

# Biogas Technology

EFFICIENT PUMPING AND MIXING TECHNOLOGY FOR BIOGAS PLANTS.

**FLYGT**  
a xylem brand

# Biogas - it comes naturally

With rising energy prices, interest in energy from renewable sources is increasing.

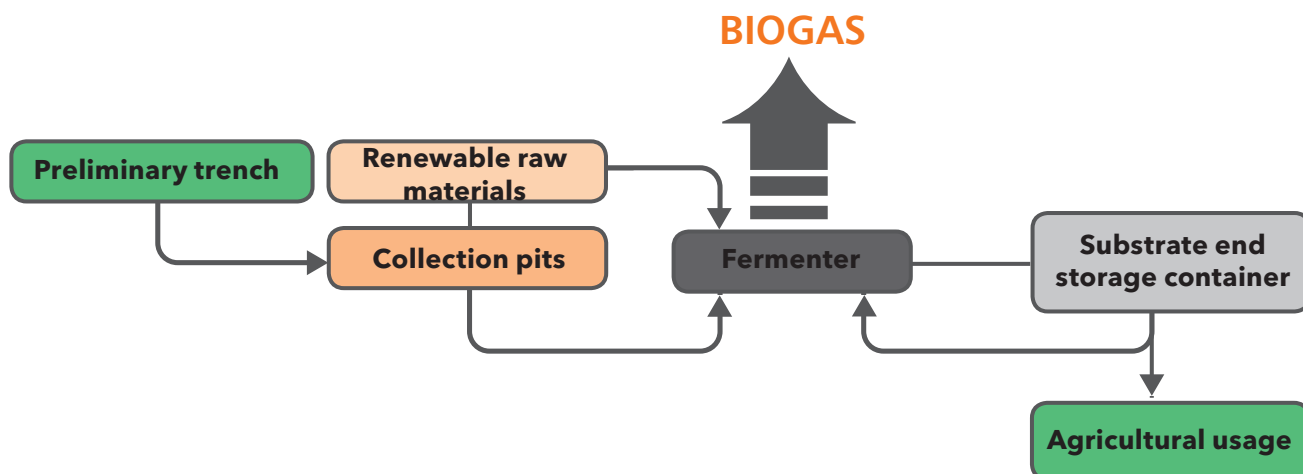
Biogas plants are among the few technologies which can be operated both nationally and locally. That's why, in recent years, not only has the number of installations increased many times over, but so has their output too. By way of comparison, the average output from biogas plants in the year 2000 was 50 kW - today it is up to 400 kW.

If a biogas plant is to operate economically, it has to be highly reliable. The complexity of the installation therefore demands high-quality components at all stages, from planning and design through to continuous operation.

## With Flygt right from the start

As the substrate has to be kept on the move, Flygt pumps and mixers are essential to biogas plants. In the case of liquid manure, they are even used in the stalls, but otherwise in the preliminary trench and collection pits, the fermenter (digester) and the substrate end storage container. They

have to cope with many variations in pipe length, diameter and heights of installations as well as ensuring thorough mixing. We offer the widest possible range of submersible pumps and mixers to ensure that your installation runs smoothly and reliably.

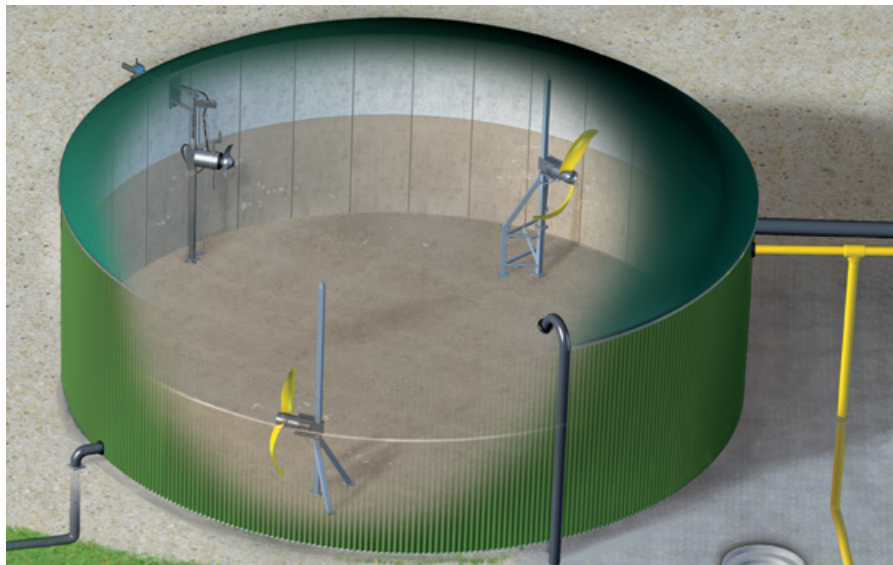


# Submersible mixers for an efficient flow

High-performance mixers are required in the fermenter (digester), as they maintain the homogeneity of the substrate, help distribute active bacteria and heat, and prevent layers of floating and sinking material.

Efficient mixing and the subsequent mixing result depend to a large degree on a strong, effective flow level being generated throughout the tank. The strength of

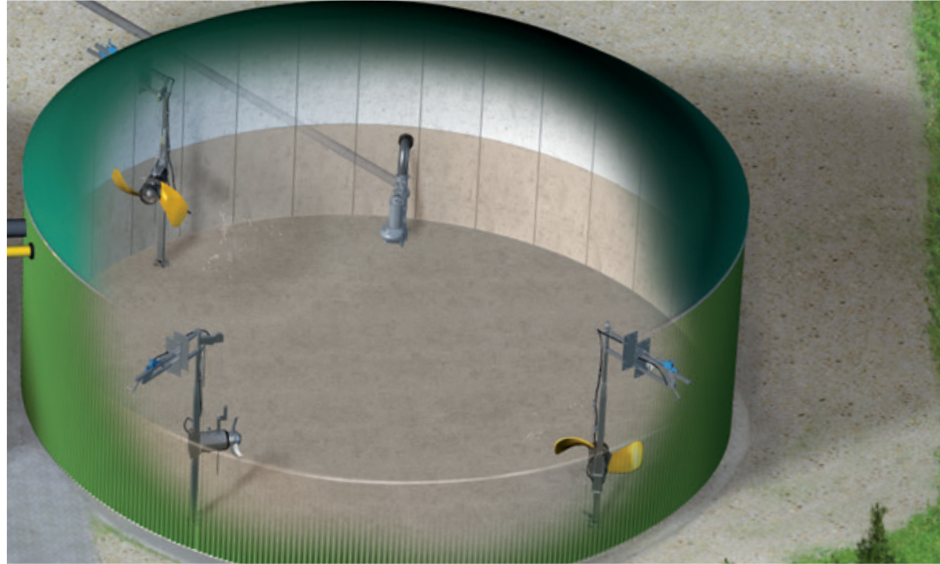
this flow is in turn dependent on the thrust. Factors determining the cost in power consumption of generating the thrust are hydraulic efficiency, speed and the diameter of the propeller. Flygt's banana mixers combine excellent hydraulic design with large diameters and low speeds and therefore represent the optimal solution for generating maximum thrust with minimum power consumption.



# More thrust – higher efficiency

## The low-speed 4460 series

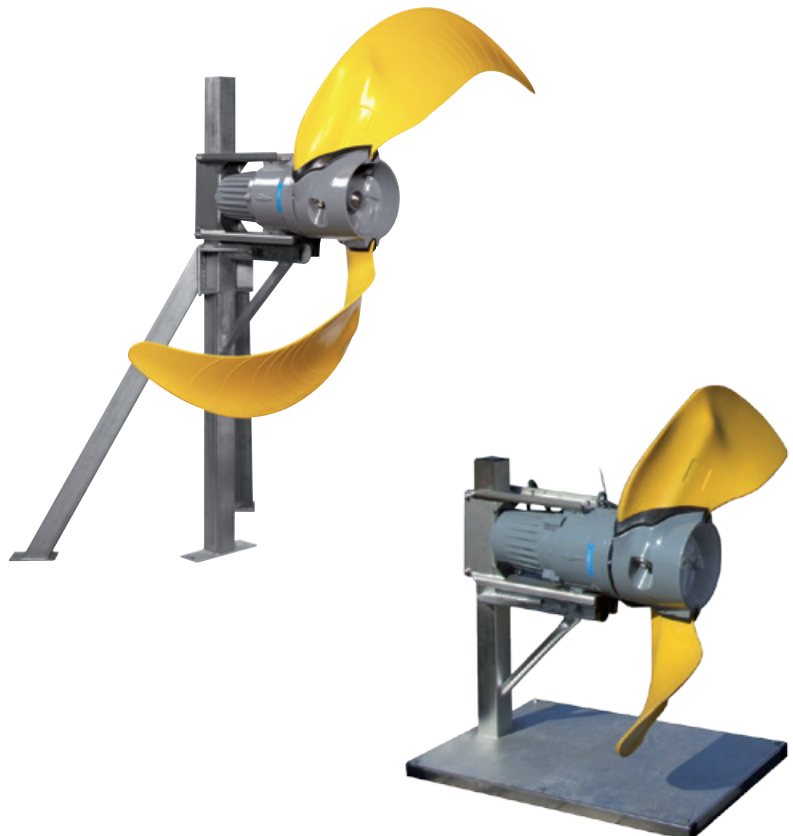
Depending on the application, the exceptionally robust design enables continuous operation of up to 180,000 hours between non routine maintenance intervals. The design of the Flygt banana propeller also provides excellent self-cleaning properties, which even prevent clogging in fibrous media. Optimal mixing and surface motion is thus ensured at all times.



## 1,300 mm and 2,500 mm

In order to meet a wealth of different requirements, Flygt banana mixers come with a choice of three different drive units, with propellers available in diameters of 1,300 and 2,500 mm as required. This modular design enables a configuration precisely tailored to the size and shape of the tank, and the material to be mixed.

Flygt submersible mixers are especially long-lasting on account of their robust and technically innovative design. So Flygt mixers boast exceptional value in the long term and really prove their worth with minimal life cycle costs. What's more, the Flygt installation accessories mean that maintenance and repairs on the mixer can be carried out with relative ease.



# Optimum positioning

In comparison with vertically and diagonally mounted mixers, Flygt banana mixers offer plenty of flexibility in terms of positioning and alignment. The mixer can be

optimally aligned, both in height and direction, and adapted to the shape of the tank. The mixer jet thus works over long distances and produces an impressive result.

## 1 Inner shaft seals

Shaft seals between the stator and the gearbox, and between the gearbox and the seal housing.

## 2 Electric motor

Squirrel-cage induction motor with thermal overload protection.

## 3 Cable entry

Compressible bush and strain relief on the cable prevent leakage into the motor.

## 4 Outer shaft seal

Mechanical face seal between surrounding liquid and seal housing.

## 5 Seal housing

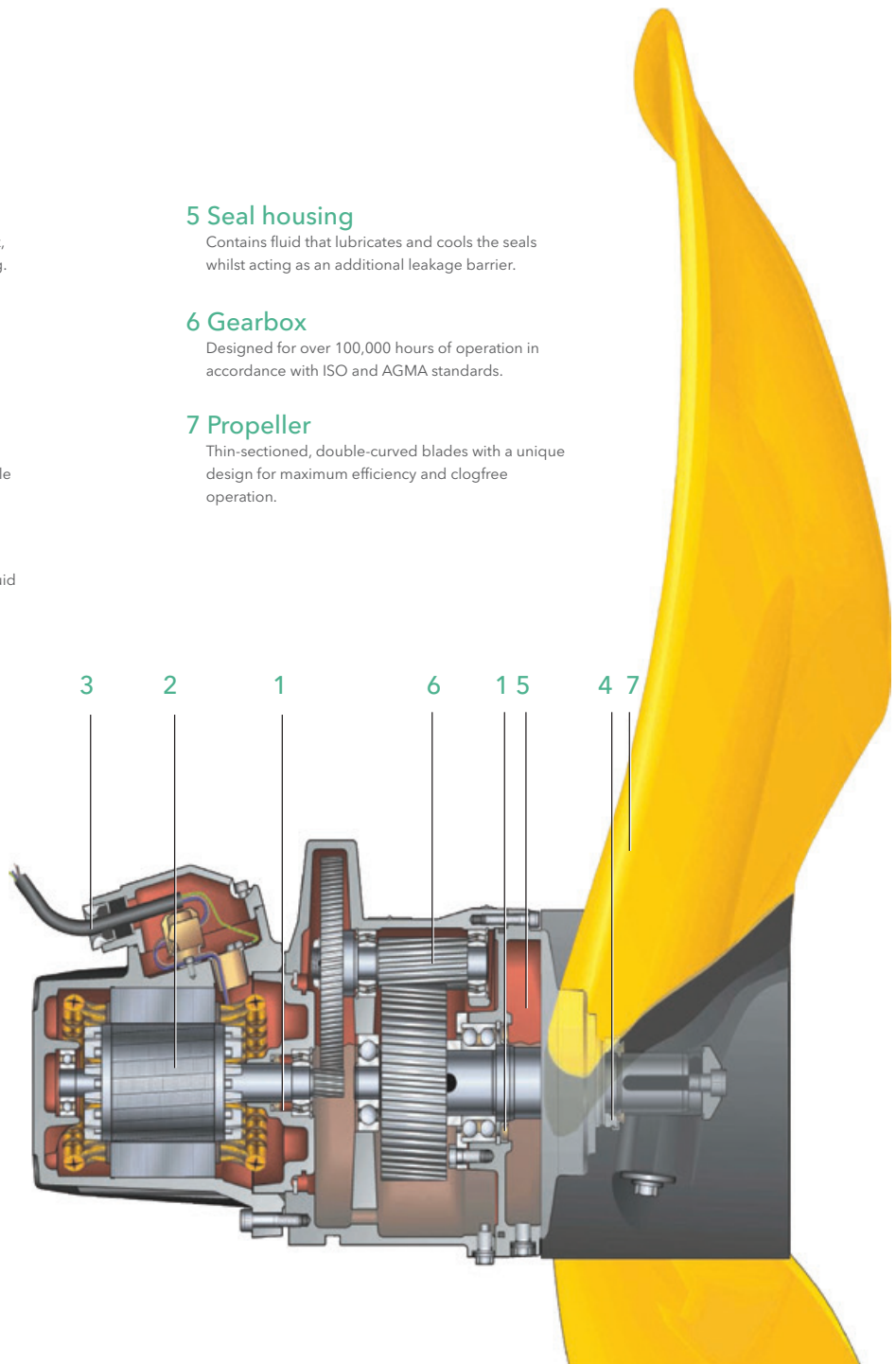
Contains fluid that lubricates and cools the seals whilst acting as an additional leakage barrier.

## 6 Gearbox

Designed for over 100,000 hours of operation in accordance with ISO and AGMA standards.

## 7 Propeller

Thin-sectioned, double-curved blades with a unique design for maximum efficiency and clogfree operation.



# Maximum mixing - minimum investment

## The compact 4600 series

Submersible mixers in the 4600 series can provide far greater flexibility than longshaft mixers in terms of positioning and alignment. The mixer jet can be easily repositioned to work over long distances. For this the mixer position can be adapted to the shape of the tank. This results in an optimum flow level, which in turn produces efficient mixing and low power consumption. The height adjustment feature is particularly useful for preventing and breaking up layers of floating and sinking material.



## Highly effective in substrate end storage containers

Flygt submersible pumps and mixers, which have already proved their worth in dealing with liquid manure, are also used in substrate end storage containers. The fermented substrate, which is generally thin and homogeneous, is, depending on the size of the container, further homogenised by Flygt mixers in the 4600 series before being pumped out by N series submersible pumps.



# Compact and flexible

## 1 Cable entry

Compressible bushing and strain relief on the cable prevent leakage into the motor, providing a reliable installation.

## 2 Oil housing

Large barrier fluid volume lubricates and cools the seal and thereby prolongs service life.

## 3 Monitoring

Thermal sensors embedded in the stator windings prevent overheating. Leakage sensors are available as options.

## 4 Bearings

Securely supports the shaft by means of one main bearing at the propeller end and a double bearing at the rear end.

## 5 Motor

High-performance, squirrel-cage induction Class H motor provides thermal overload protection and extra long service life.

## 6 Propeller

Available with different blade angles, thin double-curved propeller optimizes mixing efficiency. Wide-hub design deflects fibrous material.

## 7 Plug-in seal with the Active Seal™ system

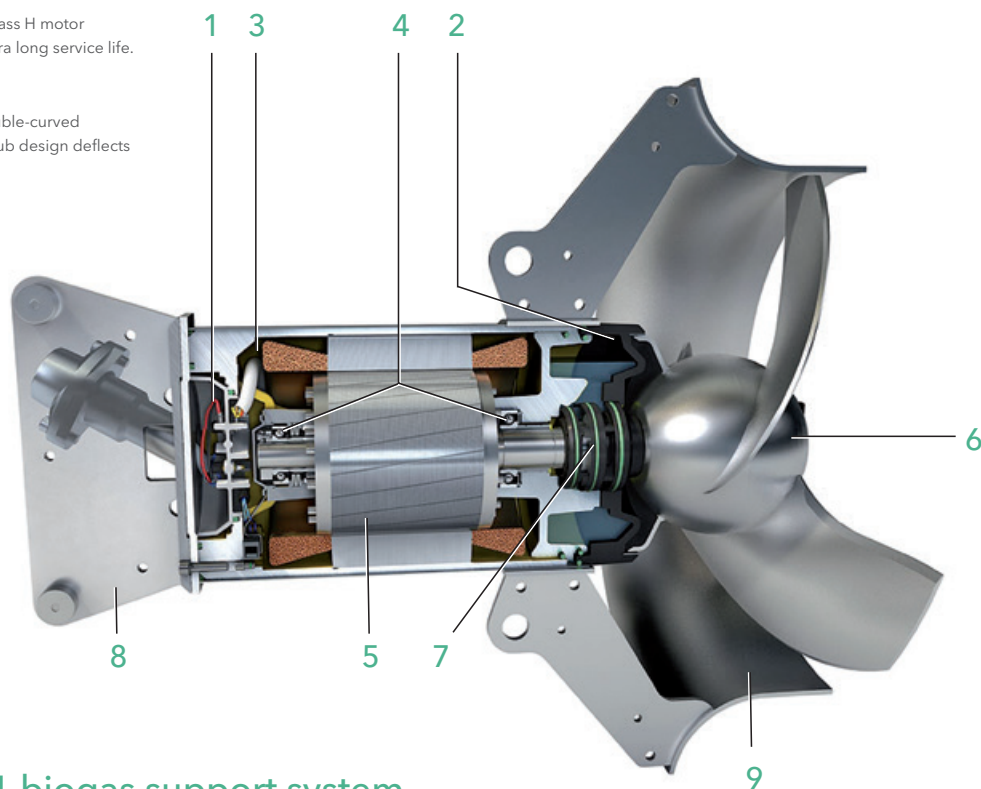
Offers increased sealing reliability and zero leakage into the motor, thereby reducing the risk of bearing and stator failure.

## 8 Materials

All external parts manufactured for excellent corrosion-resistance. Major parts in stainless steel.

## 9 Jet ring

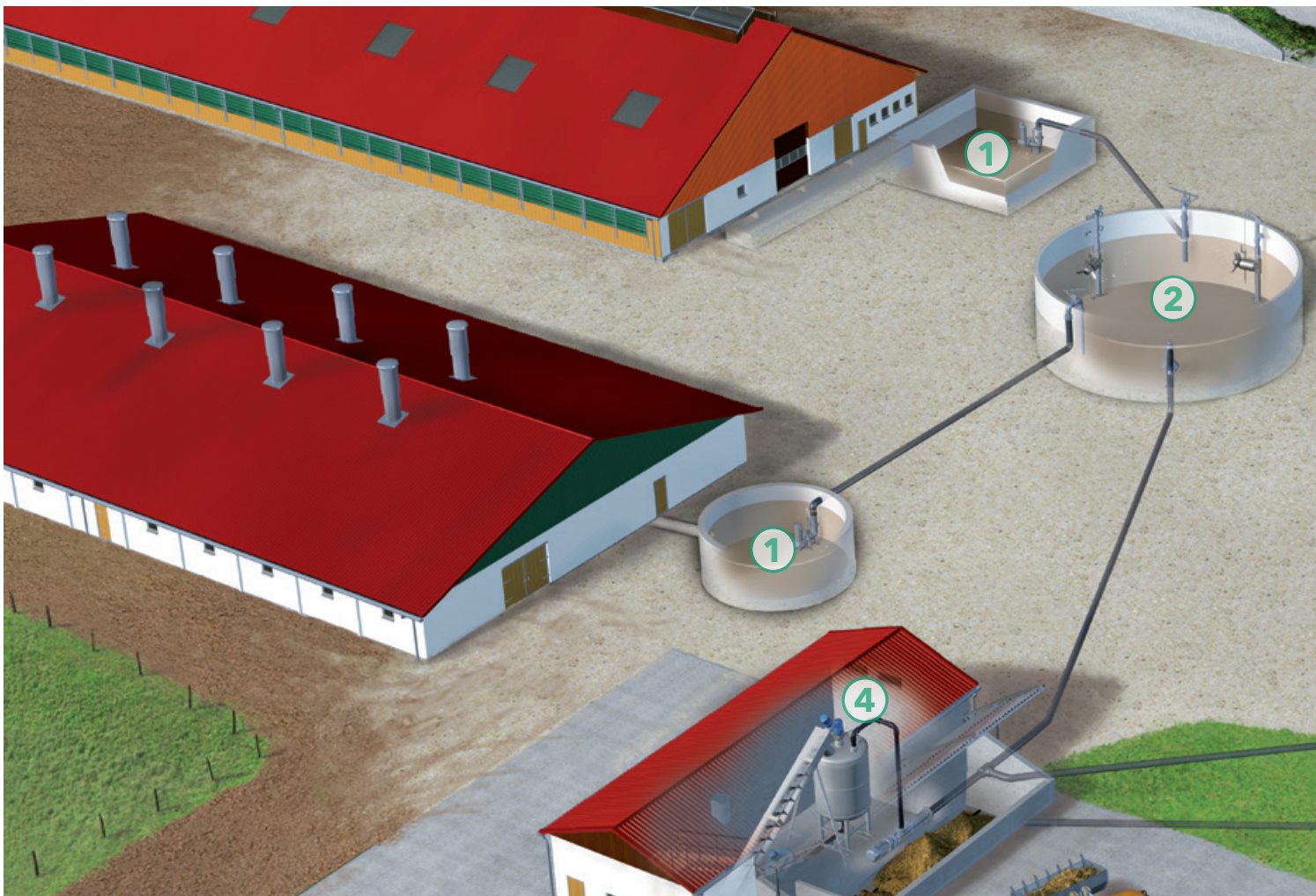
Optional jet ring increases hydraulic efficiency thereby reducing power consumption.



## BIS-1 biogas support system

The Flygt BIS-1 biogas support system offers easy installation and operation of submersible mixers in a biogas digester for both new and existing biogas digesters. The system allows for both vertical orientation and angle (+/- 45 degrees) adjustment while the tank is in operation and without accessing the tank interior. This adjustable feature allows the operator to raise the mixer to break up a crust or lower it to suspend settling solids.

The system is equipped with a patented guide bar connection that guarantees a secure and durable link between two guide-bars, minimizing vibration and thereby maximizing system longevity. The BIS-1 is compatible with the Flygt 4600 mixer series and the Flygt 4460 mixers (1.3 m propeller) and is engineered to withstand minimum 5 years of demanding service inspection.



The configuration of the installed technology is just as important as the quality of the reagents used when it comes to achieving a high gas yield. To ensure opti-

mal fermentation, the following factors are essential: stable temperatures, the exclusion of atmospheric oxygen, high activity on the part of the microorgan-

#### ① Preliminary pit

Depending on the amount of straw and feed, the quantity of dry matter in the substrate increases. With Flygt N and F series pumps, the substrate is pumped reliably into the collection pits with virtually no blockage whatsoever.

#### ② Collection pits

The liquid manure must be agitated in order to prevent the formation of layers of floating and sinking material - and higher speed Compact Flygt 4600 mixers. Flygt 4600 mixers are just the thing for the job. In the collection pits, solid and liquid coenzymes are sometimes added.

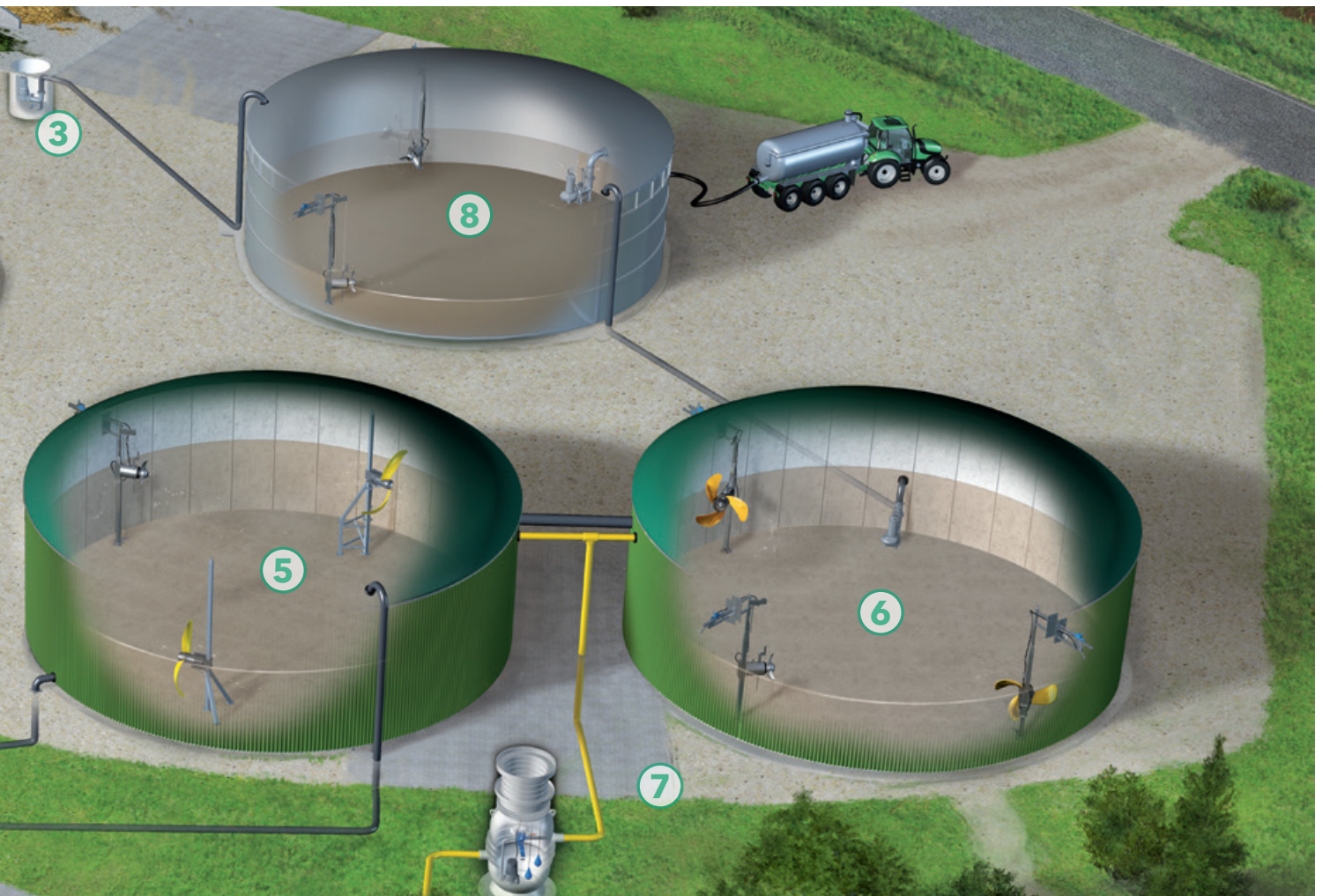
#### ③ Silage water

The silage that occurs during ensiling cannot be allowed to come into contact with the groundwater. The captured silage water can be used as fertilizer and pumped directly into the substrate end storage container. Here, D and F series pumps are ideal.

#### ④ Substrate mixing

In order to optimally harness the energetic potential of the substrate, this has to be correctly treated, with the homogeneity, temperature and solids content all playing a key role. The feeding in of the liquid substrate occurs through a progressive cavity pump, for example.





isms and, most importantly, good mixing. Flygt mixers and pumps are perfectly suited to the various processes involved in biogas production.

### ⑤ Fermenter

Flygt 4460 mixers, better known as “banana mixers” ensure the controlled mixing and homogeneity of the substrate, as well as pushing gas bubbles up to the surface. The compact mixers in the 4600 series also prevent the formation of layers of floating and sinking material.

### ⑥ Post-fermenter

In the post-fermenter, the substrate is more fluid and therefore requires less agitation. The use of the Flygt 4600 series compact mixers and the Flygt 4460 series medium-size mixers prevents the build-up of isolated residue. Furthermore, just as in the fermenter, layers of floating material are effectively combated and the gas is transported to the surface.

### ⑦ Condensate pump

A key step in purifying the gas is the removal of water. The condensation generally occurs on the cold gas pipe with the help of a steam trap. Once collected, the water is held in the Flygt Compit, where it is prevented from frosting over, and pumped out from there. The installed pump and all other components are corrosion resistant.

### ⑧ Substrate end storage container

The final destination for the fermented, generally thin substrate is the substrate end storage container. Before being applied in the field, the substrate is homogenised using Flygt 4600 series mixers. Flygt N series submersible motors are ideally suited to pumping out the substrate, as they operate without blockages and keep energy consumption low.

# The Flygt N and F series pumps for the toughest challenges

To increase the gas output and thus efficiency, most plants use a mixture of renewable raw materials, solid manure and coenzyme. This increases the levels of dry matter and impurities in the preliminary trench, meaning that pumps and mixers have to be carefully selected.

The chopper pumps of the F 3000 series are perfectly suited to pumping media with a high dry matter content. The powerful cutting impellers boast hardened edges and, along with the cutting plate, make light work of long-fibred material such as straw, resulting in a more homogenous medium that is easier to pump.



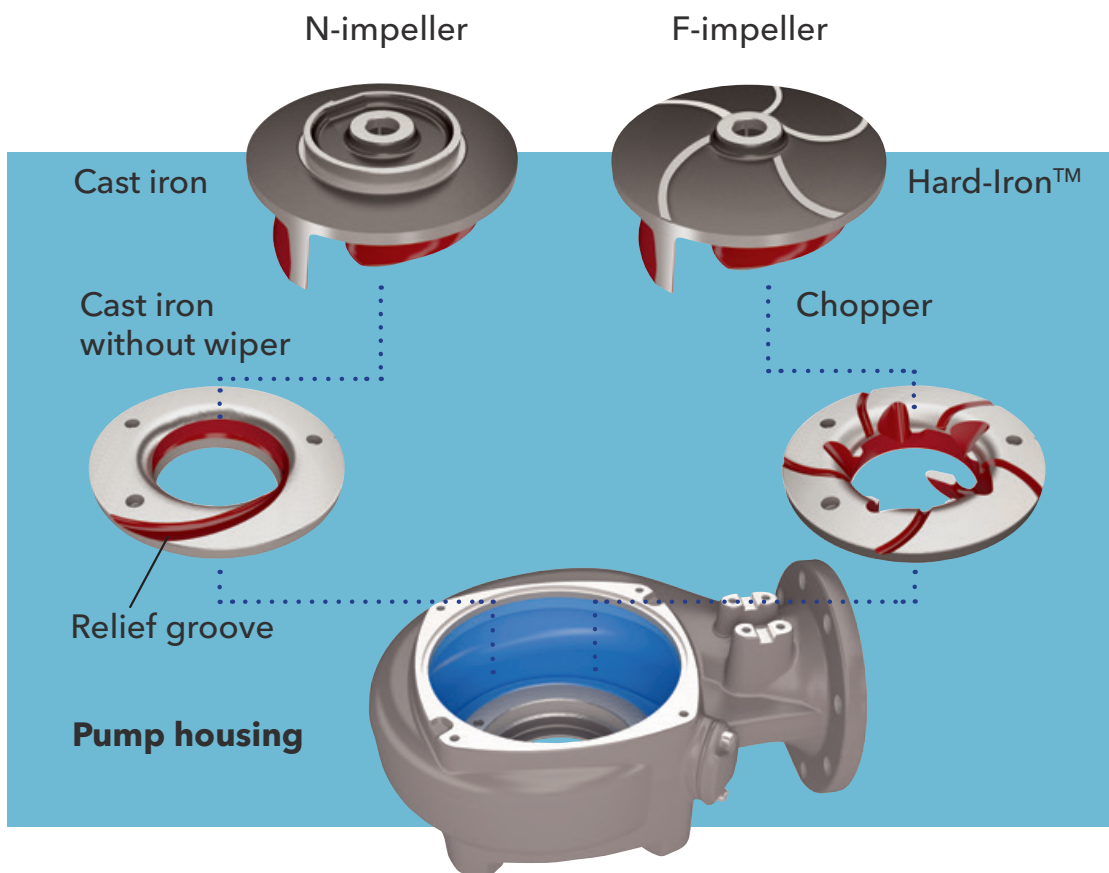
## Really in their element: N series pumps

If the risk of blockages during pumping of the fermented substrate is to be reduced to a minimum, Flygt pumps with N-impeller technology are the optimum choice. The patented hydraulic system is self-cleaning and achieves high efficiency that remains constantly above 80 per cent.

At the core of the N series pumps is the patented N-impeller, At the core of the N series pumps is the patented N-impeller which

has been operationally proven over many years open construction of the impeller, combined with a relief groove in the pump housing, reduces the risk of blockages and ensures that the pump maintains its constantly high efficiency of up to 82 per cent over the long term. This reduces the overall energy consumption and dramatically cuts the life cycle costs of the pump, making the N series pumps the ideal solution for the substrate end storage container.

# The chopper hydraulic system



The improved F series, designed for the toughest jobs, now comes with an even more efficient impeller. This impeller rotates inside a chopping plate and chops all the fibrous elements that pass through into little pieces. This makes pumping easier and prevents the impeller from becoming blocked.

The chopper pumps in the F series have been extensively tested in practice and are exceptionally powerful and reliable. With such a high standard of reliability, frustrating and expensive breakdowns are reduced to a minimum. Any foreign bodies that have got stuck are easy to remove. The fact that the impeller is so easy-to-remove is just one of the reasons why com-

compact Flygt pumps are so easy to maintain. Depending on the operating point, the exceptional efficiency of the new-generation F series results in an average reduction in energy consumption of 30 %.

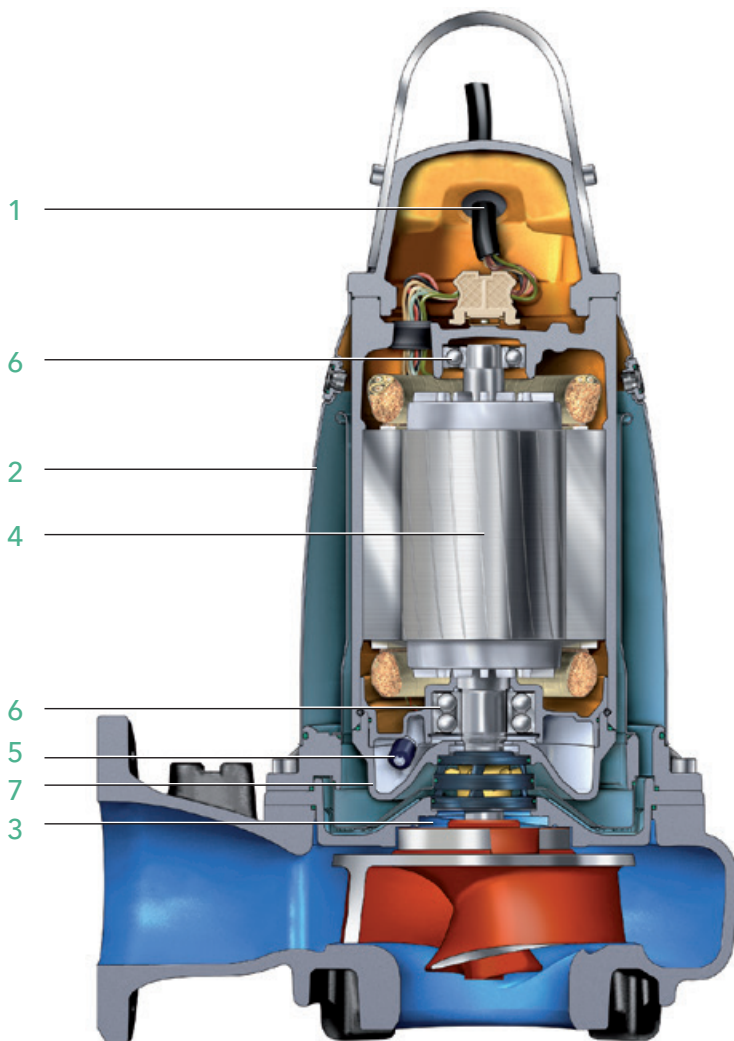
#### Modular design:

- With N and F-impellers
- With insert rings made of grey cast iron and Hard-Iron™ (25% chrome)
- Inside a universal pump housing
- For a simple changeover between N and F-pumps

The patented Flygt N-impeller in an innovative design: the impeller blades are curved a long way back to enhance the self-cleaning properties.

# Innovation for optimum reliability

A hallmark of the N-pump is its high reliability, which is partly due to SpinOut™ seal wear protection. This patented design protects the outer seal from premature wear by expelling abrasive particles from the seal chamber. In addition, the inspection chamber facilitates early recognition of seal wear and thus provides initial protection from costly resulting damage.



## 1 Cable entry

The cable entrance features both a seal and a strain relief function.

## 2 Cooling system

In normal use, the surrounding liquid cools the pump. In more demanding applications, or in dry-pit installations, all pumps can be provided with an integral closed-loop cooling system. The coolant is circulated around the stator housing by an integrated pump.

## 3 Seal wear protection

Spin-out™ is a patented design that protects the outer seal by expelling abrasive particles from the seal chamber.

## 4 In accordance with international standards

Each pump is tested and approved in accordance with national and international standards (IEC 34-1, HI, CSA). They are also available in explosion-proof versions approved by Factory Mutual (FM) and European Norms (EN).

## 5 Monitoring

Thermal sensors embedded in the stator windings help prevent overheating. The inspection chamber is equipped with a leak detector.

## 6 Long-life bearings

The bearings in all Flygt pumps have been designed to provide a minimum 50,000-hour service life.

## 7 Inspection chamber

A separate inspection chamber, situated below the bearings, further increases operational reliability. The built-in sensor promptly alerts the user to any fluid build-up and enables simple checking and maintenance.

# Flygt pumps for drainage and silage water



D 8050

Flygt pumps of the D and F series are mainly used in biogas plants for pumping drainage water and other liquids that are suitable for biogas production. These media are fed directly into the collection pit. The pump is operated by a rapidly rotating vortex generated by the impeller. This means that any particles or foreign bodies barely come into contact with the impeller, minimising the wear on the seals and protecting the impellers from excessive abrasion. With their lightweight, compact construction, these D-pumps boast outstanding versatility and, like all Flygt pumps, are enormously reliable and low-maintenance.



F 3102



F 3068



D 3057



DXVM 35-5  
DXVM 50-11



SXM 5  
SXM 7  
SXM 11



SXM 2  
SXM 3

# Corrosion-resistant and frost-free

## Versatile shaft

The Flygt Compit was originally developed for holding sewage generated during pressure draining, but is now also used for capturing percolating juices and condensate. Not only is it supplied fully equipped and ready to install but, thanks to its bulbous polyethylene body, is also pressure-resistant and can be driven over without any problem whatsoever. The normal version is capable of resisting loads of up to 12.5 t in accordance with German load class B, whereas the version made in accordance with German load class D can even support weights of up to 40 t.

## Suitable for percolating juices and condensate

The Compit is also ideal for use as a collection pit for biogas percolating juices and condensate. In combination with the blockage-free geometry and intelligent controls, the Flygt Compit is the only pump station in its class to offer one key benefit: the ability to automatically activate and deactivate the pump with a run-on period enables, depending on the pump model, particularly deep pumping without breaking the terms of the ATEX directive. The Flygt pumps of the D 8000 and SMX series are an ideal choice for the pump.

## Domestic sewage

There are a choice of two pumps: the explosion-proof Flygt M3068 and M3090 sewage pumps with external chopper for different pumping heights and quantities. While the penstock and ball valve are made from stainless steel, the discharge connection, guide claw, globe valve and crosshead are made from corrosion-resistant PAA.



# A partner with vast experience.

Every sector demands special expertise from its suppliers and this is especially true of agriculture. That's why we draw on the experience of agricultural engineers who speak your language and understand your needs quickly. After all, the more a company is defined by its professional expertise, the greater the focus on customer concerns. With us, it's Flygt submersible pumps and submersible mixers for liquid manure systems and biogas plants.

Economic and environmental development continuously calls into question the validity of existing solutions, which is why we constantly strive to break new ground and tailor our development processes to meet the expectations of our customers. Knowledge gained from our target markets all over the world constantly shapes our research, development and production. It's no coincidence that Flygt pumps and mixers meet the highest manufacturing standards in the world.

As the inventors of submersible technology and with more than 40 years' experience, our engineers have a wealth of technological expertise when it comes to the development of new products and complete systems, which time and again prove to be the most efficient and reliable solution. And the benchmark is the same wherever you go - customer satisfaction. That's why we always seek to connect with our customers, as this sharpens our understanding of what really matters - being your supplier of choice.



Flow production

## A seal of quality you can rely on



The desired yield can only be achieved if all the components work together and operate reliably. Even short interruptions in one process or another can cause the plant to fail and jeopardise its efficiency. We make submersible pumps and mixers which have been proven to be highly reliable and efficient. That's why we were delighted when Fachverband Biogas e.V. (German Biogas Professional Association) awarded us with their seal of approval.



Liquid manure mixers



Liquid manure pumps



Customer-oriented service

# Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services, and agricultural settings. With its October 2016 acquisition of Sensus, Xylem added smart metering, network technologies and advanced data analytics for water, gas and electric utilities to its portfolio of solutions. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

**For more information on how Xylem can help you, go to [www.xylem.com](http://www.xylem.com)**



WEDECO



godwin 



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