorption. The horizontal subsurface-flow systems also provide greater thermal protection of the effluent during the winter, especially in the case where frequent snow cover is expected.

USE AND MAINTENANCE

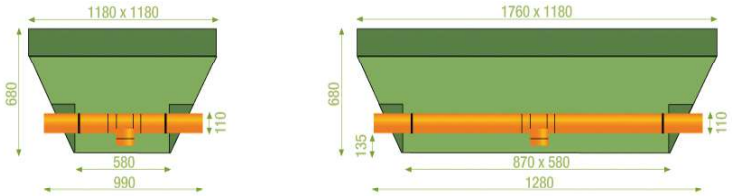
The choice of pre-treatment systems suitable for the type of sewage to treat is an important factor for guaranteeing the operation and life of a constructed wetland. Most of the solids contained in the effluent, in fact, must be removed. For this purpose, both the three-chamber septic tanks and the Imhoff biological tanks are recommended. In order to ensure the good operation of constructed wetland systems, the primary treatments must be correctly maintained, and the deposit of solid material that could obstruct the distribution systems and/or accumulations in the soil in which the vegetation grows must be monitored. During the installation phase, the beds must be positioned in such a manner that reduces the flow of rainwater in them to a minimum, creating sidewalls and reducing the formation of rivulets, thus encouraging the development of a grassy cover near to the beds. Inspections must be carried out every three months to ensure that there are no blockages at the inlet and outlet chambers and to eliminate weeds that, during the plant start-up period, could prevent the growth of the plants selected to treat the effluent. Once a year or during the primary sludge emptying operation, the distribution pipes must be cleaned using a pressure wash system.

SPECIFICATIONS ITEMS

Horizontal subsurface-flow wetland treatment systems manufactured in **ISO 9001/2008 certified company**, for secondary treatment of civil wastewater in accordance with Legislative Decree n°152/2006, formed by polyethylene (PE) one-piece beds for underground installation fitted with: PVC pipe DN110 for the connections, deflector T for the dispersion and watertight gaskets in NBR rubber: polyethylene (PE) one-piece level chambers installed upstream and downstream, for underground installation, fitted with PVC pipe DN 110 with watertight gasket in NBR rubber and threaded covers in polypropylene (PP) for inspection. Horizontal subsurface-flow constructed wetland, n° of beds.....mod.....,total plant area ..... mq.

N.B.: Underground installation instructions on page 107

Beds for contructed wetland



1. Discharge to surface watercourse or soil absorption system

Constructed wetland for secondary treatment of domestic effluent, or that assimilable to domestic effluent, with discharge to surface watercourse or soil absorption system, sized on the basis of the available surface area for planting 3 m^2/P.E.

P.E.	Surface area m^2	Beds and level chambers n°
2	6	n. 3 VS2 + n. 2 DD150FT
3	9	n. 5 VS2 + n. 2 DD150FT
4	12	n. 6 VS2 + n. 2 DD150FT
6	18	n. 9 VS2 + n. 2 DD150FT
8	24	n. 12 VS2 + n. 2 DD150FT

P.E.	Surface area m^2	Beds and level chambers n°
10	30	n. 15 VS2 + n. 2 DD150FT
12	36	n. 18 VS2 + n. 2 DD150FT
15	45	n. 23 VS2 + n. 2 DD150FT
18	54	n. 27 VS2 + n. 2 DD150FT
20	60	n. 30 VS2 + n. 2 DD150FT

2. Tertiary treatment

Constructed wetland system as tertiary treatment of effluent following secondary treatment in an aerobic percolating filter or activated sludge plant. Sized according to the surface area available for planting 1 m^2/P.E.

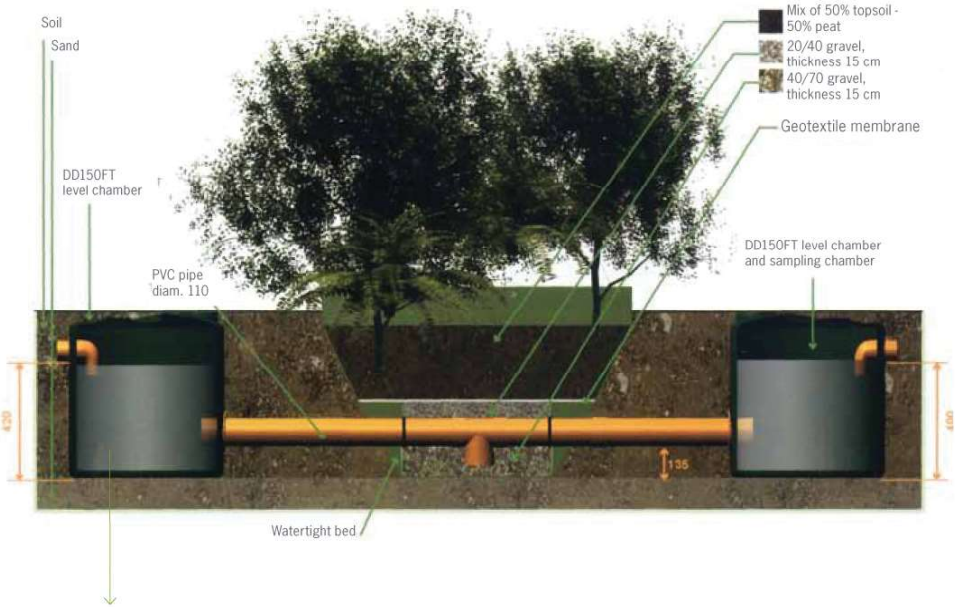
P.E.	Surface area m^2	Beds and level chambers n°
2	2	n. 1 VS2 + n. 2 DD150FT
4	4	n. 2 VS2 + n. 2 DD150FT
6	6	n. 3 VS2 + n. 2 DD150FT
8	8	n. 4 VS2 + n. 2 DD150FT
10	10	n. 5 VS2 + n. 2 DD150FT
12	12	n. 6 VS2 + n. 2 DD150FT
15	15	n. 8 VS2 + n. 2 DD150FT

P.E.	Surface area m^2	Beds and level chambers n°
18	18	n. 9 VS2 + n. 2 DD150FT
20	20	n. 10 VS2 + n. 2 DD150FT
24	24	n. 12 VS2 + n. 2 DD150FT
30	30	n. 15 VS2 + n. 2 DD150FT
35	35	n. 18 VS2 + n. 2 DD150FT
40	40	n. 20 VS2 + n. 2 DD150FT
50	50	n. 25 VS2 + n. 2 DD150FT

Installation

The beds for the constructed wetlands must be installed on a flat stable surface in such a manner that the level of effluent remains constant and the same in all the beds of the plant. To this end, 2 level chambers are installed at the inlet and outlet of the plant. In all cases, these chambers must guarantee that the level of effluent remains below ground level in order to prevent the proliferation of unwanted insects and the emission of malodours. Once installed and connected, the beds are then filled. It is advisable to place a 15-20 cm thick layer of 40/70 mm coarse gravel near to the diffuser pipes, as shown in the figure below. Then add a 15 cm layer of finer gravel (20/40). These layers are very important, in that they ensure better dispersion of the effluent and reduce the risk of clogging the bed. The remaining volume of the beds is then filled with highly porous soil consisting prevalently of a 50-50 mix of topsoil and peat.

To ensure optimum performance of the system, it is advisable to position a geotextile membrane under the layer of soil. Finally, the vegetation is planted either in the form of seeds, rootstock or species of vegetation at various levels of growth (see next page). As far as the layout of the wetland beds is concerned, these can be installed in series to form a single line. In the case of a large number of beds, a system can be created in which the beds themselves are distributed along two or three parallel lines. In all cases, however, the above instructions must be followed.



Level chamber

Item	Ø mm	H mm
DD 150 FT	580	790

Recommended plants

The planting of constructed wetland systems can be performed in three different ways: seeds, planting of rootstock or planting vegetation at various levels of growth. The most ideal system depends on the time required for activating the wetland. For subsurface-flow systems, a plant density of 4 units/m^2 is recommended. In general, the best period for planting is spring, while planting in summer (July, August) or winter is not advised. The wetland system must be inspected every three or four months in order to check the growth status of the plants and, if necessary, carry out more planting. Dead vegetation does not adversely affect the operation of the system but instead provides heat insulation for the bed. Nevertheless, it is good practice to cut the elevated parts of the plants every second or third winter.


Spotted laurel (Acuba Japonica)


Flowering rush (Butomus Umbrellaus)


Kingcup (Caltha Palustris)


Bowels golden sedge (Carex Elata)


Hemp agrimony (Epatorium Cannabinum)


Fern (Felce)


Yellow iris (Iris Pseudocorus)


Juncus


Purple loosestrife (Lythrum Salicaria)


Common reed (Phragmites Australis)


Elder (Sambucus nigra)


Club rush (Schoenoplectus)


Branched bur-reed (Sparganium Erectum)


Bullrush (Typha)

Soil absorption system (Subsurface discharge)

Technical construction requirements

The dispersion pipe must preferably consist of continuous tubular elements in HDPE of diameter 110-125 mm, with 5 to 10 mm wide slots formed in the lower part perpendicular to the pipe centreline and spaced 10 - 20 cm. The dispersion pipe must have a gradient of between 0,2% and 0,5%. The pipe is laid in a trench of minimum depth 60 cm and maximum depth 80 cm, with the width at the base not less than 40 cm. The bottom of the trench must be filled with a bed of washed stone of size 40/70 of minimum depth 30 cm. The dispersion pipe is laid at the centre of the stone bed. Prior to being covered with fill material, the top surface of the stone bed must be protected using a layer of material suitable for preventing the overlying soil from becoming clogged while at the same time guaranteeing that the drainage system remains aerated. A "filter fabric" is particularly suitable for this type of application.

On completion of the works, the summit of the trench must be slightly higher than the adjacent ground in order to prevent the formation of low spots and channels that would allow rainwater to penetrate into the drainage system. The dispersion pipe can be:

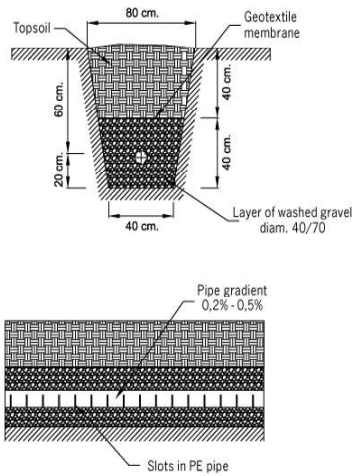
1. single;
2. branched;
3. laid along parallel lines.

In the last case, the pipes are laid at no less than 2 metres between centrelines. Greater distances, where possible, will improve the efficiency of the dispersion. On steeply sloping ground, the adoption of a soil absorption discharge system must be carefully evaluated with respect to possible landslide phenomena linked to the geomorphologic and geotechnical characteristics of the ground in question. This solution however should not be adopted in cases where the sloping ground has a gradient of more than 15%, otherwise there is a risk of the distributed effluent rising to the surface at the lower levels. The pipeline must, nevertheless, follow the direction of the contour lines in order to prevent the dispersion pipes from exceeding the above-mentioned ideal gradients. For sanitary and operational reasons, trenches housing dispersion pipes must be located far from buildings and paved areas or must be located in a manner that prevents the passage of air in the ground. In this respect, the following minimum distances should be respected:

In the presence of groundwater, the distance between the bottom of the dispersion trench and the maximum level of the groundwater must not be less than 1 m (Appendix V of I.C resolution of 04/02/77). For this purpose, the maximum level of the groundwater is intended as being the level reached by the water table, with respect to ground level, under maximum flow conditions.

The length of the dispersion pipe per user depends on the type of ground available. For reference purposes, the table shown alongside has been taken from Appendix V of the Interministerial Committee Resolution of 04/02/77.

SOIL ABSORPTION SYSTEM

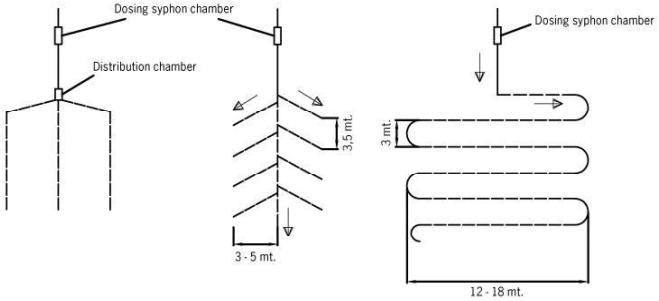


Structure types	Safety distance
Buildings	defined by local regulations
Wells, pipes, tanks or any other private works used for the supply of potable water (Appendix V of IC Resolution 04/02/77)	30 m
Wells, pipes, tanks or any other public works used for the supply of potable water (D.P.R. 24/5/88 n°236 for water destined for human consumption)	200 m

Soil composition	Length of dispersion pipe
Fine sand or light fill material	2 m/P.E.
Coarse sand and crushed stone	3 m/P.E.
Fine sand with clay	5 m/P.E.
Clay with some sand content	10 m/P.E.
Compact clay	Unsuitable

Soil absorption system (Subsurface discharge)

The following diagrams show the possible layouts of dispersion pipes indicated in the guidelines for treating domestic sewage and similar in areas not served by public sewers, as provided for by ARPA Tuscany (2005).



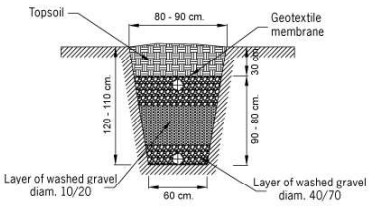
One particular soil absorption system which, due to its specific characteristics, can be used in the presence of a soil consisting of compact clay (and therefore impermeable) is the DRAINED SOIL ABSORPTION SYSTEM. This treatment system consists of a trench of approximate depth 1,20 m and width of 80 cm at the upper part and 60 cm at the bottom. The discharge pipe (dispersion pipe), consisting of an HDPE pipe with cuts in the upper part, normally formed along the length of the pipe itself 7/10 cm apart, is laid on the bottom of the trench. The trench is then filled with 40/70 size washed coarse gravel for a depth of 65 cm. It is advisable to vary the size of the gravel by placing a layer of approximately 30 cm of 20/40 size in the lower part and 40/70 in the upper part. The upper pipe (drainage pipe) connected to the Imhoff tank is laid on top of this gravel layer.

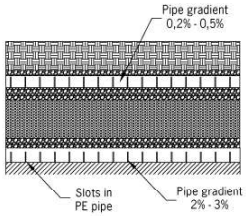
This upper drainage pipe must have the same characteristics as the lower pipe, the only difference being that the cuts must be on the underside of the pipe. More coarse gravel must then be added to cover this upper pipe for a depth of approximately 15 cm. A layer of filter fabric is then placed over the gravel in order to prevent soil from filling the voids between the stones. The trench is then topped with approximately 30 cm of topsoil and the relative area reinstated. The gradients of the pipes are an important factor and must never exceed 0,5%. The dispersion pipe must be at least 5 m longer than the drainage pipe. The upper (drainage) pipe must therefore be plugged at least 5 m before the discharge into the receptor.

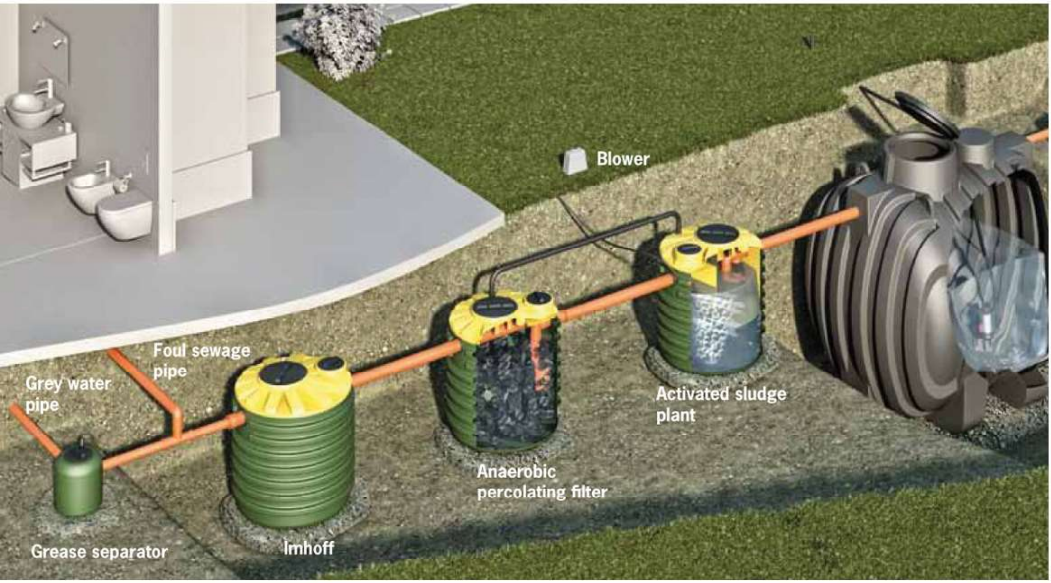
In order to introduce an aerobic atmosphere into the filter media, aeration pipes must be laid in the trench at a distance of approximately 3 m. These aeration systems must be in 110-125 mm diameter HDPE pipes, perforated to allow the passage of air. The pipes must be connected to chambers with covers that prevent the entry of rainwater.

In order to ensure the specific characteristics of this type of effluent treatment system, the trench must act as a natural container, as a result of which the ground where it is installed must be able to guarantee total geological impermeability. As far as the sizing of the drained soil absorption system is concerned, in order to guarantee a volume of filter media equal to 1-2 m^3 per population equivalent, a minimum length of between 2 and 4 metres must calculated per population equivalent. A suitable dosing siphon chamber must be installed between the Imhoff tank and the start of the soil absorption system in order to ensure that the effluent flows along the entire length of the drainage pipe.

DRAINED SOIL ABSORPTION SYSTEM







1. SECONDARY TREATMENT
2. SECONDARY TREATMENT WITH SLUDGE RECIRCULATION

DEEP SECONDARY TREATMENTS

TECHNICAL CHARACTERISTICS

Secondary treatments consisting of an anaerobic percolating filter and an activated sludge plant (with or without recirculation) allow almost 100% removal of the organic load and suspended solids with a very high reduction in the nitrogen load and phosphorous load found in domestic sewage. In this way, the discharged effluent complies with the limits laid down by table 4 of appendix 5 of Law Decree 152/2006 for discharge to land and, with the installation of an appropriate disinfection system, can be stored for eventual re-use for less noble purposes (irrigation, vehicle and hardstanding washing,...). The percolating filter is a biological reactor in which the micro-organisms, under anaerobic conditions, make use of the biodegradable substance contained in the effluent. These micro-organisms develop on the surface of special bulk fill material in polypropylene, specifically designed to maximise the contact surface area between the micro-organisms and the effluent. Activated sludge plants are systems in which the bacterial flora develops in colonies that remain in suspension in the effluent and consume the remaining biodegradable material. The process is fully aerobic and the oxygen necessary for the development of the bacteria is supplied by submersed diffusers that emit a flow of fine bubbles of air from the bottom of the tank. This also guarantees continuous effluent mixing. In systems with sludge recirculation, a part of the sludge present in the tank is recirculated to the percolator by means of an air lift system. In this way, the removal of the organic load, the nitrogen and the phosphorous is the maximum possible, allowing the effluent to be re-used for irrigation or for discharge to highly protected areas (e.g. Venice Lagoon). The outlet from the activated sludge plant is equipped with a housing in which it is possible to insert a chlorine tablet. This allows the effluent leaving the treatment plant to be disinfected before being stored.

USE AND MAINTENANCE

Bacterial organisms develop inside the two tanks forming the treatment system and transform the pollutants into inert sludge which tends to accumulate at the bottom and on the filter media of the percolating filter. Over time, an excessive accumulation of sludge leads to the release of these bacterial organisms with the resulting deterioration in the quality of the final effluent. For this reason, the tanks need to be inspected and subjected to periodic maintenance. These operations are normally carried out as part of the Imhoff tank inspection and emptying operations. Cleaning of the anaerobic filter is performed by thoroughly washing the filter bed, backwashing where necessary, paying particular attention to remove any accumulations in the inlet and outlet pipes. Cleaning of the activated sludge tanks is effected by removing a part of the excess sludge, paying particular attention to removing accumulations at the inlet and outlet pipes and cleaning the air diffusers to prevent blockages. During the tank inspection operations, make sure that there is a continuous supply of air being blown into the activated sludge plant and a recirculation of sludge to the anaerobic percolating filter. It should also be remembered that in order to ensure the correct operation of the plant, a grease separator and Imhoff tank or similar should be installed upstream of the plant itself. Furthermore, particular attention should be paid to the discharge of disinfectants, bleaches, strong acids or bases which could deactivate the biomass. The plant needs 10-15 days in order to reach normal operation. This time can be reduced however by adding biomass activators directly to the sewage.

SPECIFICATION ITEMS

Dual-stage biological plant for secondary treatment of civil wastewater or similar, manufactured in **ISO 9001/2008 certified company**, in accordance with Legislative Decree n°152/2006 for the discharge to land (Table 4), consisting of:

- Percolating anaerobic filter in polyethylene (PE) corugated one-piece structure, fitted with: black isotactic polypropylene filter media with high specific surface area; inlet dispersion pipe in PVC with watertight gasket in NBR rubber for the distribution of the flow, outlet pipe in PVC with watertight gasket in NBR rubber and submerged pipe for the discharge of the effluent; fitted also with biogas vent, threaded covers in polypropylene (PP) for inspection, emptying and cleaning purposes; optional threaded extensions;
- Low load activated sludge plant in polyethylene (PE) corrugated one-piece structure, fitted with: inlet pipe with 90° elbow in PVC with watertight gasket in NBR rubber, sedimentation chamber, outlet pipe with deflector T and housing for chlorine tablet in PVC with watertight gasket in NBR rubber; supply with an aeration system with diaphragm blower, rubber pipe and plate diffuser/s in microbored rubber; fitted also with biogas vent, threaded covers in polypropylene (PP) for inspection, emptying and cleaning purposes; optional threaded extensions;

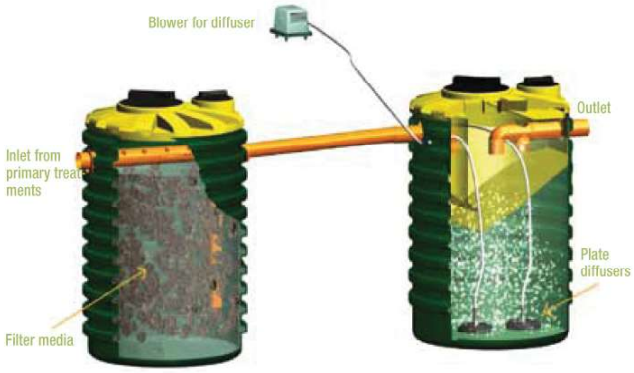
Dual stage biological plant mod.....constituted by a percolating anaerobic filter, dimensions .....x.....x.....cm and a loe load activated sludge plant, dimensions .....x.....x.....cm

N.B.: Underground installation instructions on page 107

1. Secondary treatment for discharge to land (Table 4)

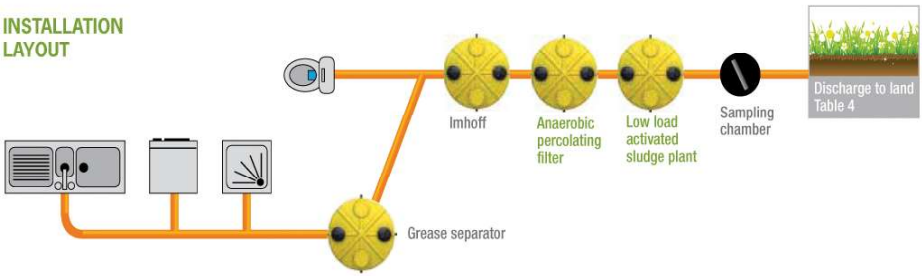
Sizing The system is designed for installation downstream of primary treatment (grease separator and Imhoff tank) and allows removal of suspended solids and organic load in accordance with table 4 of Law Decree 152/06 and subsequent amendments. The plants are designed for a daily organic load per capita of 48 g/P.E. (downstream of an Imhoff or septic tank type primary sedimentation and grease separator) and for a mean daily flow of 200 l/P.E.

Use As secondary treatment downstream of primary treatment (Imhoff tank, grease separator)for discharge to land, ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc.



Item	Anaerobic percolating filter						Activated sludge plant							P.E.
	Item	Ø mm	H mm	Cover	Extensions	Filter vol. m³	Item	Ø mm	H mm	Cover	Extensions	Aer. vol. lt.	Sed. vol. lt.	Blower	
DEP 07	NAN 1000	1150	1220	CC455-CC255	PP45-PP30	0,85	NIFA 1000	1150	1220	CC455-CC255	PP45-PP30	607	243	HP40	7
DEP 09	NAN 1000	1150	1220	CC455-CC255	PP45-PP30	0,85	NIFA 1500	1150	1720	CC455-CC255	PP45-PP30	906	362	HP40	9
DEP 11	NAN 1500	1150	1720	CC455-CC255	PP45-PP30	1,2	NIFA 1500	1150	1720	CC455-CC255	PP45-PP30	906	362	HP40	11
DEP 13	NAN 1500	1150	1720	CC455-CC255	PP45-PP30	1,2	NIFA 2600	1710	1350	CC455-CC355	PP45-PP35	1432	629	HP80	13
DEP 15	NAN 2600	1710	1350	CC455-CC355	PP45-PP35	2,06	NIFA 2600	1710	1350	CC455-CC355	PP45-PP35	1432	629	HP80	15
DEP 17	NAN 2600	1710	1350	CC455-CC355	PP45-PP35	2,06	NIFA 3200	1710	1625	CC455-CC355	PP45-PP35	1765	760	HP80	17
DEP 20	NAN 3200	1710	1625	CC455-CC355	PP45-PP35	2,52	NIFA 3200	1710	1625	CC455-CC355	PP45-PP35	1765	760	HP80	20
DEP 23	NAN 3200	1710	1625	CC455-CC355	PP45-PP35	2,52	NIFA 3800	1710	1855	CC455-CC355	PP45-PP35	2139	965	HP80	23
DEP 26	NAN 3800	1710	1855	CC455-CC355	PP45-PP35	3,17	NIFA 3800	1710	1855	CC455-CC355	PP45-PP35	2139	965	HP80	26
DEP 30	NAN 3800	1710	1855	CC455-CC355	PP45-PP35	3,17	NIFA 4600	1710	2125	CC455-CC355	PP45-PP35	2713	1085	HP80	30
DEP 35	NAN 4600	1710	2125	CC455-CC355	PP45-PP35	3,83	NIFA 4600	1710	2125	CC455-CC355	PP45-PP35	2713	1085	HP80	35
DEP 40	NAN 4600	1710	2125	CC455-CC355	PP45-PP35	3,83	NIFA 7000	2250	2367	CC600-CC455	PP65-PP45	5474	1460	HP150	40
DEP 47	NAN 7000	2250	2367	CC600-CC455	PP65-PP45	6,93	NIFA 7000	2250	2367	CC600-CC455	PP65-PP45	5474	1460	HP150	47
DEP 52	NAN 7000	2250	2367	CC600-CC455	PP65-PP45	6,93	NIFA 9000	2250	2625	CC600-CC455	PP65-PP45	5803	2020	HP150	52
DEP 60	NAN 9000	2250	2625	CC600-CC455	PP65-PP45	7,82	NIFA 9000	2250	2625	CC600-CC455	PP65-PP45	5803	2020	HP150	60

INSTALLATION LAYOUT



2. Secondary treatment with sludge recirculation

Sizing The system is designed for installation downstream of primary treatment (grease separator and Imhoff tank) and allows removal of suspended solids and organic load in accordance with table 4 of Law Decree 152/06 and subsequent amendments. The plants are designed for a daily organic load per capita of 48 g/P.E. (downstream of an Imhoff or septic tank type primary sedimentation and grease separator) and for a mean daily flow of 200 l/P.E.

Use As secondary treatment downstream of primary treatment (Imhoff tank, grease separator), for discharge to land or re-use for irrigation purposes (with appropriate disinfection), ideal for: isolated residential buildings, public offices, industrial or commercial activities, service stations, railway stations, airports, fast-food hygiene services, restaurants, bars, holiday farms, hotels, campsites, etc.

Item	Anaerobic percolating filter						Activated sludge plant with sludge recirculation								P.E.
	Item	Ø mm	H mm	Cover	Extensions	Filter vol. m³	Item	Ø mm	H mm	Cover	Extensions	Aer. vol. lt.	Sed. vol. lt.	Blower	
DEP 07RF	NAN 1000R	1150	1220	CC455-CC255	PP45-PP30	0,85	NIFA 1000R	1150	1220	CC455-CC255	PP45-PP30	607	243	HP40-HP40	7
DEP 09RF	NAN 1000R	1150	1220	CC455-CC255	PP45-PP30	0,85	NIFA 1500R	1150	1720	CC455-CC255	PP45-PP30	906	362	HP40-HP40	9
DEP 11RF	NAN 1500R	1150	1720	CC455-CC255	PP45-PP30	1,2	NIFA 1500R	1150	1720	CC455-CC255	PP45-PP30	906	362	HP40-HP40	11
DEP 13RF	NAN 1500R	1150	1720	CC455-CC255	PP45-PP30	1,2	NIFA 2600R	1710	1350	CC455-CC355	PP45-PP35	1432	629	HP80-HP60	13
DEP 15RF	NAN 2600R	1710	1350	CC455-CC355	PP45-PP35	2,06	NIFA 2600R	1710	1350	CC455-CC355	PP45-PP35	1432	629	HP80-HP60	15
DEP 17RF	NAN 2600R	1710	1350	CC455-CC355	PP45-PP35	2,06	NIFA 3200R	1710	1625	CC455-CC355	PP45-PP35	1765	760	HP80-HP60	17
DEP 20RF	NAN 3200R	1710	1625	CC455-CC355	PP45-PP35	2,52	NIFA 3200R	1710	1625	CC455-CC355	PP45-PP35	1765	760	HP80-HP60	20
DEP 23RF	NAN 3200R	1710	1625	CC455-CC355	PP45-PP35	2,52	NIFA 3800R	1710	1855	CC455-CC355	PP45-PP35	2139	965	HP80-HP60	23
DEP 26RF	NAN 3800R	1710	1855	CC455-CC355	PP45-PP35	3,17	NIFA 3800R	1710	1855	CC455-CC355	PP45-PP35	2139	965	HP80-HP60	26
DEP 30RF	NAN 3800R	1710	1855	CC455-CC355	PP45-PP35	3,17	NIFA 4600R	1710	2125	CC455-CC355	PP45-PP35	2713	1085	HP80-HP80	30
DEP 35RF	NAN 4600R	1710	2125	CC455-CC355	PP45-PP35	3,83	NIFA 4600R	1710	2125	CC455-CC355	PP45-PP35	2713	1085	HP80-HP80	35
DEP 40RF	NAN 4600R	1710	2125	CC455-CC355	PP45-PP35	3,83	NIFA 7000R	2250	2367	CC600-CC455	PP65-PP45	5474	1460	HP150-HP150	40
DEP 47RF	NAN 7000R	2250	2367	CC600-CC455	PP65-PP45	6,93	NIFA 7000R	2250	2367	CC600-CC455	PP65-PP45	5474	1460	HP150-HP150	47
DEP 52RF	NAN 7000R	2250	2367	CC600-CC455	PP65-PP45	6,93	NIFA 9000R	2250	2625	CC600-CC455	PP65-PP45	5803	2020	HP150-HP150	52
DEP 60RF	NAN 9000R	2250	2625	CC600-CC455	PP65-PP45	7,82	NIFA 9000R	2250	2625	CC600-CC455	PP65-PP45	5803	2020	HP150-HP150	60