Surface Aeration
SURFACE AERATION

INTRODUCTION

This brochure gives an overview of the activities of Landustrie Sneek BV in the field of surface aeration. Landustrie has a long history and broad experience in this field. For almost half a century Landustrie has designed, manufactured, supplied, installed and maintained many types of aeration system. Since the introduction of a full scale aeration test tank and the availability of process know-how, back in the mid eighties, Landustrie is the market leader in surface aeration. This scientific approach has resulted in the successful introduction of the Landy-7, the fourth generation slow speed surface aerator, which can easily compete with all other aeration systems on the market. The Landy-7 is in itself complete proof of Landustrie’s leading position in this market.

HIGH AND CONSTANT EFFICIENCY

The efficiencies that can be obtained with slow speed surface aerators depend on a number of factors. It is important to be aware of this, particularly when comparing slow speed aerators with other aeration systems. An important advantage of the surface aerator is that the efficiency will be constant over the full lifetime of the aerator, often up to 30 years. One important factor is the geometry of the basin in which the aerator will be installed. For different applications one can use, as a rule of thumb, the following data:

- oxidation ditches 2.2 - 2.5 kg O₂/kWh
- rectangular basins 1.8 – 3.3 kg O₂/kWh
- lagoons up to 2.0 kg O₂/kWh

A second consideration is the influence of the α-factor. For slow speed surface aerators this is normally about 0.9. This is a general scientifically accepted value. Particularly with fine bubble aeration systems α-factors are often assumed which can only be met at laboratory scale. Moreover, often no consideration is given to the composition of the waste water, which can have a detrimental influence on the function of the installed aerator.

Because of the character of the slow speed surface aerator it is impossible to avoid splashing of the waste water. The strength of a well designed aerator is that oxygen transfer is achieved with a controlled splash pattern. This is another area in which the Landy-7 distinguishes itself from other designs. If further restrictions are in place regarding splashing or noise production then Landustrie can supply specially designed aero caps (see photograph of Stora Enso, Sweden).
EXEMPLARY LOW REACTION FORCES

The design of the Landy-7 is such that both radial and axial forces are much lower than with conventional surface aerators. This has many advantages. In particular, the forces on the concrete and on the bearings of the outgoing shaft of the gearbox will be much lower. Because of this, in many cases, one can select a gearbox which will be one size smaller. Also the vibration characteristics will be reduced enormously, so that critical vibrations in the gearbox will not occur.

EXCELLENT MIXING QUALITIES

In many applications of slow speed surface aerators the function of the aerator is not just limited to introducing oxygen into the water. Also, a part of the propulsion and mixing has to be provided by the surface aerator. That is one of the reasons why the characteristic conical shape is noticeable in the design of the seven blades. This is the source of the pump function which is necessary for creating good mixing conditions inside the basin. For oxidation ditches this results in excellent propulsion. Also, when suction tubes are installed, for deeper depths, this pump function is very important to ensure a good transfer of oxygen.
The design and the shape of the blades is configured in such a way that it is impossible for any rag or other detritus to attach to the impellor. This is largely due to the virtual cone shape created by the seven blades.

The floating installation arrangement has been newly designed by Landustrie. It is a more compact installation which is not only more stable under operating conditions, but also much easier to balance due to the reversed pyramid construction. Another advantage is that the floating unit can be manufactured locally, allowing the use of less expensive local materials.

Because the complete surface aerator unit is simply built up from impellor, gearbox and electric motor, maintenance is limited to a yearly oil check and periodical checking of all greasing points.
The selection of the size of the surface aerator is primarily based on the amount of oxygen which has to be introduced into the water. The oxygen capacity of the selected Landy-7 can be regulated in two ways, either by regulating the speed by means of a variable frequency drive (VFD), or by a pole-changeable electrical motor. Alternatively, this regulation can be achieved by variation of the degree of submergence of the surface aerator, normally achieved by changing the height of the overflow weir. The actual regulation is nearly always monitored by means of an oxygen probe.

Depending on the specific circumstances it is possible that one single Landy-7 can transfer 1 to 500 kg O₂/h into the waste water. In any specific Landy-7 aerator, the range of oxygen transfer is very large. The efficiency of the surface aerator is constant over a wide range of both speed and submergence.

An important application for Landy slow speed surface aerators is in the pulp and paper industry. Whether the Landy-7 is installed in the classic aeration tank or after an anaerobic bioreactor, in both cases the Landy-7 is up to the job.

For half a century Landustrie has been involved in aeration projects, and many prestigious references have been achieved. In this brochure we restrict ourselves to some more recent examples of the over 5000 units supplied world-wide.
Since the middle of the eighties Landustrie has had the necessary facilities to undertake aerator testing in their own full scale test tank. This tank is unique in Europe, and probably in the world, in terms of size and testing possibilities. The dimensions are 20 × 20 × 6 m, creating an effective volume of 2200 m³, at a water depth of 5.5 m. In the tank a height adjustable bridge is installed in order to be able to simulate lower water depths. There is also the option of inserting extra walls in the tank to reduce the volume.

The standard drive-unit of the test installation is a 90 kW drive-unit provided with a variable frequency drive (VFD). The foundation plate is flexibly mounted and provided with 4 measurement probes using strain gauges, to measure the radial and axial forces. The rise in oxygen content is measured by 4 oxygen probes. The measured value of the axial and radial forces, the torque and the oxygen content is monitored by data loggers. In short, the monitoring is fully automatic. Apart from oxygen measurements, vibration, noise level and water flows can be measured. Oxygen measurements are undertaken in potable water, corrected to standard conditions (T= 20°C en P₀ = 1013 hPa) in compliance with the ATV norms (ATV M209E).

In this tank nearly all Landy-7 aerators are tested under different conditions. Landustrie is therefore capable of predicting the efficiency which can be expected under the given conditions. Besides measurements for Landustrie’s own use, measurements for third parties can be carried out in the presence of the client.
Landustrie has developed two standard types, the Landy-700 and the Landy-1000, both of which have the following features:
- high efficiency
- robust and reliable construction
- wide oxygenation capacity range
- low maintenance costs
- long life
- low exploitation costs

Depending on specific requirements, it is possible to supply other sizes of aeration rotors.

**LANDY-700**

The Landy-700 is an upgrade of the well-known cage rotor. The construction of the Landy-700 is similar to the Landy-1000 type, however the diameter of the brush aerator is limited to 700 mm.

Normally the Landy aeration rotor is supplied as a package unit, complete with bridge rotor, bearings, drive-unit, splash guards and a bridge. This compact unit not only allows for a simple civil engineering construction but also facilitates a very simple installation procedure. When no bridge is supplied, the bearings are located directly onto the civil construction.

The Landy-700 has a diameter of 700 mm and is available up to a length of 9 m. The oxygenation capacity is, under standard conditions, 54 kg O₂/h, at a rotor length of 9 m and an efficiency of 1.8 kg O₂/kWh.

**REGULATION OF OXYGENATION**

For regulation of the oxygenation capacity there are two options:
- Variation of the rotational speed, effected by a variable frequency drive (VFD) or a pole-changeable electric motor.
- Variation of the immersion depth of the aerator, effected by overflow weirs.
The Landy-1000 aeration rotor is the result of recent research and extensive testing. The Landy-1000 consists of a hollow seamless steel tube. Around the tube twelve blades are clamped in a star-shaped configuration. This is done by means of bolted connections (not welded). The width of the blades is 75 mm and the star-shaped blades are slightly staggered from one another. Thus, when rotating, not all the blades will hit the water simultaneously, in order to reduce the load on the bearings. On both ends of the tube splash plates are mounted to avoid splashing of the water onto the bearings. The Landy-1000 can also be supplied with a prefabricated bridge construction.

The Landy-1000 has a diameter of 1000 mm and is available up to a length of 9 m. The oxygenation capacity under standard conditions is 85 kgO₂/h, at a rotor length of 9 m and an efficiency of 2.0 kg O₂/kWh.

Landy aeration rotors can be installed in both municipal and industrial waste water treatment plants. Landustrie has also supplied Landy aeration rotors for use in potable water installations.
RENTAL OF SURFACE AERATORS

In order to fulfill the growing demand for temporary aeration installations, Landustrie offers the hire of a floating Landy-7 slow speed surface aerator. If requested the unit can also be hired without the floating construction.

These rental aerators can be used during the rebuild or renovation of existing waste water treatment plant. Of course it is also possible to apply these units for additional aeration, for use in lagoons or pond aeration or for tests in which one wants to compare different aeration systems.

PRICING

The rental price comprises a weekly rental price, with separate costs for transport, assembling, dismantling and other options.

RENTAL SUPPLY

- a Landy-7 high efficiency slow speed surface aerator
- quick delivery
- assembling and dismantling of both the existing and rental unit(s)
- optional supply of variable frequency drive (VFD)
- minimum rental period is one week

TECHNICAL DATA ON RENTAL AERATORS*

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<tr>
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<th>37 kW</th>
<th>55 kW</th>
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<tr>
<td>Motor power</td>
<td>37 kW</td>
<td>55 kW</td>
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<tr>
<td>Oxygenation capacity</td>
<td>± 80 kg O2/h</td>
<td>± 110 kg O2/h</td>
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<tr>
<td>Diameter (Landy-7)</td>
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<td>2000 mm</td>
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<tr>
<td>Peripheral speed</td>
<td>max. 5 m/s</td>
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* On request other units might be available.