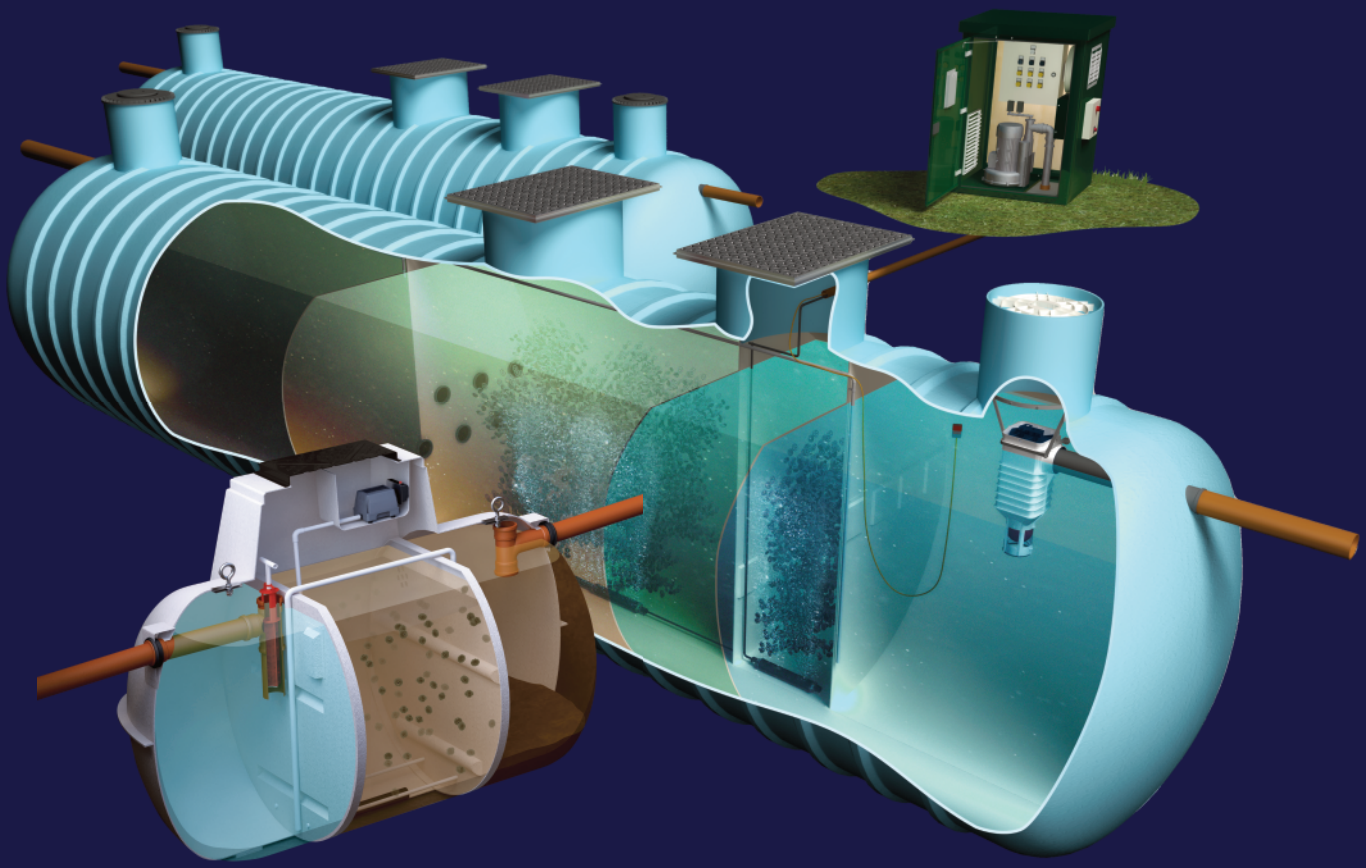
# Package sewage treatment plants

## Installation and operation manual



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**Based in Northamptonshire and with extended facilities in Bridgwater, Somerset, Marsh Industries is a leading manufacturer of sewage treatment plant, off-mains drainage products and rainwater harvesting systems for both UK and overseas markets.**

Marsh supplies sewage treatment plant and off-mains drainage products for domestic, commercial and industrial applications as well as offering engineering design and technical support.

With one of the largest merchant distributor networks available in Europe, clients ask for Marsh products and services because they know the company delivers from a solid foundation of knowledge, customer support, product quality and proven performance.

Architects, specifiers and installers within the construction sectors seek alliances and partnership with Marsh because its core products and services bring further added value to their own brands.

## Start up information for sewage treatment plants after prolonged periods of inactivity

When returning to or reopening your place of business, please follow the instructions below to enable a smooth start-up and to minimise the risk of pollution when restarting your sewage treatment plant. This guidance can be applied to seasonal locations such as holiday parks, or to businesses that have faced an enforced period of inactivity such as site refurbishment.

Firstly, make sure the area is secure and cordoned off to prevent people or animals on site from falling into the sewage treatment plant.

Where possible a qualified British Water accredited engineer should be employed to carry out these procedures. PPE must be worn and handwashing/sanitising must be carried out.

When first opening the tank chambers please ensure the area is well ventilated and engineers are wearing protective face masks. Sewer gases can accumulate in sewage treatment plants, particularly Hydrogen Sulphide, which can be very dangerous even at low levels. (Sewer gas is a complex mixture of toxic and nontoxic gases produced by the decomposition of organic household or industrial components of sewage).

- ✓ When your treatment plant is turned on, make sure the compressor/air blower is operational.
- ✓ Inspect the air filters on the top of the compressor and remove any debris impeding the flow of air.
- ✓ Check whether air is reaching the treatment zone of your sewage treatment plant. This can be done by checking for a mild jacuzzi effect in the middle chamber of the plant.
- ✓ Make sure the media (golf ball sized pieces of plastic) are freely circulating in the aeration chamber within the treatment plant. These must not be accumulating at one side of the chamber or the other.
- ✓ Ensure that the treatment plant is vented locally and that air is allowed unhindered access to the plant with no air admittance valves located on the vent.
- ✓ Be aware that when restarting your plant after prolonged periods of inactivity, smell and odour may be generated in the initial weeks while the biomass - 'good bacteria' - starts to grow again on the media (Activated carbon vents are available for purchase from Marsh Industries if this is an issue).
- ✓ Existing recirculation pipes from the final chamber to the primary chamber assist and speed up the sewage treatment process, however a temporary submersible pump with a flow of less than 10 litres a minute can be fitted into the final humus chamber to further enhance the process. The pump must be 1m below the waterline and should discharge to the primary chamber with the hose being under the waterline to minimise the agitation of solids. The pump can be operated for 20mins in every hour for 6 hours per day for the first 4 days of start up. After this period, the pump should be removed, cleaned and stored.

If you have concerns about restarting your sewage treatment plant, please contact the Marsh HQ on 01933 654582.

Note: Marsh Industries accepts no liability for any damage or loss, including consequential loss caused by the failure of any drainage equipment or any failure caused by gross solids or fats entering the sewage treatment plant.

It is the responsibility of the installer/contractor to undertake installation of the sewage treatment plant as per the manufacturer instructions.

Marsh Industries believe that the information printed in this manual is accurate, and published for information only. No warrants, express or implied, are contained therein, nor does any legal liability attach to Marsh Industries for any reason whatsoever. The company's policy is one of continuous product improvement and we reserve the right to make alterations to our range and specification without prior notice.

# 1 Pre-installation checklist

**Prior to installation please check or take note of the following:**

- ✓ Ensure that the information contained in this manual is adhered to at all times.
- ✓ When the sewage treatment plant arrives on site it is recommended to fully inspect for damage (ie, fractures to the shell or ribs, delamination, scratches or abrasions deeper than 1.5mm, stress cracks or star crazing). If any damage is seen or suspected please notify Marsh Industries immediately as problems cannot be rectified easily after installation.
- ✓ It is the responsibility of the installer/contractor to undertake installation of the sewage treatment plant as per Marsh Industries' instructions.
- ✓ All electrical work must be undertaken by fully qualified personnel under the guidance of The Health & Safety at Work Act.
- ✓ Ensure the plant is properly ventilated.
- ✓ The end-user of the plant is responsible for the operation and maintenance of the system and its discharge either direct to a watercourse or through a percolation area.
- ✓ It is important that the product is operated under the conditions for which it is designed. Any variation in these conditions could prevent the unit from performing to its full potential and the effluent discharge may not meet required standards.
- ✓ Maintain the system in accordance with this handbook.
- ✓ Any service contract offered by Marsh is mechanical only and does not include desludging (emptying of the system). The end-user must desludge the system in accordance with the guidelines provided in this handbook.
- ✓ Drainage fields, drains and desludging of the plant remains the responsibility of the end-user. Any damage to the installation due to the influx of surface water or the backing up of drainage fields or drains is not covered by service agreements.
- ✓ Contact Marsh Industries if you have any technical queries regarding the installation, maintenance or servicing of the system.

**To maintain optimum system performance the end-user must be aware of certain precautions, including the following:**

- ✗ Do not open the plant cover without firstly isolating the mains power.
- ✗ Do not alter in any way, any part of the system or internal parts supplied with the system.
- ✗ The design loading of the plant should not be exceeded.
- ✗ High volume discharges such as those from swimming pools and Jacuzzi's must never enter the system.
- ✗ Surface water must not enter the system.
- ✗ Heavy duty toilet paper, sanitary towels or incontinence pads must not enter the sewage treatment plant. This could cause severe blockages and can adversely affect organic biomass growth.
- ✗ If the plant is installed in a care home or medical facility, spent medication must not enter the sewage treatment plant as this can adversely affect organic biomass growth.
- ✗ Do not allow large quantities of chemicals to enter the system including:
    - *Water softener regenerate*
    - *Disinfectants or high concentrate bleaches*
    - *Strong acids and alkalis*
    - *Oil or grease*
    - *Pesticides*
    - *Photographic chemicals*

# 2 Site location (For guidance only)

Minimum distances for locating sewage treatment plant is set out below. These are minimum distances only – the unit should be located as far away as is practically possible. However, when locating the plant, consideration should be given to allow adequate access for a desludging tanker.

| | Any dwelling | Watercourse or stream | Spring or well | Lake/moat | Site boundary | Road | Slope, break or cuts |
|---|---|---|---|---|---|---|---|
| Plant | 7m | 10m | 50m | 50m | 3m | 4m | 4m |
| Percolation area | 15m | 10m | 50m | 50m | 3m | 4m | 4m |

# 3 Tank installation

## Site inspection

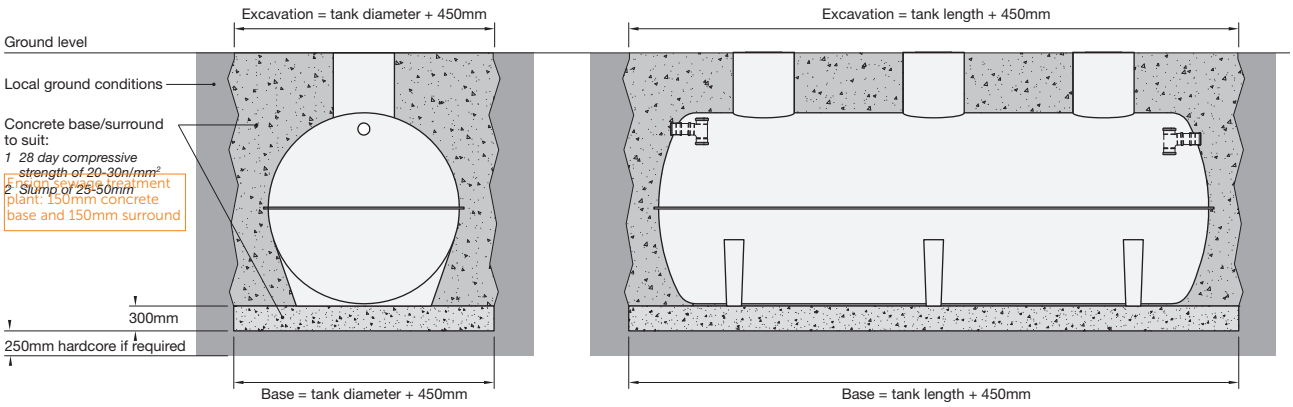
- Ensure site location ground is flat, even and free from rocks.
- If the plant is to be installed in a high traffic area, a qualified civil engineer should design a separate load bearing slab and reinforced base of hard core with metal grid support and concrete.

## Movement of the sewage treatment plant

- The weight of the tank is not evenly distributed along its length, so time needs to be taken to ensure the straps are distributed to prevent movement or slippage.
- Use only web straps to lift the tank - do not allow chains, cables or wire ropes to make contact with the tank.

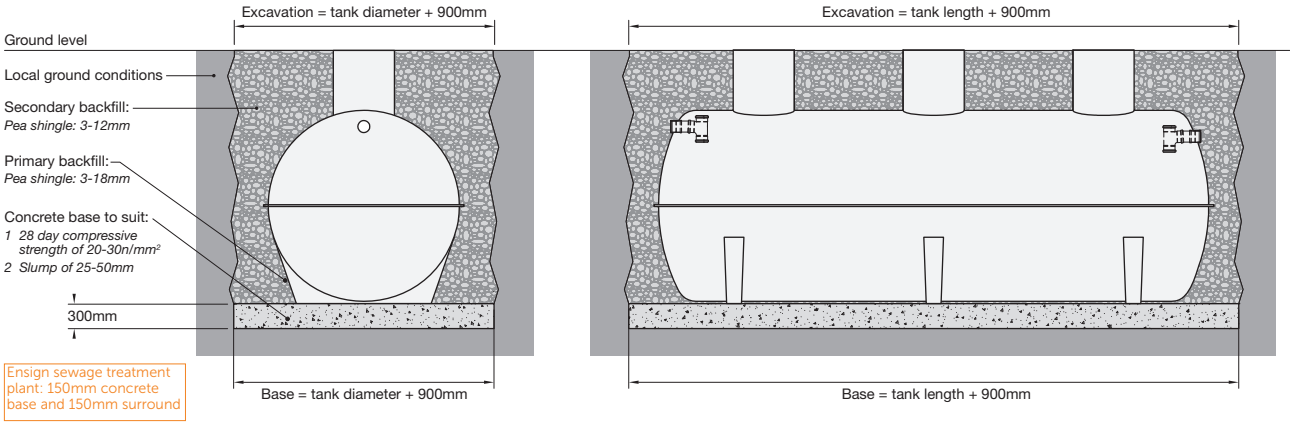
  Note: Lifting eyes (rated to 350kgs) used during the manufacture of Ensign units can be used for on-site handling - For steadying purposes only. Not to be used for lifting the tank.
- A lifting beam is to be used for tanks over 8m long.
- The tank must be fully lifted off the ground for clear movement – do not drag the tank along the ground.
- The unit needs to be chocked to prevent movement or rolling when sitting on the ground.

## Concrete base and surround (Recommended)



- Essential for wet sites where the water table can rise above the base of the system (Installation in a wet site may be precluded by site considerations in relation to effluent disposal).
- Groundwater must be controlled and prevented during the installation, even when the tank has been strapped or anchored. Failure to do so will damage the shell and invalidate all warranties.
- The excavation must be kept as dry as possible. Excess water should be evacuated using a site pump/sump, hole/suction hose arrangement. Dewatering should be continued for as long as necessary or at least until the concrete base has set.
- Ensure the excavation is safe with sloped surrounds and shuttering to safeguard the installation.
- The grade and thickness of the concrete base should be designed to suit site conditions - a minimum thickness of 300mm (Ensign sewage treatment plant: 150mm concrete base) and for high water table/wet sites a 250mm hardcore sub-base should be laid, compacted and levelled.
- *The choice of concrete is the responsibility of the installer and should be chosen to suit local ground conditions. In normal conditions with non-aggressive soils, a concrete with a 28 day compressive strength of 20 to 30N/mm$^2$ with a 25 to 50mm slump – this must adhere to the relevant BS EN standards. If in doubt seek specialist advice prior to installation.*
- *When pouring concrete around the sewage treatment plant, please ensure the maximum pressure of 15kN/m$^2$ around the plant is not exceeded. The concrete should never be poured directly on to the tank.*
- *Do not use vibrating pokers.*
- Lower the sewage treatment plant onto the concrete base ensuring the tank is level at all laterals.
- Connect up the pipework - the system is plumbed for 160mm UPVC pipe (Ensign sewage treatment plant up to 16pe: 110mm UPVC pipe). A short length of pipe with flexible joints should be used immediately before and after the sewage treatment plant to allow for movement between the tank and the pipe work.
- The excavation should be backfilled with concrete of minimum 225mm pour width to approximately 300mm below the ground level (full surround to top of tank, around turrets and inlet/outlet points).
- In a multiple tank arrangement, there must be a minimum of 500m distance between the tanks. This 500mm void must be filled with concrete during the pouring.
- Evenly fill each chamber of the tank with clean water to a depth of 700mm. Continually check the pipework levels and connections visually.
- Backfill evenly around the tank with concrete ensuring no voids are present, especially around the bottom of the tank shell and ribs.
- Continue filling the tank chambers with water whilst evenly backfilling and pouring concrete around the tank ensuring that the water level is no more than 300mm above the concrete level.
- For any tank with a lip connection, please ensure that concrete is over the lip before adding water to this point of the tank.
- Ensure all turrets and access covers are sealed to prevent concrete entering the plant. Use framework around the turrets to prevent distortion and damage to the tank.
- **We recommend that normally the depth from ground level to inlet invert of the sewage treatment plant should be no more than 1.5m.** This could change due to groundwater conditions. Deeper inverts with heavier duty shells and ribs are available from Marsh Industries.

## Granular surround (For free draining sites)



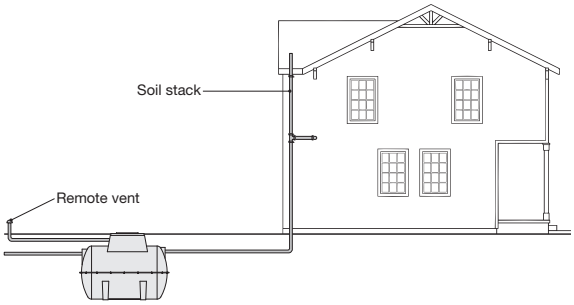

### Primary backfill

- Primary granular backfill is pea shingle between 3-18mm in size. It should be washed, have no sharp edges and contain no boulders. In winter, check to ensure there are no clumps of ice in the materials as this can create voids causing long term damage.
- Tanks must be installed with primary backfill only within the region immediately surrounding the tanks - the pour width should be 450mm. During the pour, check to make sure that no voids are created and that the pour is evenly distributed.
- The pour should be evenly to the top of the turrets and access points. Care needs to be taken to avoid distortion.

### Secondary backfill

- Secondary backfill is pea shingle between 3-12mm or coarse sand. This once again is judged to be clean, free flowing with no voids whilst pouring.
- If crushed stone is used as the secondary backfill, ensure that it is at least 450mm from the tank walls and dome ends.
- Be careful as dug material needs to be carefully selected and sifted to ensure no roots, clay or boulders are present.
- Take care when compacting the backfill material not to distort the turrets or access chambers.

## Ventilation




- It is important that a specific air venting point is provided by the installer to allow the system to freely vent and disperse gas, and also ensure air supply to the compressor if this is integral to the tank.
- For all sewage treatment plants it is recommended that a remote vent stack should be installed. This should be connected into the (marked) vent position on the tank using the 110mm grommet supplied, and terminate at a suitable distance and height from any surrounding dwellings to allow dispersal of air from the system. Consideration should be given to the prevailing wind and any local site geography that may inhibit air dispersion or allow any odours to return towards the dwellings.
- Marsh recommend external compressors (in housing supplied) to ensure a constant supply of clean, dry air. If the compressor is supplied integral to the unit (in 'basin' under manway lid) it is recommended to fit a vent local to the tank to improve air supply and quality.
- If in any doubt as to the installation of an appropriate vent, please contact Marsh Industries.

# 4 Electrical guidelines

**NOTE: If the plant is not due to be commissioned for at least two weeks it is advisable to remove the compressor.**

- Connection must be performed by a suitably qualified and experienced electrical contractor.
- The electrical requirement of the unit will be either Single Phase or Three Phase. Please check the specification that has been supplied to you about your system.
- The compressor is either linear or side channel and will come with wiring instructions.
- A GRP kiosk or above ground housing may be supplied/required dependent on the size of the plant. Please check your system specification in advance so that you are able to prepare the site for your kiosk.

## Standard gravity system with air blower (Conforms to European Standards)

- A 230V, 16amp waterproof plug and socket connector will be supplied with the unit, one for each compressor required. Please check your system specification about the quantity and type of compressor(s). On larger units, connection details can be bespoke, please check prior to installation.

**It is the end-user's responsibility for the provision of:**

- A single run of 1.5mm (or greater dependent on distance/voltage drop considerations) 3 core SWA cable from the end-user's distribution cabinet to the tank unit socket, or to the pre-wired distribution box fitted inside the GRP kiosk. The cable armour must be properly bonded to the main earth at the premises
- Cable protection via 10amp MCB/RCD or RCBO, rated 230V AC and tripping current 30mA.
- The unit will come with power failure alarm as standard. Other alarms are available, depending on your application, please check the specification supplied to you about your alarm options.
- The air pump/compressors and electric power must never be switched off. It is imperative they run 24 hours a day, every day, to ensure a constant supply of oxygen to the bacteria in the biozone.

## Alarm options

Various alarm systems are available to suit different standards and system specifications. Please contact Marsh Industries for full details.

# 5 Service checklist and maintenance

The plant must be switched off and isolated before checking the electrical components and supply.

## General

- Check to ensure the levels in the tank are even across all chambers.
- Regularly check to see if the primary chamber requires desludging (See section 7).

## Compressor

- Check to ensure all compressors are working and air hose connections are secure.
- Annually clean the filter on the top of the compressor.
- Annually check the diaphragms and replace if required.
- Check the loss of pressure alarm on compressors.
- If the compressors are housed, either in a kiosk or housing, check to ensure ventilation is adequate.

### Media (Within aeration chamber)

- Ensure media is moving around the aeration chamber freely by the diffuser/diffusers.
- Visually check to ensure adequate bio-mass growth on the media surface area.

### Polylok Filter (Tertiary filtration)

- If a Polylok Filter is fitted to the plant at the outlet end (normally only on plants over 50PE) carefully lift the filter out of the casket and wash down before returning it back into the casket securely. This should be done normally once a month.
- A high level alarm should be fitted to alert the site owner of when the filter needs cleaning.

### High level alarm

- If a high level alarm is fitted, check to ensure the high level alarm float switch is secure and working by lifting of the float switch by approximately 200mm.

### Structural

- Check to ensure the baffles are not damaged.
- Check that all manhole cover and frames are secure and all locking nuts are in place.

### Electrical

- Check supply current and amps.
- Check wiring condition and IP plugs.

# 6 Drainage fields

For development proposals in sewered areas it is usually a legal requirement to connect to the public sewer, either by gravity or pumping, as the sewage is conveyed to a municipal sewage treatment works. However, if it can be demonstrated that the proposed sewage disposal system offers a more sustainable solution to the overall water management of the site, then the regulators will consider the installation of a 'private' system.

For any such proposal you should:

- Check with your regulating body to confirm current status with regard to Registration/Consent, quality and volume limits, etc.
- Take account of the requirements of Building Regulations and discuss with the local planning authority at an early stage - well before any planning application is made.

### Drainage fields

- If you have access to a suitable area of land, discharge from your septic tank or treatment plant to a properly designed and sized drainage field is the best environmental option as the treated effluent recharges groundwater, nutrients are retained in the soil, and nutrient loads on surface waters are reduced.
- The most common form of drainage field is a subsurface percolation area comprising perforated infiltration pipes laid in shingle filled trenches – normally within 1m of ground level to allow the micro-organisms in the soil to break down the organic matter, and at least 1.2m above the winter water table.
- The drainage field has two principal purposes:
    - To allow percolation of partially treated/treated effluent to ground at a controlled rate.
    - To allow further treatment of partially treated effluent before it reaches the groundwater level.

- Before you can dispose of effluent via a drainage field you first need to assess whether such a route is appropriate, ie, you have a good depth of well-drained, well-aerated soil away from watercourses, wells/boreholes, dwellings, and avoiding sloping sites and areas prone to waterlogging.

## Trial hole and percolation test method (See figure 1)

- To calculate the exact area of land required for effective disposal an 'assessment' is required, usually by performing a percolation/water table test as outlined in BS6297 (Code of Practice for the Design and Installation of Drainage Fields for use in Wastewater Treatment) and the latest version of Building Regulations: H2.
- A trial hole should be dug to determine the position of the standing groundwater table a minimum of 1m$^2$ in area and 2m deep, or a minimum of 1.5m below the invert of the proposed drainage field pipework.
- The groundwater table should not rise to within 1m of the invert level of the proposed effluent distribution pipes. If the test is carried out in summer, the likely winter groundwater levels should be considered.
- A percolation test should then be carried out to assess the further suitability of the proposed area. A hole 300mm square should be excavated to a depth 300mm below the proposed invert level of the effluent distribution pipe. Where deep drains are necessary the hole should conform to this shape at the bottom, but may be enlarged above the 300mm level to enable safe excavation to be carried out.
- Fill the 300mm square section of the hole to a depth of at least 300mm with water and allow it to seep away overnight.
- Next day, refill the test section with water to a depth of at least 300mm and observe the time, in seconds, for the water to seep away from 75% full to 25% full level (ie, a depth of 150mm). Divide this time by 150. The answer gives the average time in seconds (Vp) required for the water to drop 1mm.
- The test should be carried out at least three times with at least two trial holes and the average figure from the tests should be taken. The test should not be carried out during abnormal weather conditions such as heavy rain, severe frost or drought.

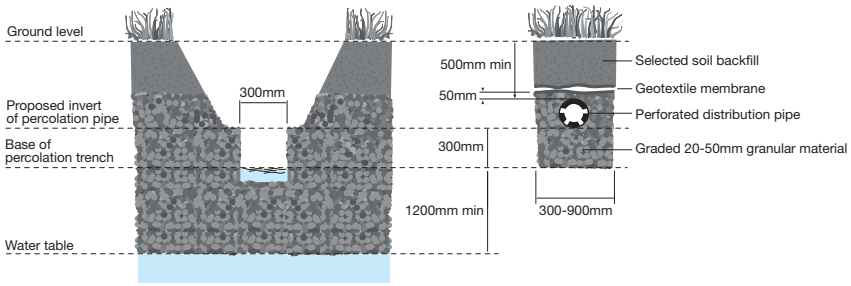



*Figure 1 - Percolation/water table test*

- Drainage field disposal should only be used when percolation tests indicate average values of Vp of between 12 and 100. This minimum value ensures that untreated effluent cannot percolate too rapidly into groundwater. Where Vp is outside these limits effective treatment is unlikely to take place in a drainage field.

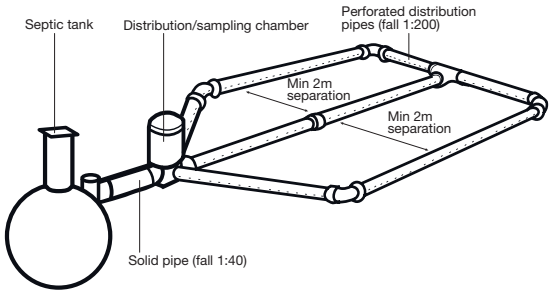



*Figure 2 - Typical drainage field construction*

## Drainage field construction (See figures 1 and 2)

- Drainage fields should be designed and constructed to ensure aerobic contact between the liquid effluent and the subsoil using perforated pipe laid in trenches.
- Pipes should be laid on a 300mm layer of clean shingle or broken stone (graded between 20mm and 50mm) at a minimum depth of 500mm and a uniform gradient not steeper than 1:200.
- Trenches should be filled to a level 50mm above the pipe and covered with a layer of geotextile to prevent the entry of silt. The remainder of the trench can be filled with soil.
- Trenches should be from 300mm to 900mm wide with areas of undisturbed ground 2m wide being maintained between parallel trenches.
- An inspection chamber should be installed between the septic tank and the drainage field.
- Drainage fields should be set out as a continuous loop fed from the inspection chamber.
- To calculate the floor area of the drainage field ($A_t$ in $m^2$), the following formulas should be used:
    - For septic tanks: $A_t = p \times V_p \times 0.25$
    - For treatment plant: $A_t = p \times V_p \times 0.20$

  Where p is the number of persons served by the tank and $V_p$ is the percolation value (secs/mm) obtained.

# 7 Desludging

NOTE: If effluent samples are to be taken they should be taken from the sample chamber or, alternatively, from the discharge pipe. Sampling should only be taken by approved test centres.

The sewage treatment plant will require desludging and maintenance as follows:

- *6PE-35PE – Annually or as required*
- *40PE-100PE – Six monthly or as required*
- *100PE-300PE – As advised*

The desludging of the plant is the responsibility of the site owner. Desludging should be carried out according to the size of the plant and dependent on usage.

It is the site owner's responsibility to provide access for the vacuum tanker, to desludge the plant. Vehicles should never drive over the system. Keep at least 4 metres away from the covers on the plant.

## Desludging procedure

- Desludging should normally be carried out by a vacuum sludge tanker.
- Licensed tankers are available commercially and the service is also provided by some local authorities.
- The sludge should be disposed of in accordance with local authority instructions or in a manner which will not cause pollution.
- The tank should be desludged before the onset of winter if conditions do not allow a tanker on site.
- The sludge in the primary chamber (s) should not be removed completely, but approximately 75mm should be kept in the bottom of the tank to re-seed the new sludge, which will be formed when the tank is put into use again.

  The depth of sludge can be checked using the following technique:
    - *Use a pole that can touch the bottom of the tank and wrap the bottom 1.4m with a white rag.*
    - *Lower the pole to the bottom of the tank and hold for several minutes to allow the sludge layer to penetrate the rag.*
    - *Remove the pole and note the sludge line, which will be darker than the colouration caused by the liquid waste.*

      *(Typically a dark sludge line approximately 2/3rd from the bottom of the pole means you should desludge).*
- The primary chamber must be refilled with fresh water after desludging.
- On every alternative desludge, dead humus/scum should be skimmed from the final settlement tank(s). Ensure the tee pieces in all chambers are clear.

- Care must be taken not to damage the treatment plant with the hose of the vacuum tanker.

Please note:

- The sewage treatment plant should be clearly marked and vacuum tanker should never come closer than the depth of the excavation for the system unless the appropriate precautions have been taken. Never drive over the sewage treatment plant.
- Desludging should never be carried out alone due to potential dangers.
- The access cover should never be left off while the unit is unattended.
- The continued performance of the plant will depend on regular maintenance and cleaning. It is the end-user's responsibility to desludge the unit and keep the vents clear.

## Further safety precautions

- Naked flames should not be used in vicinity of the tank due to the danger of explosion.
- Never enter a tank unless a safety line is attached to the person entering the tank and a second person is above ground to help if the entrant is overcome by gasses or foul air. Personnel entering the tank must have suitable breathing equipment and be fully trained in man entry techniques.
- As safety and security is of vital importance in sewage treatment systems, the following aspects are critical:
    - *Protective clothing/gloves/breathing apparatus, should be worn at all times.*
    - *Always remove contaminated clothing and protective equipment after working with sewage treatment Systems.*
    - *Wash hands and face prior to eating, drinking or smoking.*
    - *Adequate first aid boxes should be present.*
    - *When working with machinery/electrical equipment, proximity of water should be noted. All tools and electrical equipment should be kept dry.*
    - *A second person should be present when carrying out non-routine maintenance.*
- Disused or abandoned tanks should be demolished, filled in or sealed so that accidental entry is impossible.

# 8 Warranty information

Marsh Industries offers an initial 12-month warranty on every plant installed provided that it is installed, commissioned (if required) and maintained in accordance with the manufacturer's instructions and also provided that the unit has not been subject to damage or abuse. This warranty covers all of the GRP components and any other additional installed components against malfunction.

## **British-made** off-mains drainage systems for domestic, commercial, agricultural and leisure sites

**Marsh Industries delivers water/wastewater treatment products and solutions to the domestic, commercial and agricultural sectors from its UK manufacturing plants in Kettering and Bridgwater.**

The company is recognised as a collaborative and trusted partner to its customers, with a reputation for providing quality products that really do add value:

- *Sewage treatment plants 4-1000+ PE*
- *Pump stations 234-20,000+ litres*
- *Septic tanks and cesspools 2800-20,000+ litres*
- *Septic conversion units 4-60+ PE*
- *Grease traps 234-20,000+ litres*
- *Trash/debris barriers*
- *Agri-silage tanks up to 100,000 litres*
- *Stormwater attenuation up to 130,000 litres*
- *Rainwater harvesting systems 1500-20,000+ litres*
- *Oil separators, wash-down separators and silt traps*

All products are fully type-tested and certified to ensure compliance with relevant environmental permitting programmes and building regulations.

In addition, the company's state-of-the art computer software, GAIA, can generate precise, bespoke commercial sewage treatment plants and pump chamber systems to the finest specification.

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