KEE

Specialists in Domestic & Industrial Wastewater Treatment

Wastewater Treatment Systems

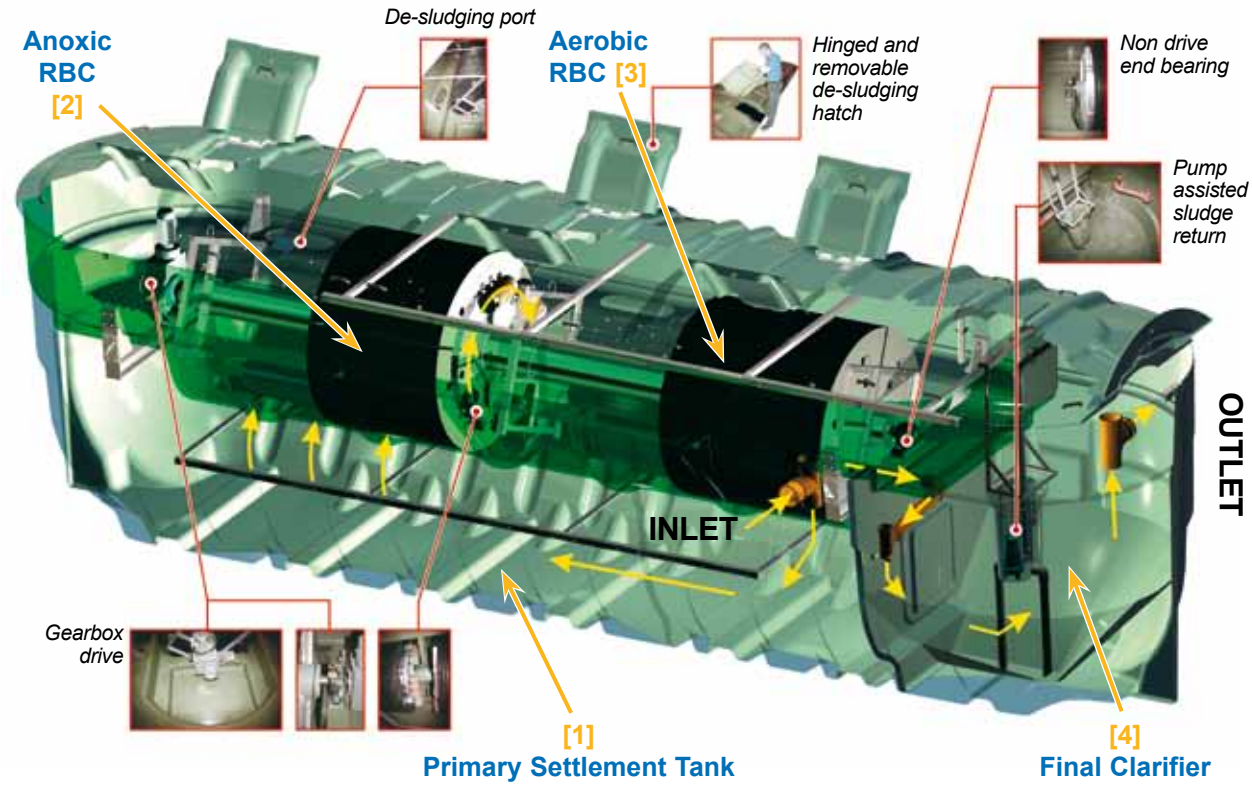
- Rotating Biological Contactors (RBC)
- Submerged Aerated Filters (SAF)

KEE Biological Processes
Rotating Biological Contactors (RBC)

The KEE compact, self contained single piece NuDisc® and Modular wastewater treatment systems use Rotating Biological Contactor (RBC) for the biological stage.

The RBC is rotated slowly by a small electric motor through a reduction gearbox and is arranged so that a proportion of its surface area is submerged in the effluent at any one time. As the RBC rotates, the surface of the media is subjected alternately to wastewater (sewage) and air, encouraging an aerobic, biologically active film of micro-organisms (biomass) to become established on each side of the media sheets.

This biologically active film grows in size, is self regulating and oxidises the pollutants in the sewage. The micro-organisms use the polluting material (measured as BOD) as a substrate (food) and as they do so, multiply in number, maintaining a specific biomass thickness to ensure optimum process efficiency.



Visualisation of a KEE Process NuDisc® Managed Flow Technology System

NuDisc®
Self Contained Single Piece System

Central to the operation of each NuDisc® is the Rotating Biological Contactor (RBC), which supports a biologically active film (biomass) of aerobic micro-organisms.

Wastewater flows into the Primary Settlement Tank (PST) [1], where solids are settled out and retained.

The accumulated sludge is drawn off periodically. Partially clarified liquor containing fine suspended solids flow upwards into the first stage of the Biozone, which houses the Managing RBC stage [2], for initial biodegradation (breakdown of wastewater BOD) by biomass attached to the RBC media. Solids return to the PST via a slot in the bottom of the biozone; the liquor is transferred to the second stage Biozone and Polishing RBC [3] for further treatment.

Any solids remaining are settled out in the Final Clarifier [4]. The quality of the treated wastewater is generally suitable for discharge to a watercourse with consent from Environmental Authorities.

Features of the NuDisc®
Single Piece Treatment System

- Single piece self contained treatment system using RBC technology for aerobic treatment of wastewater.
- Fabricated in lightweight, corrosion resistant and tough Glassfibre Reinforced Polyester (GRP).
- Incorporates KEE Process NuDisc® technology offering substrate and flow balancing.
- Virtually silent and odour free.
- Minimal site work, ease of installation and commissioning.
- Low maintenance costs and simple to operate and maintain.
- Stable and reliable fixed film process with consistent performance.
- Handles and maintains performance during peak flow conditions.
- Extremely low power demand – RBC driven by a direct coupled geared motor.
- Suitable for small to medium flows up to 70m^3/day in a single piece configuration.
- Lowest lifetime cost. Structural components have a 30 year design life with 100,000 hour L_{10} design life for mechanical/electrical components.
- Aesthetic, sectional, hinged lightweight, low profile GRP covers provide complete access for ease and safety of maintenance, offering protection against weather and reducing fly and insect nuisance.
- KEE fixed price operation and maintenance contract.

NuDisc® Installations

BK NuDisc® Preikestolhytta, Norway

This plant (left) serves a Youth Hostel and Restaurant with the load fluctuating considerably through the year.

The effluent quality requirements are stringent; nutrient removal is required with total phosphorus to be reduced to less than 1 ppm.

The plant is housed in a dedicated building to provide easy access for maintenance in Arctic Scandinavian weather conditions.

F13 NuDisc® - Welsh Water plc, UK

This plant (left) serves Welsh Water plc site, handling domestic wastewater and surface water.

Design Dry Weather Flow (DWF)
1 litre per second.

Full Flow to Treatment (FFT)
3 litres per second.

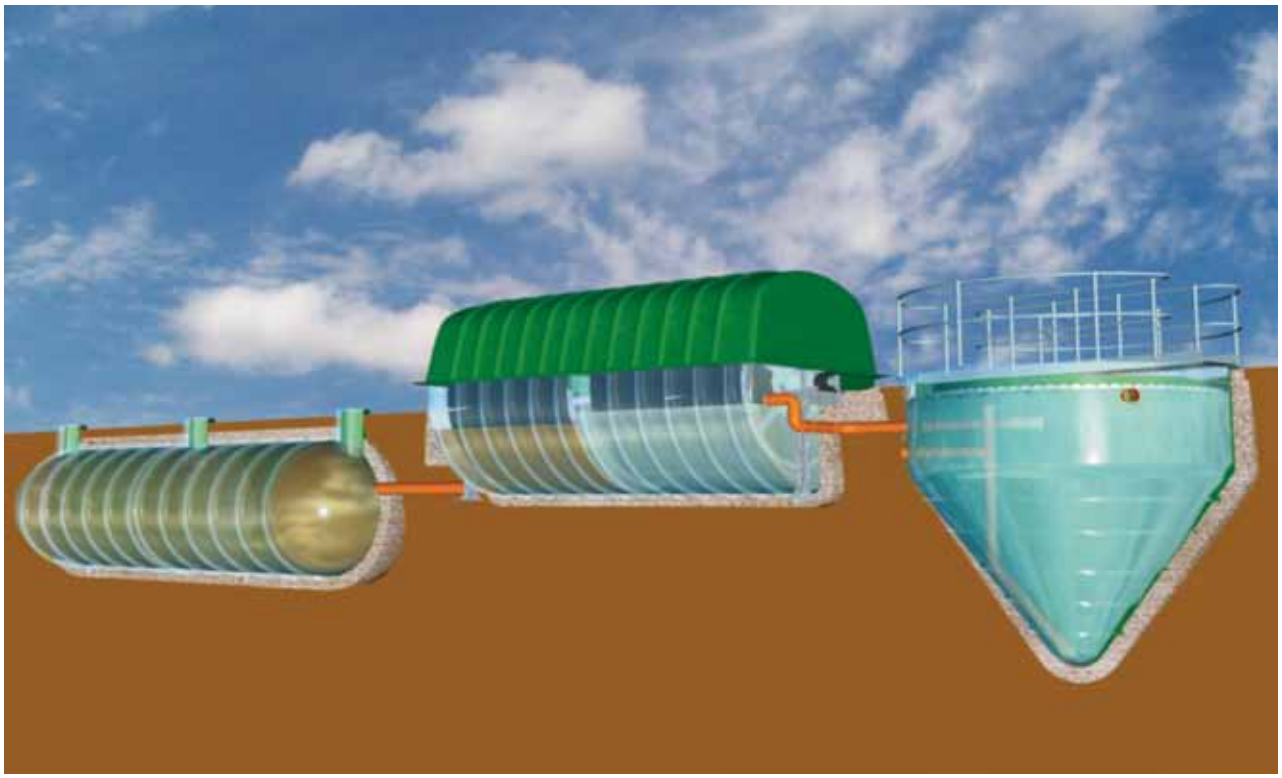
Design Final Effluent
BOD <40mg/litre and Suspended Solids <60mg/litre.

Actual Final Effluent
BOD <10mg/litre SS <20mg/litre.

KEE Biological Processes
RBC Modular Systems

The three principal unit operations of the NuDisc® namely, Primary Settlement Tank (PST), Rotating Biological Contactor (RBC) and Final Clarifier are broken down into separate units in the form of a KEE Modular System to provide greater flexibility and treatment for larger flows.

Visualisation of a KEE Managed Flow RBC Modular System



Features of RBC Modular System

- Modular system with two or three items of plant. Using RBC technology for aerobic treatment of wastewater.
- Fabricated in lightweight, corrosion resistant and tough Glassfibre Reinforced Polyester (GRP).
- Incorporates KEE NuDisc® technology offering substrate and flow balancing.
- KEE fixed price operation and maintenance contract.
- KEE fixed price operation and maintenance contract.
- Minimal site work, ease of installation and commissioning.
- Low maintenance costs and simple to operate and maintain.
- Stable and reliable fixed film process with consistent performance.
- Can handle and maintain performance during peak flow conditions.
- Suitable for medium to large flows up to 400 m^3/day in factory built prefabricated equipment and much larger flows in in-situ site built structures.
- Extremely low power demand – RBC driven by a direct coupled geared motor.
- Aesthetic, sectional, hinged lightweight GRP cover giving complete access for ease and safety of maintenance, offering protection against weather and reducing fly and insect nuisance.
- Over 30 years design life for structural components and 100,000 hour L_{10} design life for mechanical/electrical components. Lowest lifetime cost.

KEE RBC Modular Plants
System Installations

DN19S RBC Kinallen WwTW, N.I.

The multiple stream RBC Plant (left) designed for a Population Equivalent of 1800 to treat combined domestic wastewater and surface water.
Design final effluent requirement, BOD <35mg/litre, Suspended Solids <55mg/litre and NH_4-N <10mg/litre, 95% ile.
Actual final effluent standard BOD <10mg/l, Suspended Solids <20mg/litre and NH_4-N <2.6mg/litre.

DN16 RBC System Winchester, UK

The wastewater treatment plant (below) serves a Hotel to produce final effluent with BOD <20mg/litre, Suspended Solids <30mg/litre and NH_4-N <10mg/litre.

Multiple RBC System – Corpach, UK

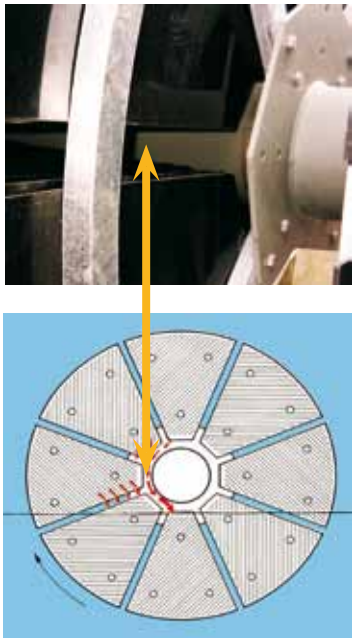
The RBC plant (right) is serving a population of approximately 2000 and is treating municipal wastewater from the village of Corpach.

The plant consists of Primary Settlement Tanks, 3m dia. RBCs and GRP Final Clarifiers.

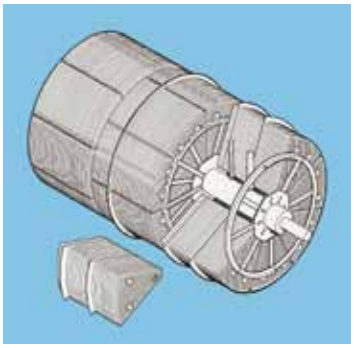
The plant is designed to treat a flow of 710m^3/day with a BOD loading of 91.21kg/day.

The design final effluent standard is BOD of less than 20mg/litre and Suspended Solids of less than 30mg/litre.

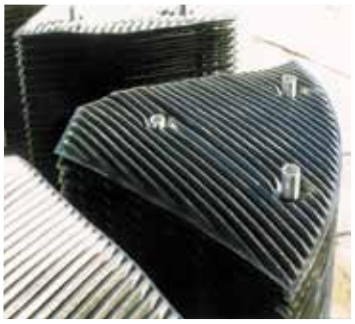
KEE RBC Construction Processes



- Media packs designed and arranged to ensure annular and radial separation to provide drainage of media. This ensures aeration of all the biomass and avoids media blockage.

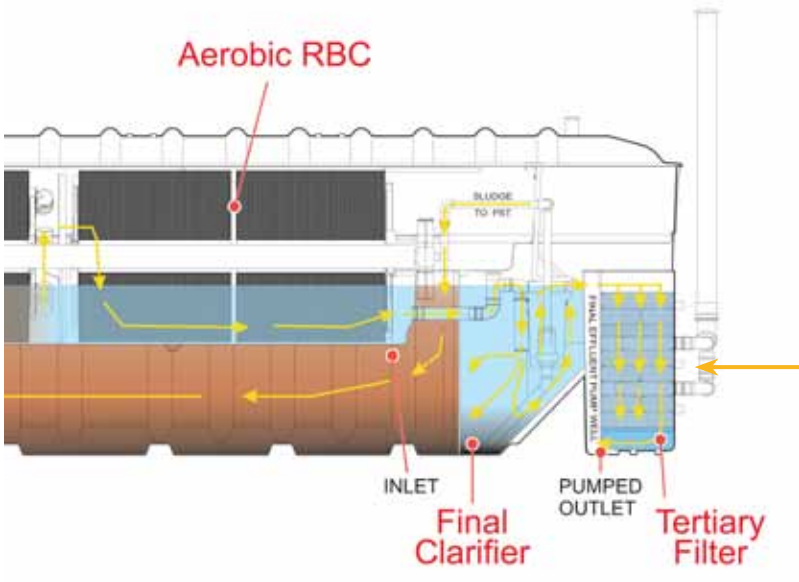


- Media packs can be assembled onto and removed individually from the framework. This avoids the need to dismantle the whole RBC if any one pack needs to be removed.

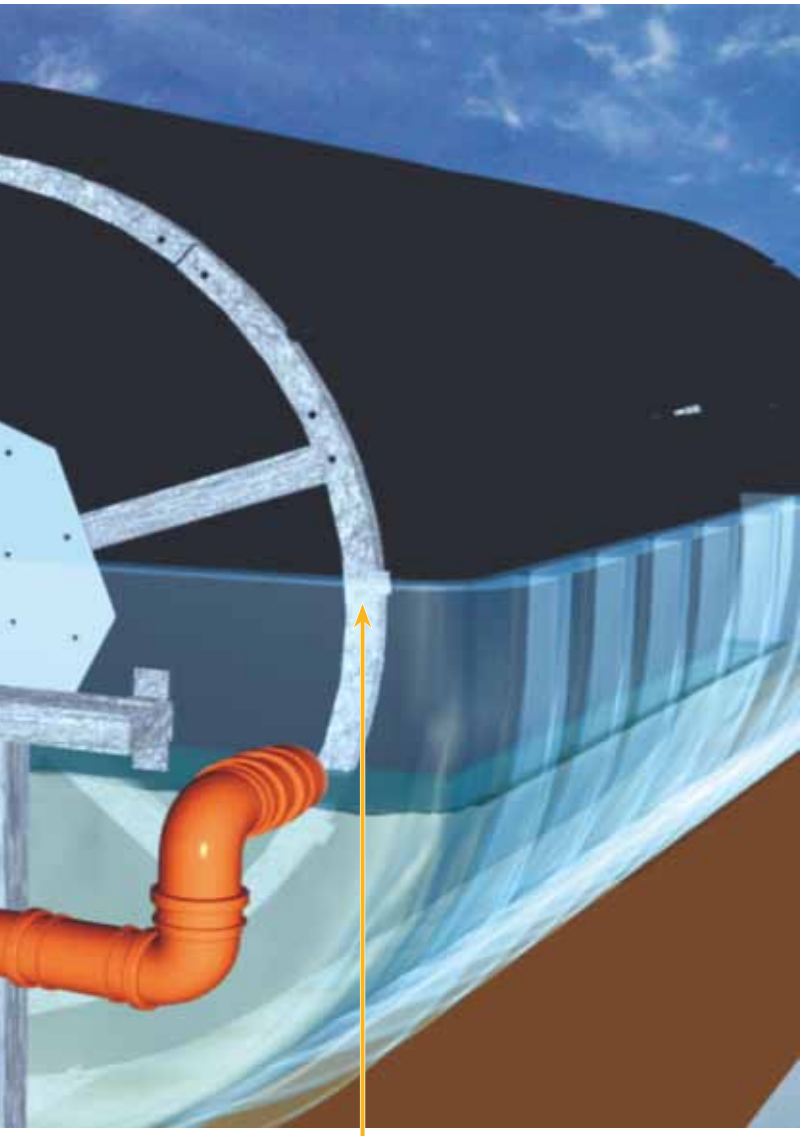


- Media manufactured from virgin, polypropylene copolymer sheets with high tear resistance and stability against ultraviolet decay. Three tubular members support the media sheets on the steel framework.

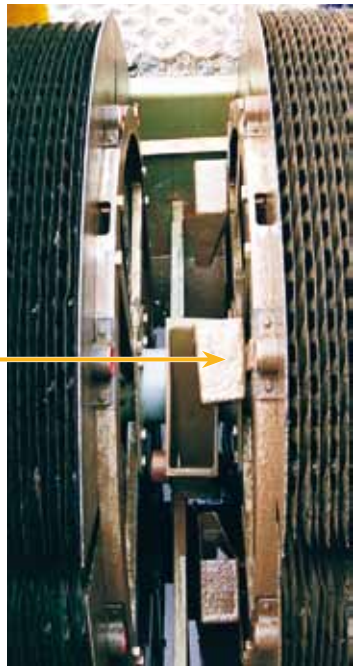
- Media sheets formed with specific boss detail to transfer loads onto the support tubes and to ensure adequate interaction between individual media sheets and tubular support member.



KEE RBC Design Features



- Bucket feed arrangement for NuDisc® technology.



- Media support structure showing RBC collar plate, arms, outer ring, media tubular support clamps. High tensile galvanised steel fixings with mechanically locking nuts.

- Galvanised mild steel framework to support media packs. Designed for 30 years fatigue life.

- **NewDisc®-R**
  An option of a built-in Tertiary filter and UV disinfection System.

- Non-drive end bearing showing auto-lube bearing with waxoil protection.

  Bearings and geared motor are selected for 100,000 hours life L_{10} basis.

KEE NuDisc®

RBC Single Piece Packaged and Modular Wastewater Treatment Systems

for Nitrification and Nutrient (Total Nitrogen and Phosphorus) removal

KEE Process Ltd presents the NuDisc®, nutrient-removing Single Piece and Modular Packaged Plant.

These systems are for the treatment of wastewater to include BOD reduction, nitrification, total nitrogen reduction and/or phosphorus removal.

The Single Piece NuDisc® and modular systems are versatile and can be applied to achieve any one or a combination of these requirements. Built on their proven technology introduced over 45 years ago, the NuDisc® brings many advanced features specifically aimed at simplification and maintenance of the plant.

The design of the plant includes a structural GRP Tank and internal components designed for a life in excess of 30 years. The mechanical components are selected for 100,000 hours L_{10} life. The end result is a plant with very low lifetime costs.

The biological stage uses the well-proven principle of attached growth rotating biological contactor (RBC) which supports a biologically active film (biomass) for the biological treatment of the wastewater.

The RBC stage is divided into two specific zones, the first one acting as an anoxic reactor and the second as an aerobic reactor.

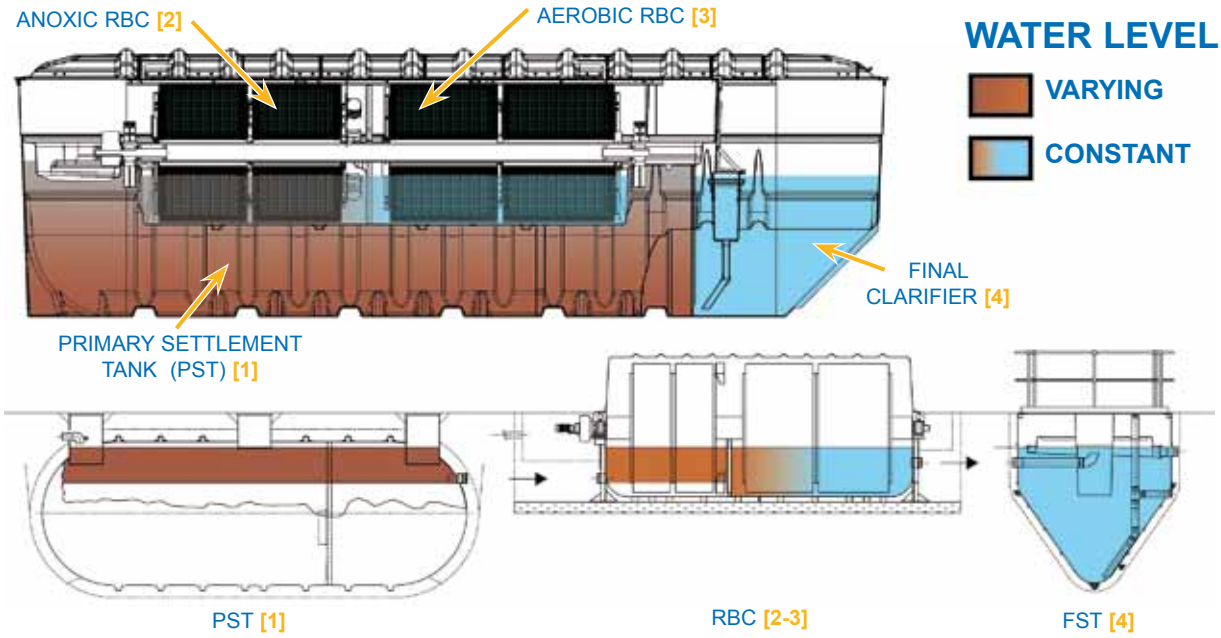
The whole system, including the primary settlement tank, the RBC and the final clarifier, are housed in a single GRP tank and arranged in such a way that flow attenuation becomes an integral part of every plant.

The wastewater enters the primary settlement tank which is the first stage of the treatment process. Here the solids are settled out and retained as sludge, which is drawn off periodically for disposal.

The partially clarified liquor is then brought in contact with the anoxic stage of the RBC reactor, where initial degradation of BOD and de-nitrification take place.

The biomass in the anoxic stage also provides biological attenuation of organic pollutants, which are partially treated and degraded into much more readily treatable substrate for the aerobic RBC stage.

NuDisc® technology being used in a single piece configuration and in a modular system - Schematic layout.



The downstream aerobic RBC stage is operated under plug flow conditions, where BOD removal and nitrification takes place. The NuDisc® system is configured to achieve the desired final effluent quality and, where phosphorus removal to less than 1mg/l is a requirement, this is achieved by coagulating phosphorus out of the treated effluent at the end of the RBC stage as the effluent is transferred to the final clarifier.

The final clarifier is benched at the bottom to facilitate sludge consolidation for return to the primary settlement tank through a pump-assisted hydrostatic sludge return system. In applications requiring denitrification, the nitrified effluent is introduced into the anoxic zone of the treatment system.

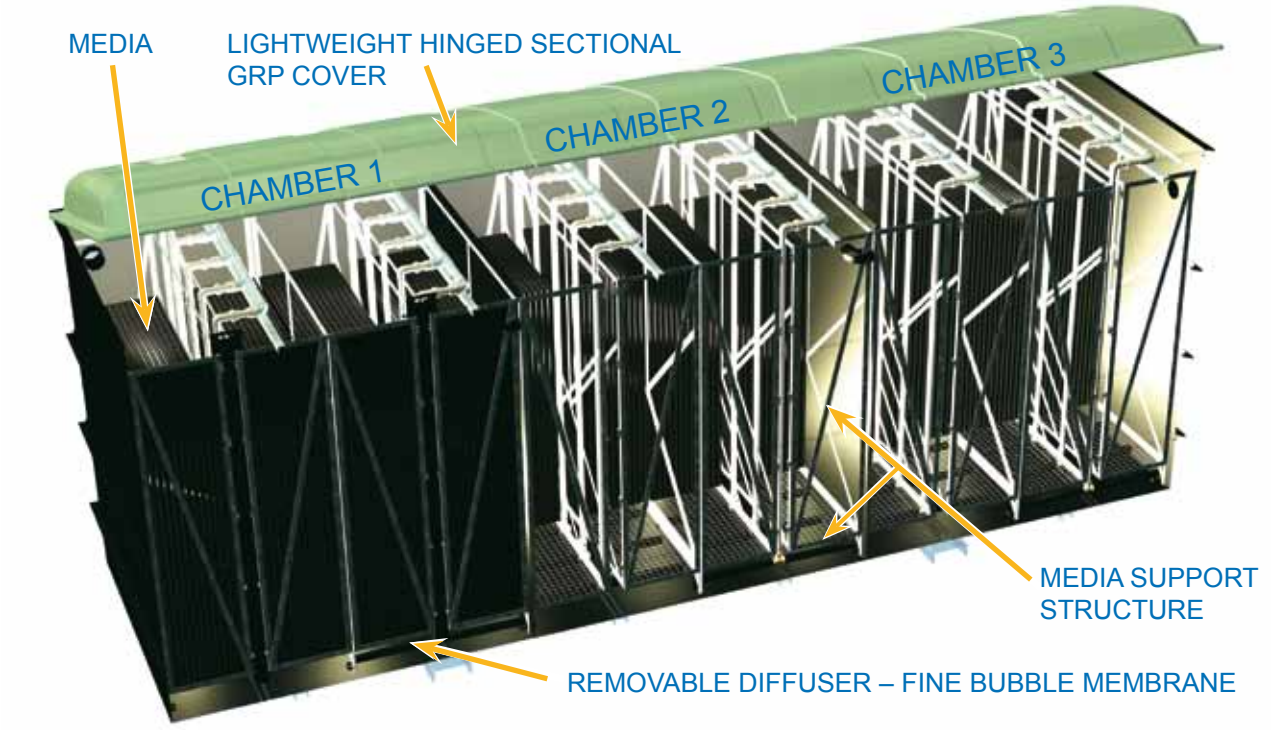
The NuDisc® concept is offered for flows from 1m³/day through to 70m³/day and is normally packaged into a single piece structure with low profile aesthetically acceptable sectional GRP cover. The covers incorporate hatches to facilitate easy desludging and access to mechanical items for annual or bi-annual lubrication and maintenance. This same NuDisc® technology can be offered as a Modular RBC System where the individual unit process operations are separated to provide flexibility in design and for treating larger flows in excess of 70m³/day.

Submerged Aerated Filter (EnviroSAF)
An alternative to RBC technology

As an alternative to RBC technology, KEE also offer a submerged, biological aerated fixed film system for the aerobic treatment of wastewater utilising a range of EnviroSAF modules.

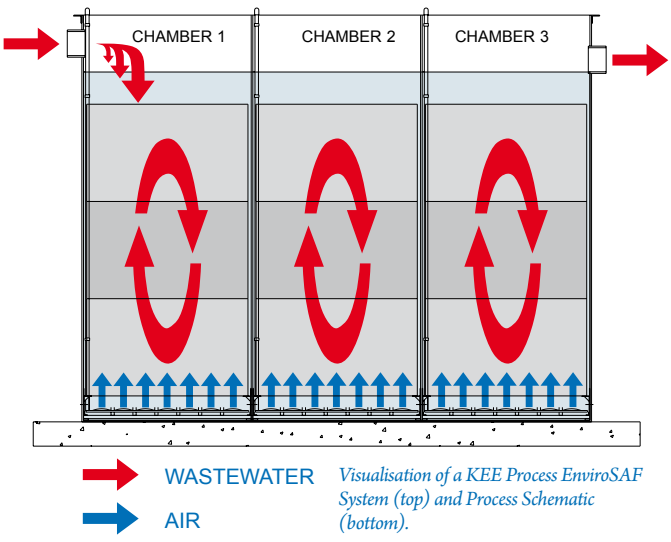
Using the well proven 'attached growth reactor' principle, units consist of specially designed structured media, suspended over a fine bubble membrane diffuser in a GRP or protected steel tank.

The structured media, with a high surface area to volume ratio, supports a biologically active film of micro-organisms, which treat the wastewater by using oxygen provided by diffused air from the membrane diffuser.



Why the KEE Submerged Aerated Filter Modules?

- Plant continues to function during maintenance.
- Easy access to fine bubble membrane diffusers.
- Diffusers can be removed for maintenance without removal of media.
- No emptying of the EnviroSAF tank contents.



Visualisation of a KEE Process EnviroSAF System (top) and Process Schematic (bottom).

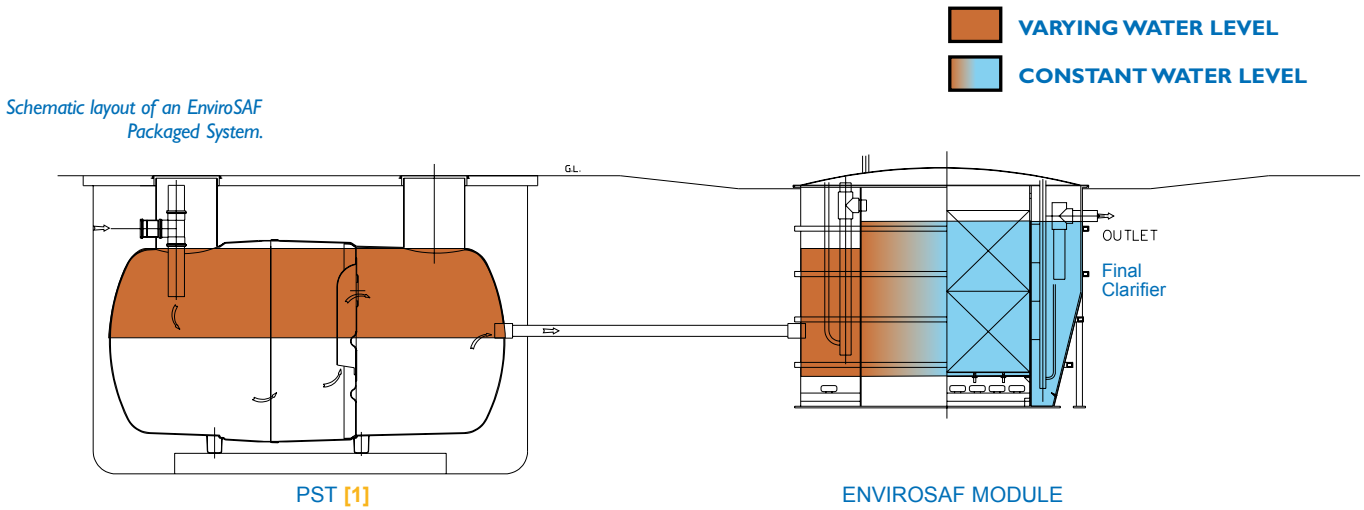
KEE EnviroSAF
Packaged Wastewater Treatment Plant

EnviroSAF is a packaged wastewater treatment plant based on submerged aerated filter technology.

The system consists of a primary settlement tank which also incorporates sludge storage and balancing capacity. The biological treatment module, with integral final clarifier, is housed in a separate unit.

The whole system can be installed to blend in with the surrounding area and can be virtually underground to minimise visual impact. As with other KEE products, EnviroSAF includes the KEE Managed Flow® system.

Schematic layout of an EnviroSAF Packaged System.

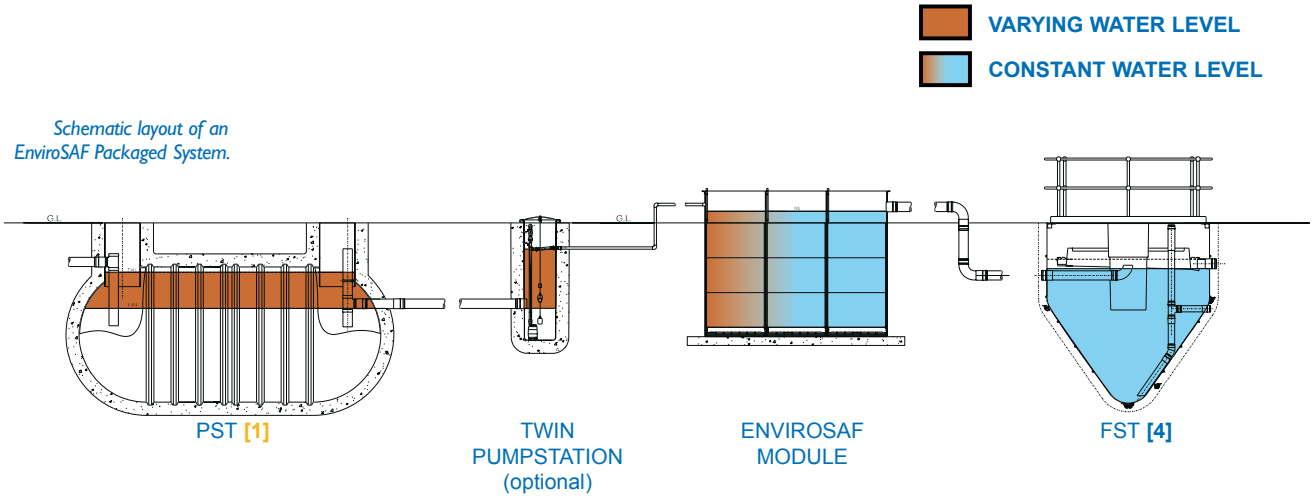


A Modular System

The modular version of the EnviroSAF packaged plant is suitable for treatment of larger flows of wastewater.

With this system, the biological treatment stage and the final settlement tank are separate units and greater flexibility is achieved for difficult site conditions via the system's modular construction.

Schematic layout of an EnviroSAF Packaged System.



Features of EnviroSAF

- Modular system with two or three items of plant. Submerged Aerated Filter technology for aerobic treatment of wastewater.
- Fabricated in lightweight, corrosion resistant and tough Glassfibre Reinforced Polyester (GRP).
- Incorporates KEE Process Managed Flow technology offering substrate and flow balancing. Can handle and maintain performance during peak flow conditions.
- Stable and reliable fixed film process with consistent performance.
- Aeration of wastewater through fine bubble membrane tubular diffusers. The diffusers can be removed for maintenance without removing the media or emptying the EnviroSAF tank of its contents.
- Patented structured media with media profile designed to induce alternating pressure-velocity gradients in the air and wastewater mixture to increase mixing and transfer of oxygen to wastewater and biomass film.
- Minimal site work, ease of installation and commissioning.
- Low maintenance costs and simple to operate and maintain.
- Virtually odour free with acoustic insulated enclosure for air blower.
- Low power demand – Air for aerobic treatment provided by efficient blowers.
- Aesthetically acceptable, lightweight, low profile, sectional hinged GRP cover giving safety and complete access for ease of maintenance, protection against weather and reducing fly and insect nuisance.
- Medium to large flows up to 400m^3/day treated in factory built prefabricated units. Larger flows treated in in-situ site built modules.

EnviroSAF Installations

EnviroSAF Scotland, UK

The KEE EnviroSAF complete system (left) made up of a buried PST, covered EnviroSAF and a Circular Hopper Bottom GRP final settlement tank.

The EnviroSAF module (above) is ready for installation on site.

Other technologies, systems and services offered by the KEE Group.

Wastewater Treatment Solutions

- **Rotating Biological Contactor (RBC) Wastewater Treatment Systems**
  - NuDisc® Single Piece Packaged RBC Treatment Plants
  - Modular Packaged RBC Treatment Systems
  - Large Diameter RBC Treatment Systems for site erection
- **Submerged Aerated Filters**
  - Single Piece EnviroSAF Systems
  - Modular Packaged EnviroSAF Treatment Systems
  - Large EnviroSAF in on-site constructed concrete tanks
- **Activated Sludge Systems**
  - Extended Aeration (EA)
  - Sequencing Batch Reactors (SBR)
- **Anaerobic Reactors**
  - Industrial Wastewater Treatment
- **Settlement Tanks and Packaged Pumping Stations**
- **Custom made composite GRP covers and enclosures**

Treatment Plant Service

- **Service, Maintenance and Operations**
- **Replacement parts and associated products**

Telephone 0800 389 0457 for more information on these and other products and services developed and offered by the KEE Group.

Integrated Management (IMS)

PAS 99
Process : *IMR 512239*
Services : *IMR 517921*

Quality Management (QMS)

BS EN ISO 9001
Process : *FM 515540*
Services : *FS 517918*

Health & Safety Management (OHS)

BS OHSAS 18001
Process : *OHS 515542*
Services : *OHS 517920*

Environmental Management (EMS)

BS EN ISO 14001
Process : *EMS 515541*
Services : *EMS 517919*

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KEE

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