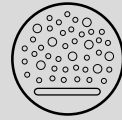


# Aeration Systems

for modern wastewater treatment

**invent**<sup>®</sup>  
umwelt und verfahrenstechnik



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## Water needs responsibility

Water is the basis and the source of all life. However, the pollution of our waters keeps reaching ever more ominous proportions. This makes the purification of contaminated water and the provision of water of high quality the most important ecological tasks of our times. Since the early 90s **INVENT** Umwelt- und Verfahrenstechnik AG has developed, produced and globally sold innovative machines, systems and processes for the efficient purification and treatment of water. Our daily work and our efficient products contribute to the preservation of water quality on a global scale.

Find out more at  
[www.invent-uv.de](http://www.invent-uv.de)

Leaders in mixing and aeration

# Aeration systems in biological wastewater treatment

The key elements of biological wastewater treatment include the aeration tanks with their mixers and aerators. Their task is to keep the purifying bacteria in suspension and provide them with an optimum supply of oxygen to ensure that the required purification performance is achieved.

Wastewater treatment plants represent some of the largest consumers of municipal energy, with a large percentage of the energy within a plant being used to generate the compressed air for the aeration system of the activated sludge plant. Consequently, this is where there is the greatest potential for optimization within the plant as a whole.



Biological wastewater treatment in the activation basin



**INVENT** has specialized in this very topic and, with a broad portfolio of aeration products, is able to offer an ideal solution for all versions of the activated sludge process. Adding an innovative control concept, the **ALPHAMETER®**, and the **iTURBO®** high-speed turbo blower to our product range enables us to implement high-efficiency complete systems by taking a holistic approach.



## Design and Simulation

We work very closely with our customers to ensure the smooth technical planning of projects around the globe. **INVENT** has developed a special method to characterize and design our aerators using performance maps. In particular, water depth and diffuser density play major roles.

The layout and design for an ideal aeration system must involve a project-specific and holistic approach and start with a comprehensive requirements analysis. Various options are simulated to find an optimum solution, which vary in terms of the diffuser arrangement, the aeration density and the tapering of the aerators.

During the implementation phase of the project, the piping design is also examined to determine pressure loss and air distribution. Our CFD experts at **THINK FLUID DYNAMIX®** simulate and visualize your plant as required to minimize risks and consequently reduce overall project costs. This is how we integrate exactly the right aeration system into your plant according to your specific objectives.

## Research and Development

We use state-of-the-art equipment, measuring methods and analytics in the **INVENT** laboratories to continuously develop and optimize our products.

- Scale models are analyzed using laser and ultrasonic measurement methods to determine the fluid mechanical parameters.
- We carry out chemical analyses to examine mixing processes on both a micro and macro scale.
- The standard methods recommended by DWA<sup>1</sup> or ASCE<sup>2</sup> are used to measure the material transport.

- We conduct measurements on large plants using the corresponding measuring equipment.
- The „bubble size“ parameter is determined using optical measurement methods.

A method developed by **INVENT** allows us to characterize and design aeration systems with only a few measurements. We also take oxygen input measurements according to all current guidelines tailored specifically to your plant.

Quality inspection of an **INVENT** aeration system



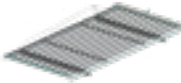
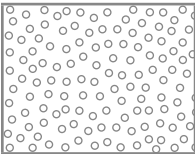
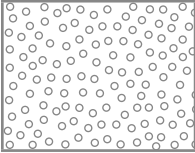
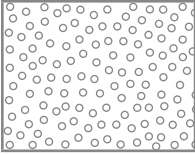
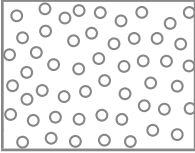
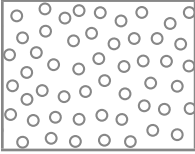
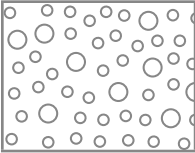
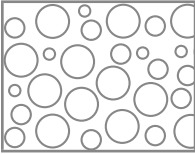
## Quality Assurance

A primary task is to ensure the quality of our products. All **INVENT** aeration systems undergo product-specific tests prior to delivery in terms of their static and dynamic tightness or oxygen input as well as material properties.

<sup>1</sup> DWA: German Association for Water, Wastewater and Waste e.V.

<sup>2</sup> ASCE: American Society of Civil Engineers

# Overview of the INVENT Aeration Systems

| SYSTEM                                           |                                                                                     | BUBBLE SIZE                                                                                                 |
|--------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| E-FLEX® Membrane Aeration System                 |    |  Very fine bubbles        |
| E-FLEX®-FLOAT, floating Membrane Aeration System |   |  Very fine bubbles       |
| iDISC® Membrane Aeration System                  |  |  Very fine bubbles      |
| HYPERCLASSIC®-Mixing and Aeration System         |  |  Fine bubbles           |
| HYPERDIVE®-Mixing and Aeration System            |  |  Fine bubbles           |
| TEX-FLEX® Textile Membrane Aeration System       |  |  Fine to medium bubbles |
| iCBA®, Coarse Bubble Aeration System             |  |  Coarse bubbles         |

| APPLICATION    |                                                                                           | PRODUCTS                                                                                                                          |
|----------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Operation mode | Continuous Aeration                                                                       | E-FLEX®, E-FLEX®-FLOAT, iDISC®, HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System, TEX-FLEX®, iCBA® |
|                | Intermittent Aeration                                                                     | E-FLEX®, iDISC®, HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System                                  |
|                | Seasonal Aeration                                                                         | HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System, iCBA®                                            |
| Reactor        | Complete mixed Tanks                                                                      | E-FLEX®, E-FLEX®-FLOAT, iDISC®, HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System, TEX-FLEX®, iCBA® |
|                | Plug Flow Tanks with Tapering                                                             | E-FLEX®, iDISC®, HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System, TEX-FLEX®, iCBA®                |
|                | Closed Loop Recirculation tanks with Flow Accelerators                                    | E-FLEX®, iDISC®                                                                                                                   |
|                | Aerated Wastewater Ponds/ Lagoons                                                         | E-FLEX®-FLOAT, floating HYPERCLASSIC®-Mixing and Aeration System                                                                  |
| Process        | Activated Sludge Process (C-Elimination/Nitrification)                                    | E-FLEX®, E-FLEX®-FLOAT, iDISC®, HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System, TEX-FLEX®        |
|                | SBR Process (Sequencing Batch Reactor)                                                    | E-FLEX®, iDISC®, HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System                                  |
|                | Aerobic Sludge Digestion                                                                  | HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System, iCBA®                                            |
|                | Anammox Process                                                                           | HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System                                                   |
|                | Mixing and Equalization Tanks                                                             | HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System                                                   |
|                | Aerated Grit Removal Systems                                                              | iCBA®                                                                                                                             |
|                | Stripping (VOC Desorption, NH <sub>3</sub> , H <sub>2</sub> S, Deacidification/Lime trap) | HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System, iCBA®                                            |
|                | MBR (Membran Bio Reactor) Aeration for Oxygen Supply                                      | HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System                                                   |
|                | MBR (Membran Bio Reactor) Air Scouring of submersed Membrane Modules                      | iCBA®                                                                                                                             |
|                | MBBR (Moving Bed Biofilm Reactor)/ IFAS (Integrated Fixed Film Activated Sludge)          | iCBA®                                                                                                                             |
|                | Leachate Treatment                                                                        | HYPERCLASSIC®-Mixing and Aeration System                                                                                          |
|                | Pure Oxygen Aeration                                                                      | HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System                                                   |
| Other          | Swing Zones                                                                               | HYPERCLASSIC®-Mixing and Aeration System, HYPERDIVE®-Mixing and Aeration System                                                   |
|                | Biofermentation                                                                           | HYPERCLASSIC®-Mixing and Aeration System                                                                                          |
|                | Aeration in very deep tanks                                                               | TEX-FLEX®, iCBA®                                                                                                                  |

Do you have an application that doesn't fit into any cookie-cutter scheme?

Then ask us. Our team performs all the tasks for you, starting from design and dimensioning, project planning and assembly through to commissioning and services - even for your unique project.



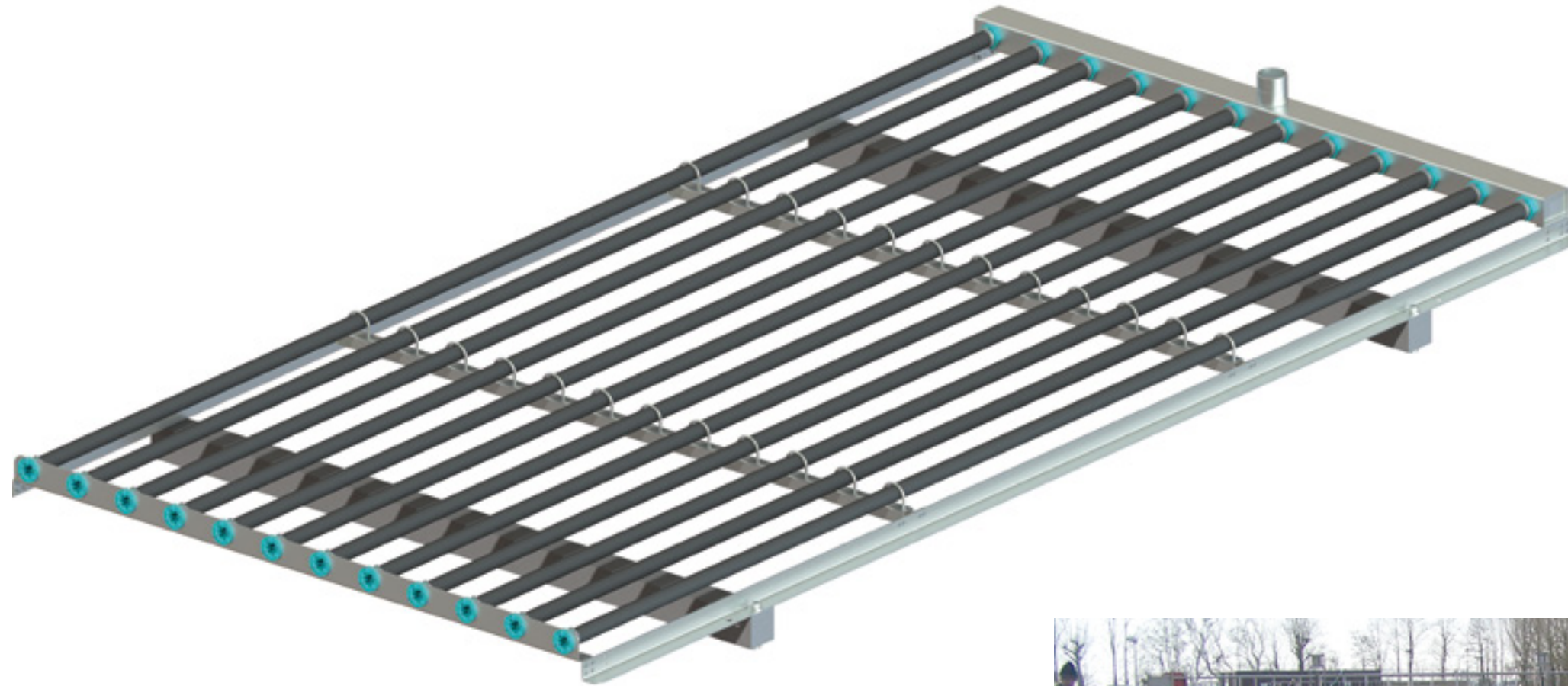
Very fine bubbles

# E-FLEX<sup>®</sup>, the flexible tube membrane aeration system

The requirements for a highly efficient, rugged, and versatile aeration system prompted the development of the **E-FLEX<sup>®</sup>** Membrane Aerator.

## Applications

|                |                                                        |
|----------------|--------------------------------------------------------|
| Operation mode | Continuous Aeration                                    |
|                | Intermittent Aeration                                  |
| Reactor        | Complete mixed Tanks                                   |
|                | Plug Flow Tanks with Tapering                          |
|                | Closed Loop Recirculation tanks with Flow Accelerators |
| Process        | Activated Sludge Process (C-Elimination/Nitrification) |
|                | SBR Process (Sequencing Batch Reactor)                 |



**E-FLEX<sup>®</sup>** Aeration Module –  
the compact design makes it  
easy to handle

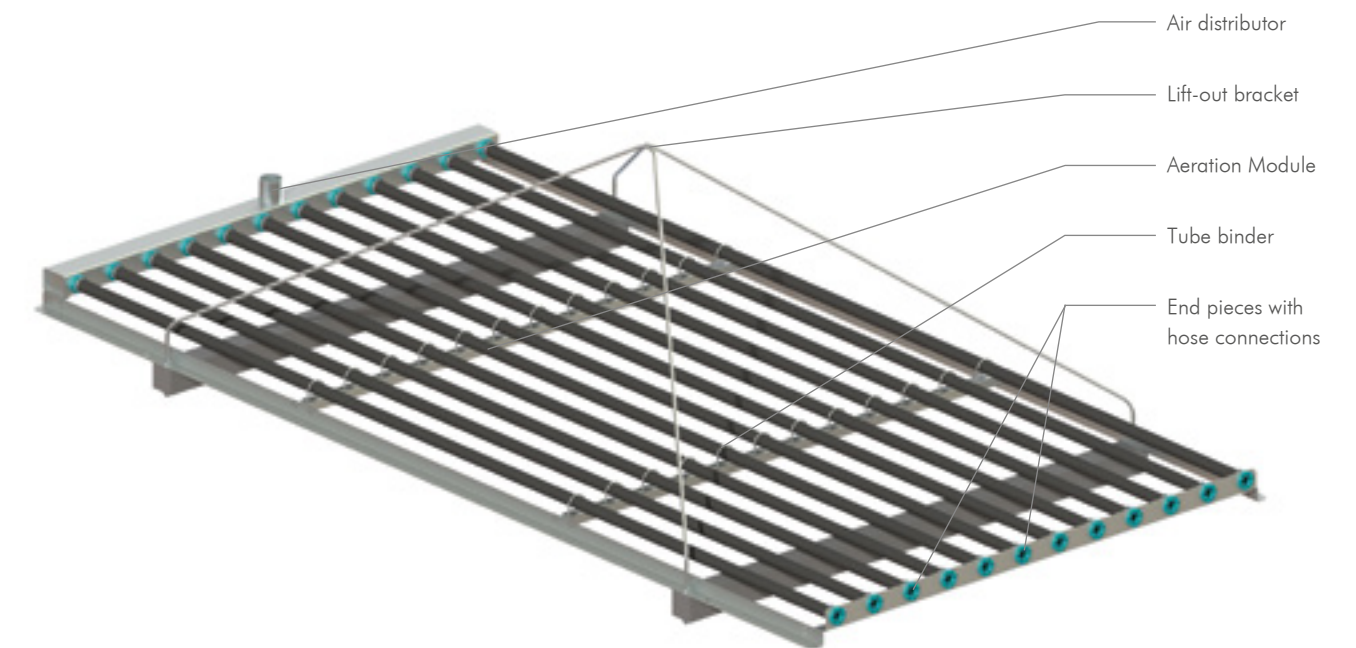
**E-FLEX<sup>®</sup>** Membrane Aeration System in service  
at a wastewater treatment plant in Belgium

Membrane aeration systems are positioned or permanently mounted at the bottom of the activated sludge tank to maximize the oxygen input by utilizing the entire water depth.

### Advantages of the E-FLEX<sup>®</sup>-Aeration System:

- Freely oscillating diffuser tubes guarantee the highest possible oxygen transfer efficiency with an extremely fine bubble aeration pattern
- Rugged design
- The modular design allows flexible engineering of new, or, if necessary, retrofitting of existing installations
- Large usable control range and modular concept allow flexible operation management
- The use of a lifting kit and pre-assembled modules ensures extremely fast and easy installation, even in filled basins





**E-FLEX®** Membrane  
Aeration System in service  
at a wastewater treatment  
plant in Mexico

### Operating principle

The core elements of the **E-FLEX®**-Aeration System are the individual, freely oscillating diffuser tubes. When air is supplied, the membranes expand, their fine individual slits open and the air is released as fine bubbles.

The upward water flow between the individual membranes induces a slight oscillating motion of the circulating tubes. This in turn results in higher bubble release frequencies and consequently produces small bubble sizes. The underflow of the **E-FLEX®** Aeration Module effectively prevents constriction and therefore coalescence above the membranes and also deposits below the module.

The bubbles generated over the entire membrane circumference creates very large specific aeration areas. This makes it possible to achieve much higher aeration densities than with conventional systems. The overall efficiency is therefore considerably improved once again.

When not in use, the membranes fold up and the individual slits close so that they are watertight. Any deposits that may occur are effectively blown out or permanently prevented by supplying air again and pressurizing the membrane. In general, the system is maintenance-free and ideal for intermittent processes.

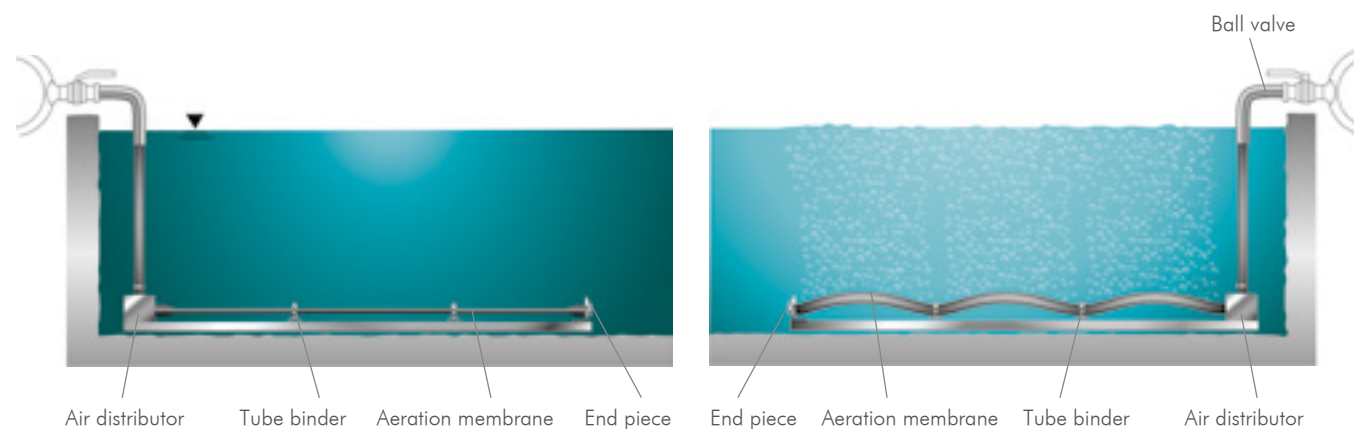
### Lift-out version

A liftable module is available for the basic version. It consists of two epoxy coated steel feet and a lifting bracket. The lift-out system is lifted into the aeration tank in a completely pre-assembled state. The aeration module securely stands on the bottom of the basin due to its own weight and does not require any additional fastening.

The lift-out design offers a wide range of advantages, particularly in recirculation and closed loop reactor basins with narrow ditch widths as well as in smaller aeration basins. It also ensures maximum operational reliability.

Special base assemblies are available for aeration basins with larger basin widths. They allow several aeration modules to be combined to form a lift-out system.

Schematic diagram of the **E-FLEX®**  
Membrane Aeration System at a  
standstill and in operation





Very fine bubbles

# E-FLEX®-FLOAT, the floating tube membrane aeration system



E-FLEX®-FLOAT Aeration Module

Floating air supply  
lines with the  
E-FLEX®-FLOAT



The **E-FLEX®-FLOAT** Aeration System is designed for use in most variations of the activated sludge process, especially in the following applications:

- Aerated wastewater ponds or lagoon basins with foil sealing
- Soil-banked basins with natural sealing
- Natural ponds and lakes and aerated river channels
- All aerated basins with uneven bases where conventional floor aerators cannot be leveled
- Plants in which a lift-out system is preferred that does not necessarily require additional installations in the basin

## Advantages:

- Use of the proven, highly efficient **E-FLEX®** Aeration Module
- Individual aeration chains cover a large area during operation, thereby ensuring efficient utilization of the entire basin volume
- There is no need to level individual modules
- The use of floating air supply lines allows installation even in filled basins

For cases in which an installation at the bottom is not possible or only practical under difficult conditions, **INVENT** has developed the **E-FLEX®-FLOAT** Aeration System

## Applications

|          |                                                        |
|----------|--------------------------------------------------------|
| OM       | Continuous Aeration                                    |
| Reactor  | Complete mixed Tanks                                   |
|          | Aerated Wastewater Ponds/ Lagoons                      |
| Pro-cess | Activated Sludge Process (C-Elimination/Nitrification) |



E-FLEX®-FLOAT  
Aeration System in operation  
in an activation basin

## Operating principle

The **E-FLEX®-FLOAT** Aeration System is based on several aeration chains. They can move laterally through the activation basin to their longitudinal axis. A single chain consists of an air line, which also serves as a buoyancy body. Individual aeration modules are interconnected at regular increments in this floating line

through flexible downpipes. The rising fine air bubbles produce a flow that moves individual chains back and forth. The maximum displacement of a chain is adjusted using anchor ropes at the edge of the basin.

## Lift-out version

The floating design makes it possible to access each module easily, without emptying the basin. Aeration modules can be lifted out from a boat in compliance with safety regulations while the plant is in operation. The aeration chain being worked on is disconnected from the blower air supply to do this.



Very fine bubbles

# iDISC® Membrane Aeration System



Module of the iDISC® -  
Aeration System

The iDISC® Membrane Aeration System was developed and optimized for oxygen transfer in activation basins for municipal and industrial wastewater treatment plants.

The iDISC® Membrane Aeration System is installed on the bottom of the basin and achieves the maximum possible oxygen transfer values as a result of a fine, uniform bubble pattern.

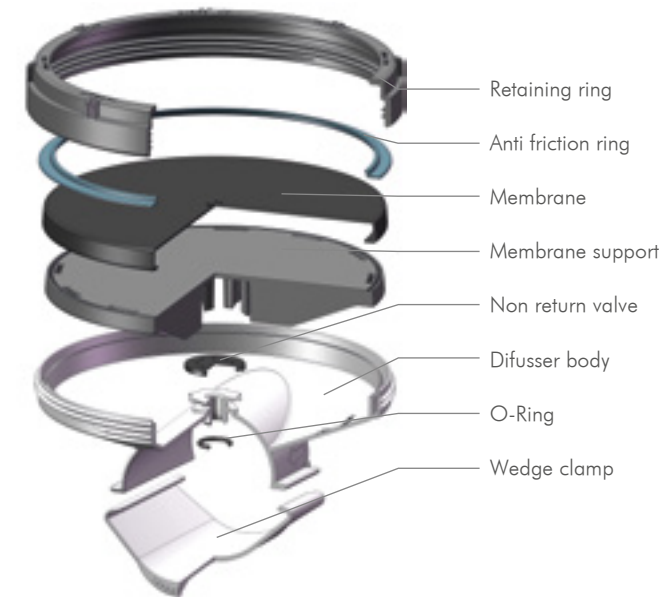
## Advantages of the iDISC® Membrane Aeration System:

- Mechanically rugged design guarantees many years of use even in deep basins
- Optimized construction based on fluid mechanical principles ensures the best possible bubble pattern even in combination with additional equipment in the basin
- Large usable control range allows flexible operation management
- High oxygen utilization results in excellent energy efficiency
- **INVENT** offers a complete process design to ensure oxygen demand for the specified load cases with optimal geometric configuration

The iDISC® Membrane Aeration System impresses with its wide range of applications, easy installation and virtually maintenance-free, long service life.

## Applications

|                |                                                        |
|----------------|--------------------------------------------------------|
| Operation mode | Continuous Aeration                                    |
|                | Intermittent Aeration                                  |
| Reactor        | Complete mixed Tanks                                   |
|                | Plug Flow Tanks with Tapering                          |
|                | Closed Loop Recirculation tanks with Flow Accelerators |
| Process        | Activated Sludge Process (C-Elimination/Nitrification) |
|                | SBR Process (Sequencing Batch Reactor)                 |



Design of the iDISC®  
Membrane Aeration System

Installation of the iDISC®  
Membrane Aeration System



## Operating principle

The principle of the iDISC®-Aeration System is based on fundamental research the mass transfer of oxygen into water. It is also based on the generation of fine bubbles through flexible membranes developed in the **INVENT** research laboratories in Erlangen, Germany, and Monza, Italy.

The iDISC®-Aeration System consists of flexible membrane discs with ultra-fine slits. When air enters below the membrane, the slits open, allowing the air to enter the liquid in the form of fine bubbles. The large number of slits produce small bubble sizes. The uniform distribution of slits on the disk surface prevents constrictions and reduces coalescence over the membranes.

The bubbles generated over the entire membrane surface create very large specific surfaces. This improves the overall oxygen transfer efficiency.

# HYPERCLASSIC®- Mixing and Aeration System



HYPERCLASSIC®-Mixing  
and Aeration System

The **HYPERCLASSIC®**-Mixing and Aeration System was introduced in numerous process stages of municipal and industrial wastewater treatment plants over 20 years ago.



## Applications

|                |                                                                                            |
|----------------|--------------------------------------------------------------------------------------------|
| Operation mode | Continuous Aeration                                                                        |
|                | Intermittent Aeration                                                                      |
|                | Seasonal Aeration                                                                          |
| Reactor        | Complete mixed Tanks                                                                       |
|                | Plug Flow Tanks with Tapering                                                              |
|                | Aerated Wastewater Ponds/ Lagoons                                                          |
| Process        | Activated Sludge Process (C-Elimination/Nitrification)                                     |
|                | SBR Process (Sequencing Batch Reactor)                                                     |
|                | Aerobic Sludge Digestion                                                                   |
|                | Anammox Process                                                                            |
|                | Mixing and Equalization Tanks                                                              |
|                | Stripping (VOC Desorption, NH <sub>3</sub> , H <sub>2</sub> S, Deacidification/ Lime trap) |
|                | MBR (Membran Bio Reaktor) Aeration for Oxygen Supply                                       |
|                | Leachate Treatment                                                                         |
| Other          | Pure Oxygen Aeration                                                                       |
|                | Swing Zones                                                                                |
|                | Biofermentation                                                                            |

The **HYPERCLASSIC®**-Mixing and Aeration System in operation at an industrial wastewater treatment plant

The **HYPERCLASSIC®**-Mixing and Aeration System is a fluid mechanically optimized aeration system featuring a dry-installed drive and a mixer body in the shape of a hyperboloid, which is installed close to the bottom.

It uniquely combines the characteristics of a mixer with those of an aerator. As a result, it offers extremely flexible operating and application ranges:

- Mixing without aeration
- Aeration with fine bubbles coupled with homogeneous agitation and deposit-free mixing
- Intermittent operation (e.g. SBR process)

The sophisticated design, the rugged construction and the mechanical aeration principle make this mixing and aeration system very versatile. As such, **INVENT** offers a reliable and variable solution for complex problems:

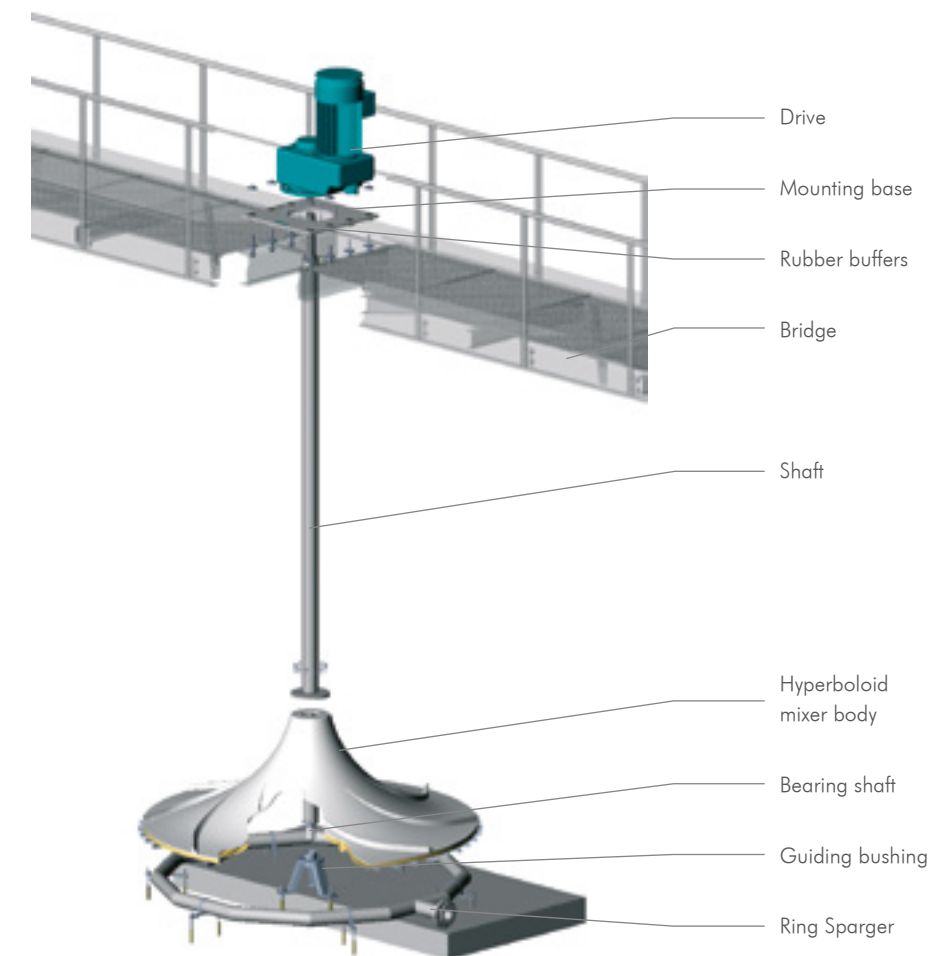
- High oxygen supply capacity, even in difficult media (high MLSS<sup>1</sup>, surface-active substances)
- No increased pressure drop during operation, in contrast to membrane aeration
- No aerosol formation
- Prevents deposits in all operating stages
- Materials are tailored to operating conditions (temperature, pH value, salinity and precipitation, etc.)

<sup>1</sup> MLSS: Mixed Liquor Suspended Solids



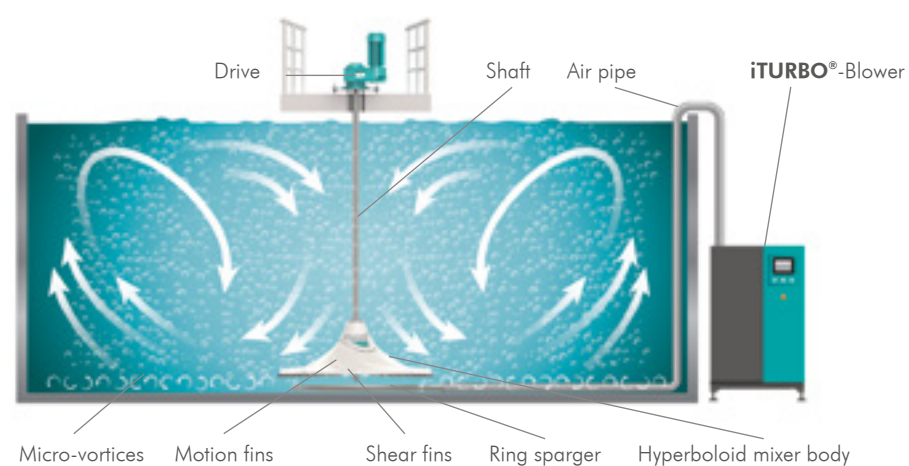
**HYPERCLASSIC®**-Mixing and Aeration System in a municipal wastewater treatment plant

## Design of the **HYPERCLASSIC®** - Mixing and Aeration System



The **HYPERCLASSIC®**-Mixing and Aeration System is customized to your requirements on an individual basis. It can also be supplied in different versions – for mounting on a bridge/tank cover or as a lift-out or floating system.

Schematic diagram of the hyperboloid mixing and aeration system



### Operating principle

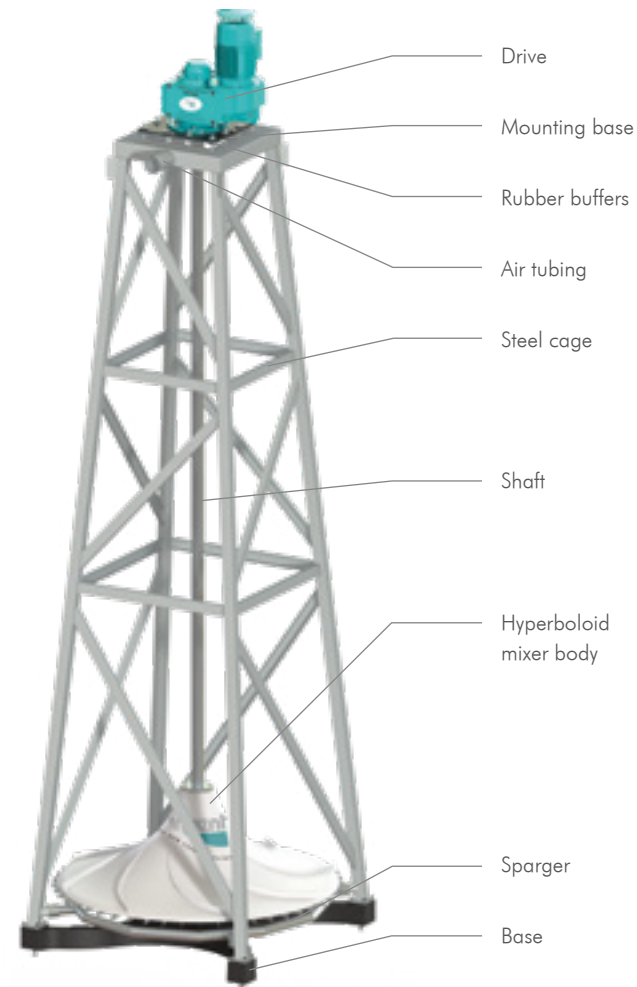
The hyperboloid mixer body rotates close to the bottom and produces a bottom flow directed outwards in a radial direction via the integrated transport fins. The current rises up the basin wall and transports all particles upwards until they are just below the water surface. The overall flow created here ensures that the activated sludge is vigorously mixed.

In aeration mode, the ring sparger also feeds air under the mixer body, which is equipped with special shear fins on the bottom side. The rotation of the mixer body thoroughly mixes the air with the wastewater and breaks it up at the shear fins into tiny bubbles, which are distributed in a radial outward direction throughout the basin.



# Other Designs

## Design of the **HYPERCLASSIC®**-Mixing and Aeration System in the cage



**HYPERCLASSIC®**-Mixing and Aeration System in a cage in operation in an industrial wastewater treatment plant

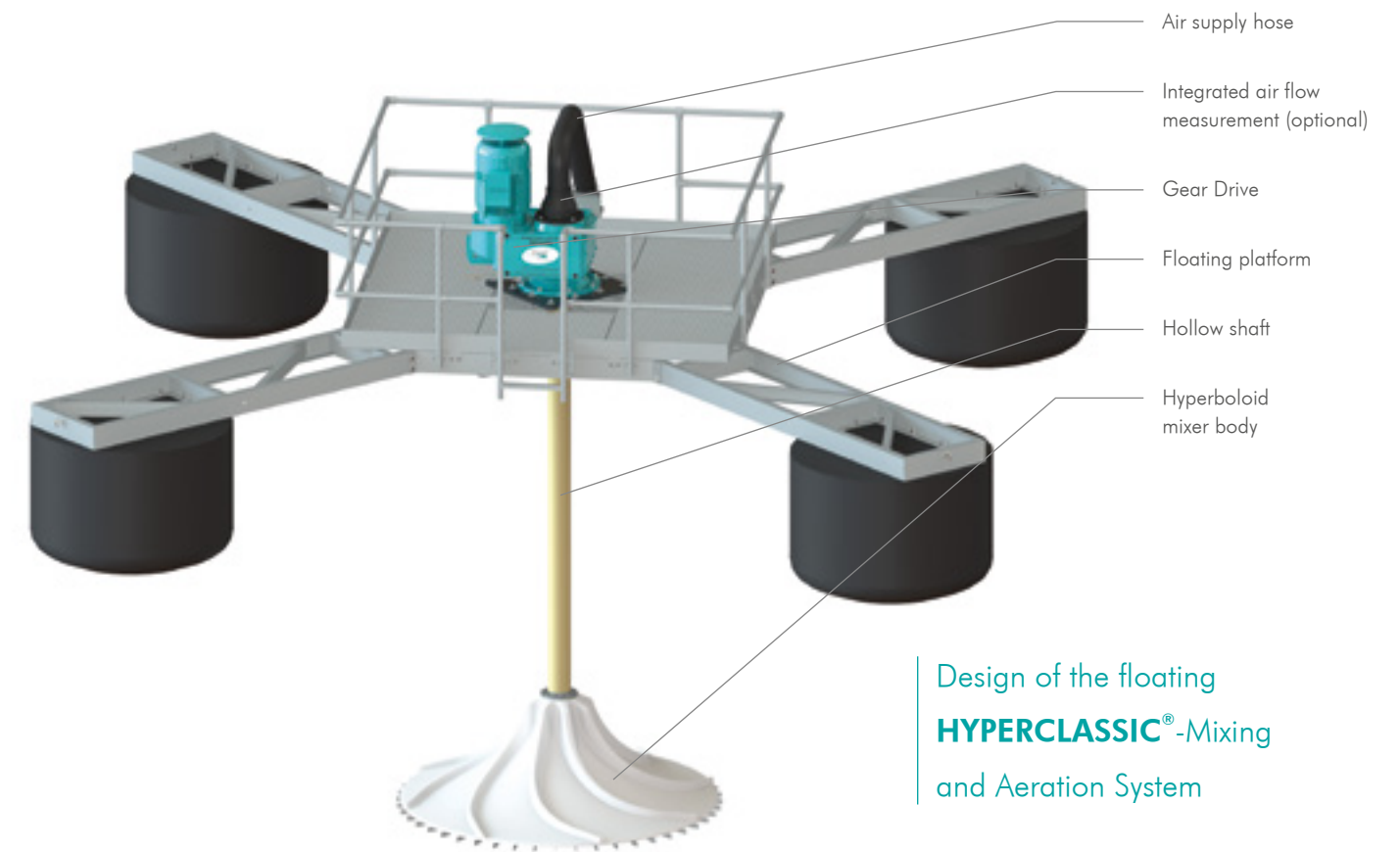


## The cage solution of the **HYPERCLASSIC®**-Mixing and Aeration System

**INVENT** combines the **HYPERCLASSIC®**-Mixing and Aeration System with a specially developed cage solution for applications where bridges cannot be implemented. The entire system can be lifted and installed in filled basins, without interrupting operations in any way.

The cage consists of a heavy base structure with an attached steel or stainless steel cage. The heavy weight of the steel structure ensures that the system always remains in the predefined position. In addition, the shape of the base supports the formation of a flow that facilitates aeration and mixing

The floating **HYPERCLASSIC®**-Mixing and Aeration System in operation at a pond treatment plant

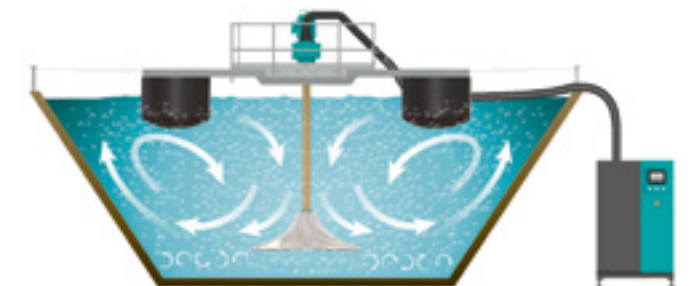


## Design of the floating **HYPERCLASSIC®**-Mixing and Aeration System

## The floating **HYPERCLASSIC®**-Mixing and Aeration System

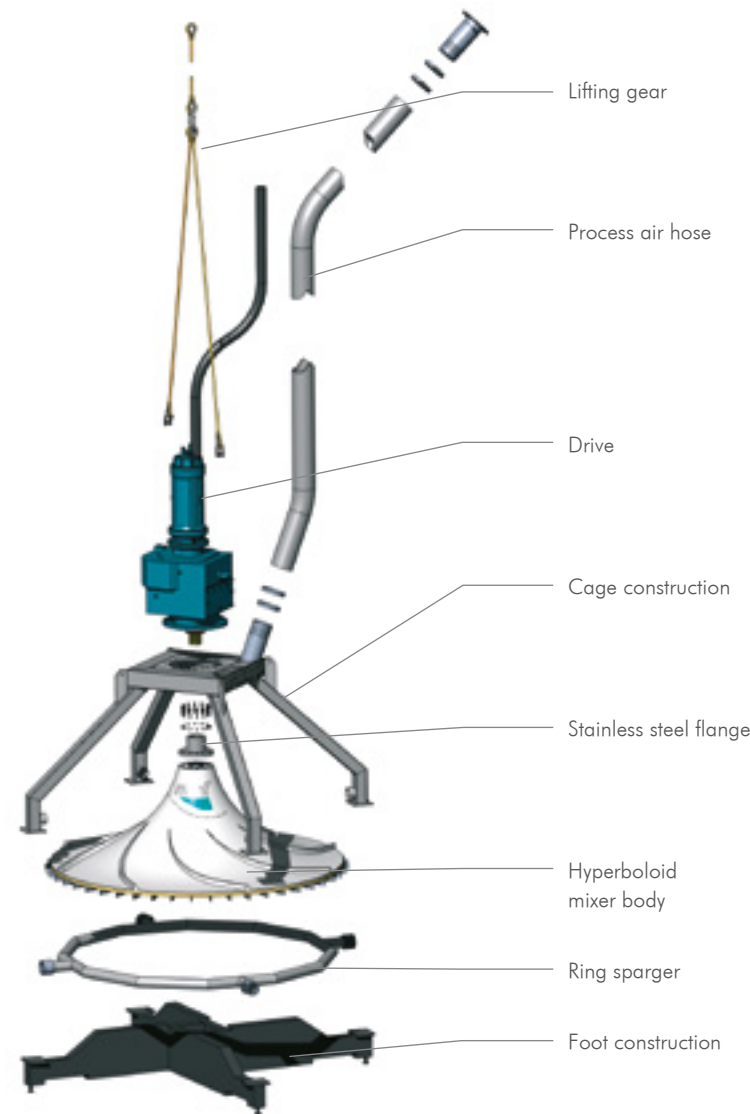
To date, there have been limited options available to owners of aerated lagoons treatment plants for mixing and aeration: The enhancement of our **HYPERCLASSIC®**-Mixing and Aeration System as a floating version solves this problem.

Because the **HYPERCLASSIC®**-Mixing and Aeration Systems have proven themselves for many years in conventional wastewater treatment plants, **INVENT** engineers looked for a solution for their use in aerated lagoons and designed a floating platform. Pulled to the right place and fixed there with mooring ropes, the hyperboloid-shaped mixer effectively mixes the wastewater pond.



The aeration occurs directly through the hollow shaft to which the mixer body is attached. The air is distributed in fine bubbles thanks to the uniform rotary motion of the mixing element. The **HYPERCLASSIC®** floating Mixing and Aeration System offers efficient and reliable wastewater treatment for pond treatment plant operators.

## Design of the HYPERDIVE®-Mixing and Aeration System



### Submersible drive: The HYPERDIVE®- Mixing and Aeration System

Various local conditions may require the use of mixers with submerged drives. The **HYPERDIVE®**-Mixing and Aeration System with submersible drive ensures the efficient supply of oxygen and optimum mixing during the biological stage of municipal and industrial wastewater treatment systems.

The advantages of this mechanical aeration system include:

- A very high oxygen supply capacity, in pure water as well as in wastewater (high  $\alpha$ -values)
- Fine bubble aeration
- No increased pressure loss
- No aerosol and noise generation
- Quick and easy installation, even in filled basins
- Avoiding sludge deposits
- Mixing without aeration possible

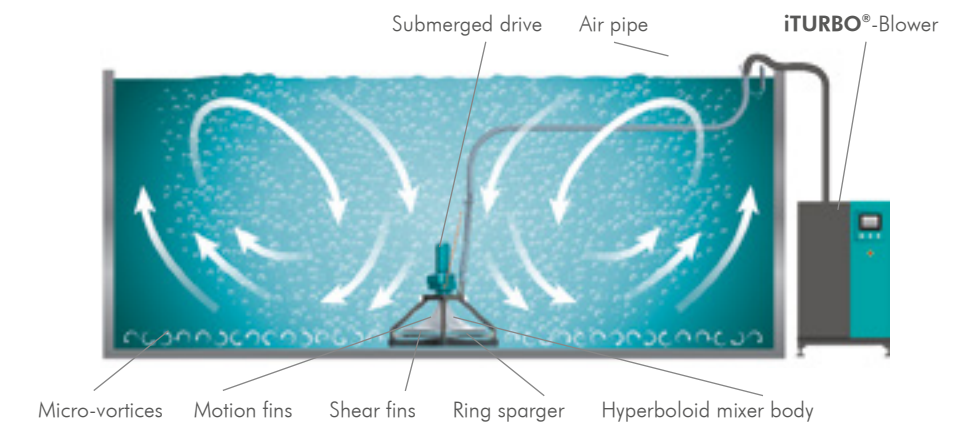
Air passes through the supply air hose via the cage structure into an application-optimized outlet system. Dispersing tunnels and shear fins on the underside of the mixer body break up and disperse the air bubbles that flow outwards there.

The three-dimensional main flow generated by the hyperboloid mixer body transports the fine air bubbles radially outward during aeration operation and distributes them throughout the basin. As a result, the activated sludge flocs are optimally supplied with oxygen and homogeneously distributed in the basin. The result is maximum oxygen transfer and yield.

## HYPERDIVE®-Mixing and Aeration System



### Schematic diagram of the HYPERDIVE®-Mixing and Aeration System



### The cage construction of the HYPERDIVE®-Mixing and Aeration System

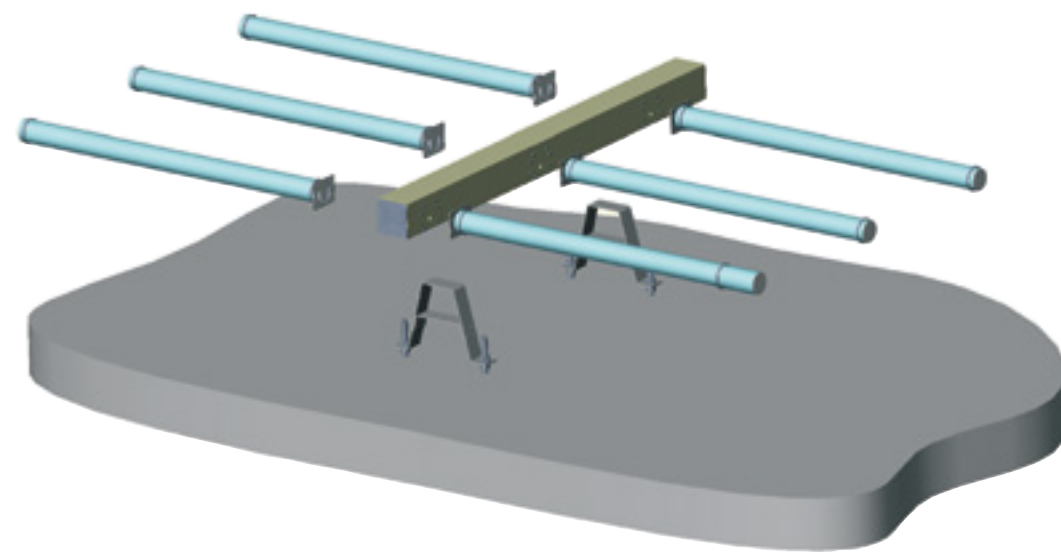
The cage consists of a heavy base structure with an attached steel cage. The stainless steel cage contains the air supply and distribution unit in the aeration ring. The base design supports the formation of the flow below

the hyperboloid mixer body, which facilitates aeration and mixing. The heavy weight of the **HYPERDIVE®**-Mixing and Aeration System keeps it in the pre-determined position at all times.



Fine to medium bubbles

# TEX-FLEX®, highly resistant textile membrane aeration system



Design of a **TEX-FLEX®**-Aeration System with air distributor unit and attachment

The **TEX-FLEX®**-Aeration System is a high-strength textile membrane-based tube aerator that produces fine to medium bubble sizes. It is specifically designed for use in problematic wastewater.

The combination of a rugged stainless steel body enveloped by a highly resistant textile membrane makes the system perfectly suited for use in deep basins, as well as wastewater contaminated with oil, grease, acids and solvents

## Advantages of the TEX-FLEX®-Aeration System:

- Even after several years of service, the aeration performance does not deteriorate and the pressure loss of the system remains consistently low
- Easy and quick assembly
- The lift-out version can be lifted in and out even when the basin is full

The **TEX-FLEX®** aeration system was specially designed for use at great water depths or with problematic medium properties.

## Applications

|          |                                                        |
|----------|--------------------------------------------------------|
| OM       | Continuous Aeration                                    |
| Reactor  | Complete mixed Tanks                                   |
|          | Plug Flow Tanks with Tapering                          |
| Pro-cess | Activated Sludge Process (C-Elimination/Nitrification) |
| Other    | Aeration in very deep tanks                            |

Lift-out version of the **TEX-FLEX®**-Aeration System on an industrial wastewater treatment plant (pulp and paper industry)



## Operating principle

The aeration grid is pressurized with air and the air is distributed along the tubes through an outlet opening to the distributor. The air inside the **TEX-FLEX®** Aeration Element exits through a specially shaped opening, which ensures that the air is uniformly distributed.

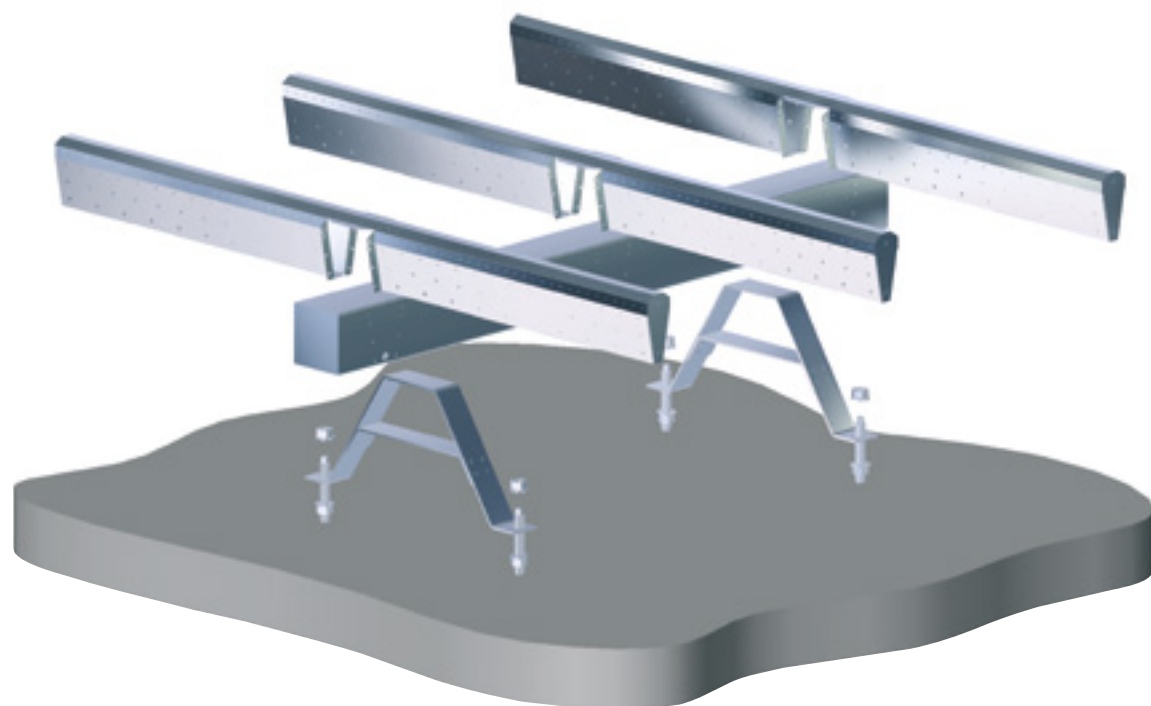
## Lift-out version

The lift-out version of the **TEX-FLEX®**-Aeration System mounted on an additional heavy steel beam. The steel beam is used as a reinforcement and ballast weight. The aeration system is also fitted with a steel bracket, which makes it easy to lift out and in. In this case, a flexible hose supplies the air.

The system can be lifted out and then back in again when the basin is full.

# iCBA<sup>®</sup>, robust coarse bubble aeration system

iCBA<sup>®</sup> Aeration Elements  
with the air distributor and  
bottom mounting



The iCBA<sup>®</sup>-Aeration System is **INVENT's** solution for applications requiring coarse-bubble aeration. With its rugged construction made of stainless steel, the iCBA<sup>®</sup>-Aeration System is perfect for even the hardest applications in industrial and municipal wastewater treatment plants. Limitations of conventional membrane aerators, such as high air temperatures or problematic wastewater components, do not restrict the area of application. Even after many years, the aeration performance remains constant. The pressure loss of the system remains consistently low.

iCBA<sup>®</sup>-Aeration System  
during operation at an  
industrial wastewater  
treatment plant in Sweden



When it comes to energy or maintenance, the iCBA<sup>®</sup>-Aeration System is the perfect solution for applications that require coarse-bubble aeration.

## Applications

|                |                                                                                           |
|----------------|-------------------------------------------------------------------------------------------|
| Operation mode | Continuous Aeration                                                                       |
|                | Seasonal Aeration                                                                         |
| Reactor        | Complete mixed Tanks                                                                      |
|                | Plug Flow Tanks with Tapering                                                             |
| Process        | Aerobic Sludge Digestion                                                                  |
|                | Aerated Grit Removal Systems                                                              |
|                | Stripping (VOC-Desorption, NH <sub>3</sub> , H <sub>2</sub> S, Deacidification/Lime trap) |
|                | MBR (Membran Bio Reactor)<br>Air Scouring of submersed Membrane Modules                   |
|                | MBBR (Moving Bed Biofilm Reactor)/<br>IFAS (Integrated Fixed Film Activated Sludge)       |
| Other          | Aeration in very deep Tanks                                                               |

iCBA<sup>®</sup> -  
Aeration System  
assembled



## Operating principle

The iCBA<sup>®</sup> Aeration Element consists of a specially shaped hollow stainless steel body featuring optimized air outlets that produce large bubbles. The base distribution unit, which is manufactured from a square stainless steel tube, acts as a support for the aera-

tion element. The air is supplied by a central air supply line at the bottom of the basin, which is located above the distribution pipes. The customer is responsible for installing the air supply and the downpipe on the wall of the basin.

# Additional Products

## iTURBO® high speed turbo blower

The iTURBO®-Blower was specifically designed for supplying air to aeration systems in activated sludge plants. It rounds off **INVENT**'s range of high-efficiency aeration systems and aeration control products, while maximizing system performance and minimizing energy costs. The blower is designed for maximum efficiency and offers the perfect balance of stability and reliability.

### Advantages of the iTURBO®-Blower:

- Compact, light weight package for quick and simple installation
- Integrated sound reducing with motor, turbo-impeller, VFD<sup>1</sup> and control system in a single compact package
- Reduces operating costs by up to 50 % when compared to conventional blowers

- Maintenance is limited to changing the air filters
- User friendly HD touch screen HMI
- Customized turbo impellers provide peak efficiencies over the desired flow range
- High speed PMSM<sup>2</sup> optimized for speed and torque control

For information on the operating principle and all other technical information, please refer to the separate product brochure



iTURBO®-Blowers in a municipal wastewater treatment plant in the Czech Republic

## THINK Fluid Dynamix® - fluid mechanical solutions with CFD

**THINK Fluid Dynamix®** is the consultation and engineering service provider for state-of-the-art computational technologies such as CFD<sup>1</sup> and automated optimization.

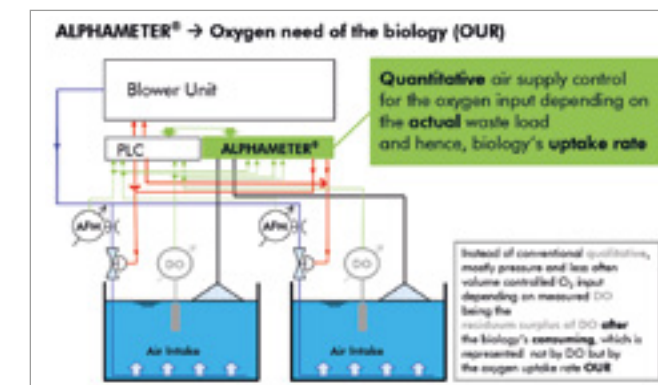
Computational fluid dynamics is an advanced computer-based technology that employs computational methods to analyze and solve problems related to fluid flows. CFD allows us to create a virtual work environment that is supported by real data. This is how physical phenomena are simulated, case studies are tested and design problems are solved before the construction of a plant even begins.

Sophisticated, customer-specific solutions in water and process engineering can therefore be simulated on during the planning phase and the results can be analyzed.

Our objectives are to provide our customers with clever solutions and ever smarter designs. Let us contribute to your success!

[www.think-fluid-dynamix.com](http://www.think-fluid-dynamix.com)

## ALPHAMETER® - controlling and monitoring aeration processes



Functional diagram of the ALPHAMETER®

The **ALPHAMETER®** has ushered in a new era in controlling and monitoring aeration processes. It combines liquid and gaseous phase measurements to facilitate the real-time calculation of key parameters for process and aeration control including:

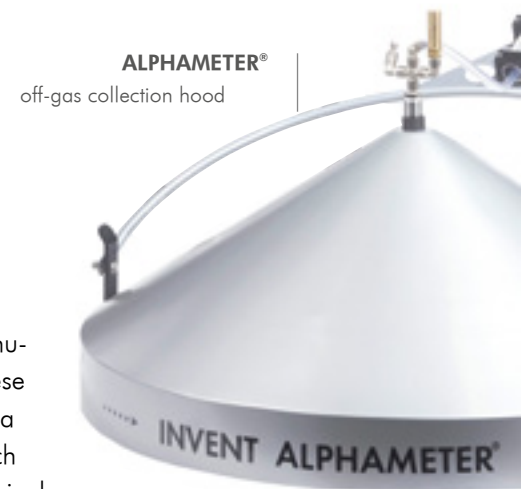
- Oxygen utilization under operating conditions ( $\alpha$  OTE)<sup>2</sup>
- Process Oxygen Uptake Rate (OUR)<sup>3</sup>
- Mixed Liquor  $\alpha$ -value<sup>4</sup>

The precision and continuous determination of these values allows us to take a completely new approach for controlling the biological process as well as the aeration system's performance. This enables considerable energy savings with intelligent process control.

The performance parameters, such as oxygen utilization  $\alpha$  OTE and  $\alpha$ -value, are measured and processed in real time and deliver valuable information about the aeration system. This makes it possible to draw conclusions about daily and seasonal changes in the oxygen supply capacity, the long-term behavior of the aeration equipment. It can also determine maintenance and service requirements and any obstacles to the transfer of oxygen that may occur.

This information is key to understanding the plant's oxygen input and cleaning capability. It also makes it possible to improve the performance and adjust conventional control systems.

For more information, please refer to the separate product brochure



<sup>1</sup> VFD: Variable Frequency Drive

<sup>2</sup> PMSM: Permanent Magnet Synchronous Motor

<sup>3</sup> OUR: Process Oxygen Uptake Rate

<sup>4</sup>  $\alpha$ -value: Oxygen supply properties in activated sludge

<sup>1</sup> CFD: Computational Fluid Dynamics

<sup>2</sup> OTE: Aeration System Oxygen Transfer Efficiency

# References



WWTP DC Water Blue Plains, USA

## HYPERCLASSIC®-Mixing and Aeration System

- Plant:** DC WATER Blue Plains WWTP, USA  
**Contractor:** World Water Works, Oklahoma City, OK, USA  
**Type of plant:** Municipal WWTP  
**Start-up year:** 2017  
**Application:** Mixing and aeration in a DEMON SBR tank  
**Scope of delivery:** Engineering and Design  
24 **INVENT HYPERCLASSIC®**-Mixing and Aeration Systems  
CFD modeling, physical scale testing  
Installation and start-up



WWTP Stora Enso, Skoghall, Sweden

## E-FLEX®-Float Membrane Aeration System

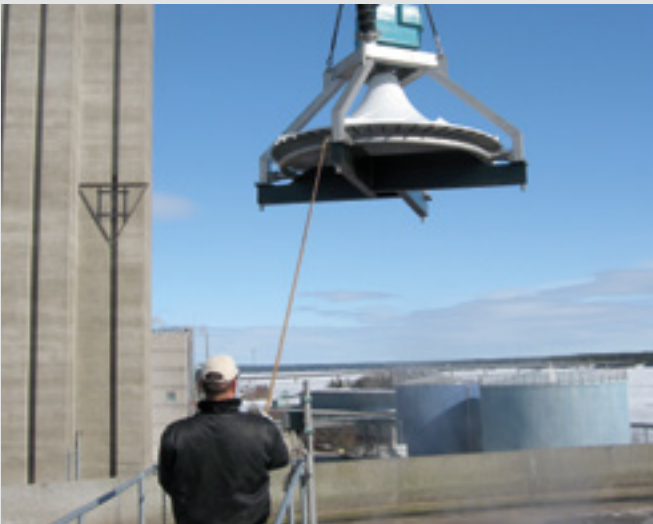
- Plant:** Stora Enso, Skoghall, Sweden  
**Contractor:** ATEK Avvatningsteknik AB, Sweden  
**Type of plant:** Industrial WWTP, Pulp and Paper Industry  
**Start-up year:** 2012  
**Application:** Aeration for BOD/COD-Removal in a Lagoon  
**Scope of delivery:** 330 **E-FLEX®**-Float Aeration Modules



WWTP Westdale, WA, Australia

## iDISC® Membrane Aeration System

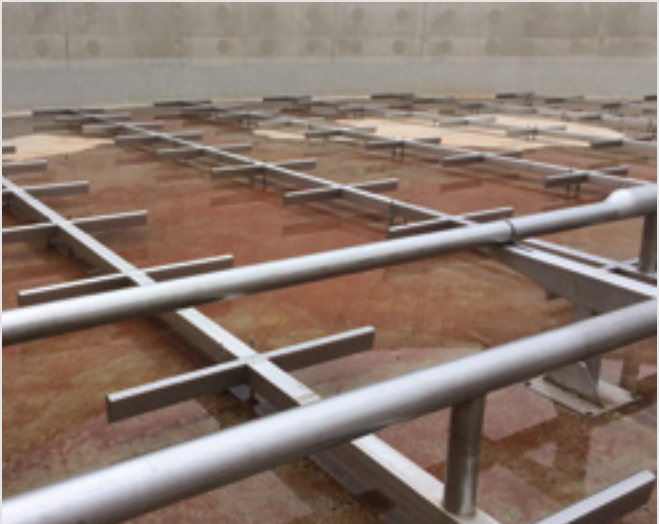
- Plant:** Westdale, WA, Australia  
**Contractor:** **INVENT** Pacific Pty. Limited  
**Type of plant:** Municipal WWTP with 30% Slaughter House Influent  
**Start-up year:** 2017  
**Application:** SBR/IDAL  
**Scope of delivery:** 8,000 **iDISC®**-Aeration Systems



WWTP Obbola, Sweden

## HYPERDIVE®-Mixing and Aeration System

- Plant:** Obbola, Sweden  
**Contractor:** ATEK Avvatningsteknik AB, Sweden  
**Type of plant:** Industrial WWTP, Pulp and Paper Industry  
**Start-up year:** 2009  
**Application:** Mixing and Aeration in an Activated Sludge Tank and Selector  
**Scope of delivery:** Engineering and Design  
8 **HYPERDIVE®**-Mixing and Aeration Systems  
Installation and start-up



WWTP Laita Landerneau, France

## iCBA®-Aeration System

- Plant:** U.C.L.A.B Laita Landerneau, France  
**Contractor:** Nantaise des Eaux Ingénierie, France  
**Type of plant:** Industrial WWTP, Dairy Industry  
**Start-up year:** 2016  
**Application:** Aeration in MBBR Tank (50 % carriers type F2))  
**Scope of delivery:** 144 **iCBA®** Aeration Modules



WWTP Morelia, Mexico

## E-FLEX® Membrane Aeration System

- Plant:** Morelia, Mexico  
**Contractor:** **INVENT** Umwelt- und Verfahrenstechnik AG  
**Type of plant:** Municipal WWTP  
**Start-up year:** 2006  
**Application:** Aeration for BOD-Removal and Nitrification  
**Scope of delivery:** 352 **E-FLEX®** Aeration Modules



WWTP Fiskeby, Norrköping, Sweden

## TEX-FLEX®-Aeration System

- Plant:** Fiskeby Board, Sweden  
**Contractor:** ATEK Avvatningsteknik AB, Sweden  
**Type of plant:** Industrial WWTP  
**Start-up year:** 2010  
**Application:** Aeration for BOD/COD-Removal  
**Scope of delivery:** 8 Liftable **TEX-FLEX®** Aeration Modules á 28 Aeration Holes

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## Leaders in mixing and aeration

Please find our current list of sales partners at [www.invent-uv.de](http://www.invent-uv.de)