

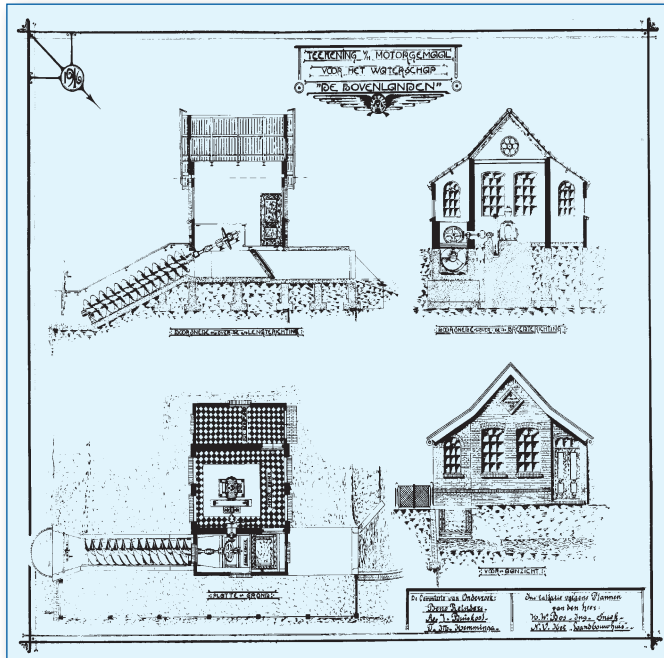
# LANDOX Flow Boosters



**AT LEAST 10% EFFICIENCY IMPROVEMENT  
OF YOUR FINE BUBBLE AERATION SYSTEM**

**Landustrie**   
SINCE 1913

# LANDUSTRIE



## OVER 100 YEARS OF HISTORY

- ✦ In 2013 Landustrie celebrated its 100th anniversary.
- ✦ The foundations were laid in 1913, when the company was active in the agricultural sector and the evolving phases of polder drainage. Since the 1960s, Landustrie has been a leading global supplier of aeration technology. In this capacity Landustrie has designed, manufactured, supplied, installed, and maintained different versions of the LANDOX flow boosters tailored to suit the optimal process of the respective oxidation ditches.
- ✦ Today, Landustrie is a state-of-the-art manufacturing and engineering company, combining traditional proven products and techniques with high-tech innovations.

## LANDOX FLOW BOOSTERS

Landustrie is the world's leading solution provider for wastewater aeration. Landustrie has extensive knowledge and experience, and a strong track record in this field.

For more than half a century Landustrie has designed, manufactured, supplied, installed and maintained fine bubble aeration systems as well as surface aeration systems. These include low speed surface aeration impellers and horizontal brush aerators.

As a prominent manufacturer of innovative, durable, and highly efficient aeration systems, Landustrie introduced the vertical shaft LANDOX flow booster in the 1980s. This flow booster offers the perfect solution for improving oxygen transfer, mixing, and propulsion in oxidation ditches fitted with fine bubble diffusers.



*LANDOX flow booster fixed to steel bridge*

## AERATION IN GENERAL

Wastewater aeration is the process of adding air into wastewater to allow aerobic bio-degradation of pollutants.

The activated sludge process is the most common option in wastewater treatment. Aeration in an activated sludge process is based on transferring atmospheric air ( $O_2$ ) into a liquid filled basin, promoting the cultivation and reproduction of micro-organisms which carry out the treatment process by breaking down organic matter.

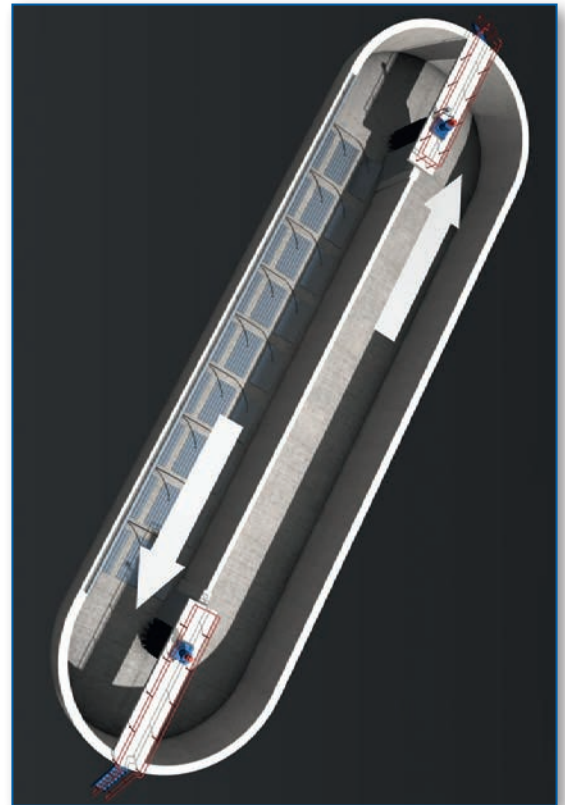
Aeration also re-establishes dissolved oxygen levels in the final effluent in order to sustain plant and animal life when discharged into rivers and lakes.

## SUSTAINABLE SOLUTIONS

By supplying flow boosters that achieve an optimal water flow for increasing oxygen transfer and enabling a service life of 25 years or more, Landustrie provides a highly sustainable solution contributing to lower energy consumption. This results in a reduction of the carbon footprint and in the lowest possible total cost of ownership.

Landustrie helps you achieve a truly sustainable product by combining many years of aeration engineering experience with professional project guidance throughout the entire process.

Costs associated with processing are kept low by Landustrie specialists who provide expertise from the conceptual design phase through commissioning and start-up. This guarantees the delivery of environmentally friendly, sustainable and economically viable products.



*Continuous aeration grids with LANDOX flow booster*

## RESEARCH & DEVELOPMENT

Even though Landustrie builds the most durable and efficient vertical shaft flow boosters in the world today, we never rest.

We have our own in-house testing laboratory where we are able to develop new ideas into tested and proven products.

The LANDOX flow booster is the result of research in the field of aeration and extensive testing. We design and build customized LANDOX flow boosters to suit your needs. Each customized unit will perform as expected thanks to extensive knowledge, many years of experience and in-house development and testing.



# LANDUSTRIE

## DESIGN

The LANDOX designed and manufactured flow boosters operate more efficiently and cost effectively than conventional horizontal shaft mixers. They stand out against conventional flow boosters due to their design, which combines operational benefits with self-cleaning capabilities, as well as ease of inspection and maintenance.

Once dimensioned with our proprietary software, Landustrie engineers utilize finite element analysis (FEA) software, which calculates all the stresses on the flow booster and civil structures to ensure a robust and reliable construction of the flow booster.

The LANDOX flow boosters are manufactured to include a hollow tube provided with 16 radially-mounted blades. The rotor is made of carbon steel, and is held in place by a specially designed bearing, which is supported by the operating platform. A high efficiency motor and gearbox drive the rotor. The drive unit, bearings and lubrication points are accessible above the water level from the operating platform, which contributes to the ease of inspection and maintenance of the system.

Our engineers will incorporate the unique site-specific characteristics into the appropriate conceptual design. These site-specific variables can be accommodated through ingenuity and flexible engineering.

## MANUFACTURING

To ensure the absolute highest quality product, we manufacture all of our LANDOX flow boosters at our factory in Sneek, The Netherlands. The factory is equipped to manufacture flow boosters in diameters ranging from 700 mm up to 4000 mm in the required rotor length to suit water depths up to 10 m and channel widths up to 12 meter.

At our 15.000 m<sup>2</sup> state-of-the-art manufacturing facility, we have all of the latest technology to build the most durable and efficient flow boosters currently available.

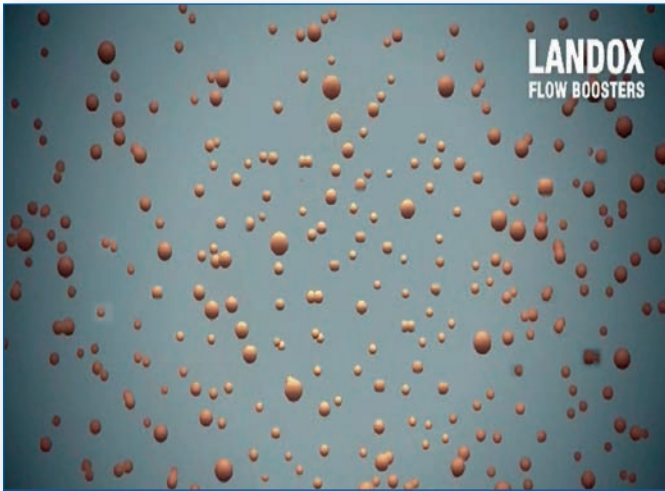
From metal forming and welding, to application of corrosion protective coatings and paint, and through to the final assembly, each step of the manufacturing process is under our roof and importantly, under our quality control programs.

For example, in our facility we perform X-ray and/or ultrasonic tests in critical areas to further ensure your LANDOX flow booster will be a robust and reliable system for decades to come.

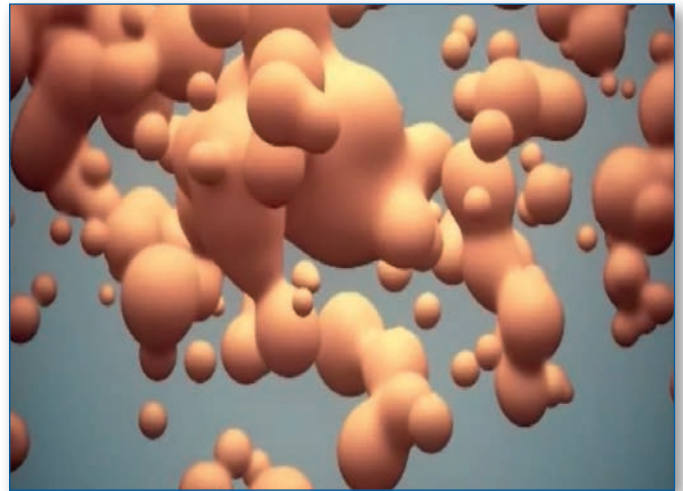
Landustrie has earned and operates under ISO 9001-2008 and SCC (Safety Checklist Contractor) certifications.



*Oxidation ditch with fine bubble diffusers and LANDOX flow booster*



*No disturbance of air bubbles*



*Coalescence of air bubbles*

## OPERATION

In fine bubble aeration systems, mixing and aeration are two independent operations. In an oxidation ditch, the propulsion of the water can be achieved either by horizontal shaft boosters or by vertical shaft flow boosters.

The LANDOX vertical shaft flow booster ensures the required mixing of the medium and achieves a perfect plug flow operation of the wastewater over the entire water depth in straight or folded oxidation ditches. As a result, at least 10% better performance of diffusers is achieved. This performance superiority is achieved across a variety of flow systems, including aeration domes, strip-shaped diffusers or other similar systems. This leads to significant savings in required aeration energy, and in the reduction of CO<sub>2</sub> emissions.

Depending on the shape and the volume of an oxidation ditch the mixing and propulsion can be achieved using one or more LANDOX flow boosters. They are usually positioned in the bends of the oxidation ditch where propulsion energy can be utilised most efficiently. At that location flow resistance losses are the highest. By slowly rotating the flow booster (5 to 25 rpm) the water is pushed forward.

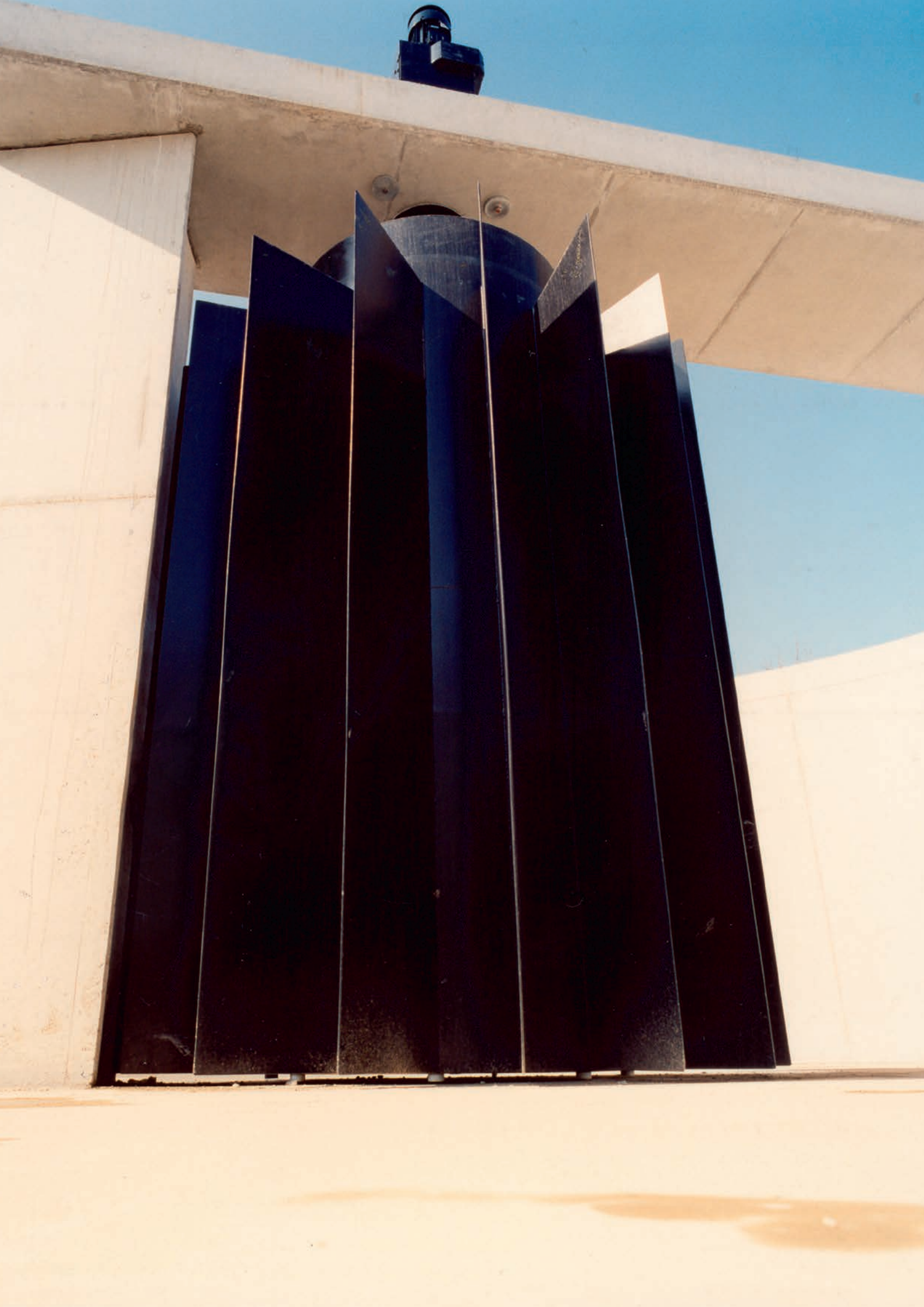
The required energy of propulsion ( $W/m^3$ ) for vertical shaft flow boosters is less than the required energy of propulsion for horizontal shaft flow boosters. The LANDOX flow booster achieves optimal mixing, ensuring that dead zones in the bends will not occur and therefore there will be no settlement in the water.

With conventional horizontal mixers, the direction of rotation is perpendicular to the flow direction, which leads to mixed zones and causes velocity gradients to occur.

As a result of these velocity gradients, the oxygen transfer efficiency of the fine bubble aeration decreases as the spiral flow pattern causes the fine bubbles to coalesce. Additionally, dead zones and short circuiting can be seen with the use of banana blade type mixers, as the mixing energy is not added to the areas in the ditch where the losses are the greatest.

LANDOX flow boosters stand out from conventional horizontal shaft flow boosters due to their unique design, positioning in the oxidation ditch, operational reliability, long service life and ease of maintenance.





## APPLICATIONS

LANDOX flow boosters are used for the biological treatment of wastewater. They act to provide mixing and propulsion in oxidation ditches, thereby boosting oxygenation efficiency of fine bubble aeration.

A wastewater aeration system fitted with both fine bubble diffusers and LANDOX flow boosters will combine the oxygenation efficiency of fine bubble aeration, with the operational reinforcement and reliability of the flow boosters and the oxidation ditch stability.

LANDOX flow boosters are in operation around the world. They are manufactured and serviced under license agreements from Landustrie in both the USA and Japan by WesTech and Maezawa Industries Inc. respectively in order to serve these markets appropriately.

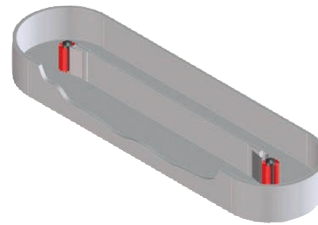
## ENHANCED OXYGENATION EFFICIENCY

The LANDOX flow booster acts to generate a plug-flow system that is distinctive in an oxidation ditch, thus achieving an almost laminar water flow through the channels across the whole depth of the oxidation ditch. This boosts efficiency of the fine bubble aeration system.

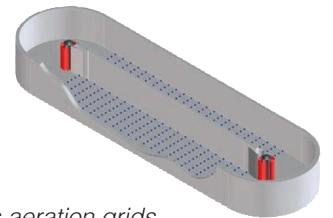
The LANDOX flow booster stands out against any other flow booster due to the distinctive plug flow conditions that it generates. As a result, fine bubbles originating from aeration domes or strip-shaped diffusers remain as fine bubbles over the total water depth. The principle of a proper plug flow condition created by the LANDOX flow boosters ensures that coalescence of fine bubbles does not occur. Therefore, the oxygenation efficiency of the fine bubble aeration system increases significantly, saving at least 10% of the total aeration energy cost. Conventional horizontal shaft flow boosters generate a turbulent flow of the water rather than a plug flow, encouraging coalescence of fine bubbles and reducing the oxygenation efficiency.

The LANDOX flow boosters are ideal for use in any form of fine bubble aeration, including aeration domes, strip-shaped diffusers or similar systems, as well as in any shape of oxidation ditch.

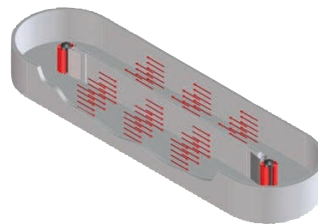
## ADDITIONAL BENEFITS



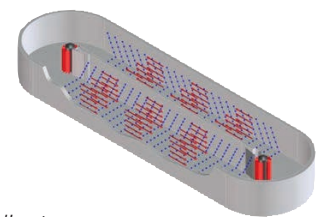
*No dead zones*



*Continuous aeration grids*



*Plug flow*



*No flow gradients*

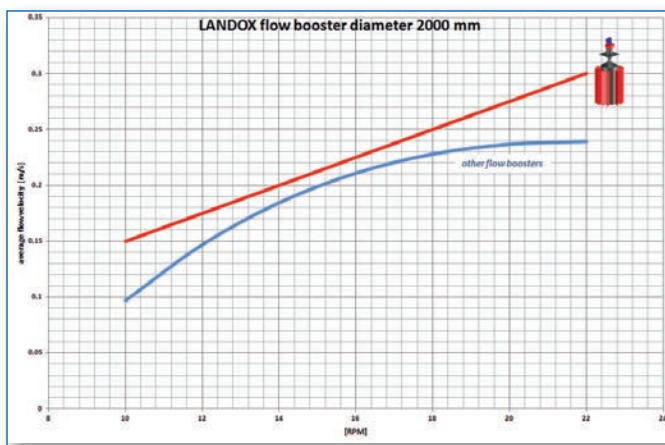
**Oxygenation efficiency of the fine bubble aeration system increases significantly, saving at least 10% of the total aeration energy cost.**



# LANDUSTRIE

## EASE OF CONTROL

The degree of propulsion and of mixing power may be controlled by adjusting the rotation speed of the LANDOX flow booster. Variable Frequency Drives (VFDs) are a common method of adjusting the speed of rotation in order to optimize energy efficiency. This optimizes starting and stopping the LANDOX.



VFD control of LANDOX flow booster against conventional propulsor

## BEST USE OF SPACE

Conventional horizontal shaft flow boosters require a substantial distance from bends and aeration grids, which reduces the maximum available space for the aeration grids.

LANDOX flow boosters are installed in the bends of an oxidation ditch, thereby allowing the use of continuous aeration grids throughout the full straight portions of the oxidation ditch.

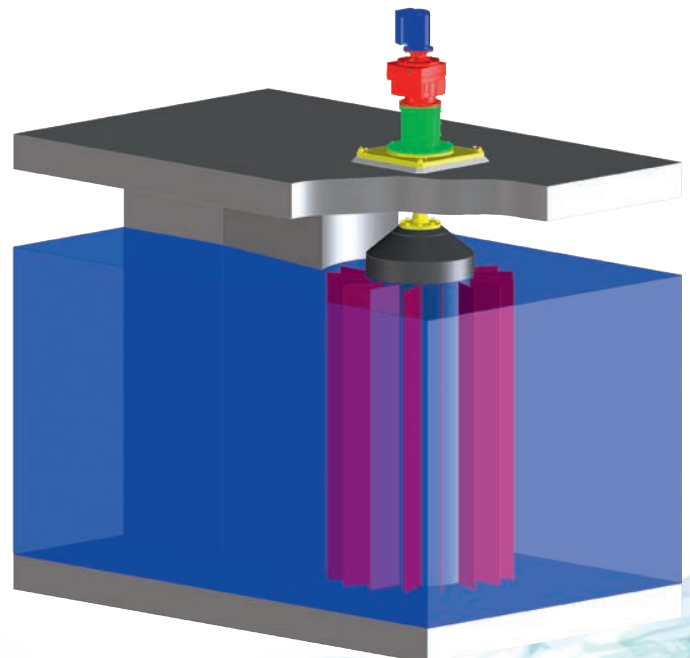
This has a favourable effect on the oxygen transfer efficiency and also reduces the energy-consuming flow resistance, thus resulting in saving of propulsion energy and operating costs.



LANDOX flow boosters at WWTP Porirua, New Zealand

## NO SETTLEMENT

The difference in velocity of the flow booster and the water velocity ensures optimal mixing. This ensures that dead zones in the bends do not occur, and prevents sedimentation from occurring in the water.



General arrangement of LANDOX flow booster



## SELF-CLEANING AND NON-CLOGGING

Conventional flow boosters are sensitive to clogging by means of fibres, rags or other kinds of fouling.

Due to the unique design and method of propulsion of the LANDOX flow booster, the system is self-cleaning and insensitive to clogging.



*Undesirable clogging of conventional mixers*

## SIMPLE AND ROBUST

Landustrie guarantees simple and robust construction with the least possible material thicknesses by utilizing finite element analysis (FEA) software. This is performed for any steel grade from which the blades of the LANDOX flow booster are manufactured.

LANDOX flow boosters also lead the way in product quality, which is realized by superior reliability and longevity.

## PROVEN TECHNOLOGY

The LANDOX flow booster is an advanced development based on proven technology. The proper and satisfactory functioning has been demonstrated worldwide at various wastewater treatment plants, such as:

## OPTIMISATION

Fine bubble aeration systems can often be deployed more efficiently and effectively. A substantial amount of energy can be saved when the operation of the aerator is based on the real load of a treatment plant and not on the original design parameters.

Precise adjustment is very important in view of the fact that about 80% of the electric power at a wastewater treatment plant is consumed by aeration. In the design stage of a wastewater treatment plant, process calculations are based on the theoretical maximum load of the plant, including a projection of growth for the coming years. The conceptual design of a fine bubble aeration system is based on those initial values. But what happens when the actual load is much less than anticipated load, or when the circumstances are very different from those originally assumed? By adjusting the operation of the aeration system to the actual plant load, the aeration efficiency can be improved considerably. This allows for energy savings as high as 30%, resulting in reduction of usage costs and consequently a reduction of the carbon foot-print.

Landustrie has developed a toolbox to evaluate and adjust the operation of an aeration system against the actual load of a treatment plant. The final objective of this scan is optimization of the aeration process, thus improving efficiency, power utilization, and durability. Whether employed in a new oxidation system or in a retrofit of an existing plant, Landustrie is the ideal partner to provide you the best technical and economic advice.

- ✦ Düsseldorf, Germany
- ✦ Corfu, Greece
- ✦ WWTP Massilon, USA
- ✦ King Chein, Japan
- ✦ Te Maunga, New Zealand
- ✦ WWTP Glenwood Springs, USA
- ✦ WWTP Nochi, Japan

# LANDUSTRIE

## EXPERIENCE

Landustrie has been involved in aeration technology for more than half a century in more than 60 countries worldwide.

This has given Landustrie the knowledge and experience to design well functioning aeration systems as well as to optimize existing aeration systems.

Our experience varies from providing single small-scale flow boosters to providing multi-unit, large-scale projects, and anything in between.



*LANDOX flow booster*



*Sizes can vary from 700 mm up to 4500 mm diameter*

## INSTALLATION AND COMMISSIONING

The Landustrie teams are renowned for the quality of work in their field of expertise. Under any condition, the installation and maintenance teams are able to deliver high quality and fast solutions. On-site tuning to your required site-specific characteristics is one of the skills of the team.

The LANDOX flow boosters can be installed by the experts on our special installation team. Another option is the use of a Landustrie supervisor, who will ensure proper installation of the flow booster together with a local team.

Our supervisor can also be called upon for commissioning and start-up of the flow boosters to ensure optimum performance and long service life.



## MAINTENANCE

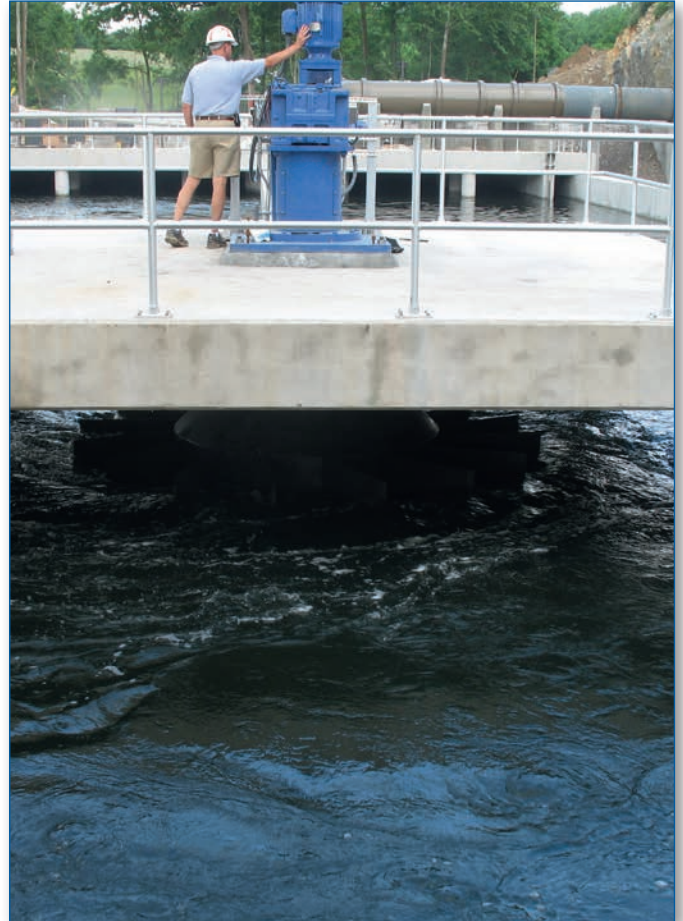
Landustrie can provide both preventive and, if required, corrective maintenance for the flow boosters.

Furthermore, spare parts are easily available and can be quickly dispatched to your site for maintenance, ensuring that minimum down-time of the flow boosters is achieved.

The knowledge of the manufacturing process and decades of experience designing, operating, and maintaining aeration systems makes Landustrie the clear choice to provide full after-sales support for any flow booster.



*Inspection and maintenance above water level*



*Easy inspection and maintenance access*

## AFTER-SALES SERVICES

The after sales is not restricted only to spare parts, but also includes everything from repairs and problem solving to maintenance, training, and upgrades.

For more information:

[aftersales@landustrie.nl](mailto:aftersales@landustrie.nl)



## MORE THAN FLOW BOOSTERS

Landustrie produces a wide range of equipment for wastewater treatment, which includes:

- ✦ Pumps
- ✦ Archimedes screw pumps
- ✦ Hydropower screws
- ✦ Brush aerators
- ✦ Surface aerators
- ✦ Screen cleaners
- ✦ Clarifiers and sludge thickeners
- ✦ After sales service that is second to none

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