

Maximum  
operational reliability



Powerful industrial  
gear units



Power through  
the agitator

## Agitator drives for biogas production

Case study: PRG Präzisions-Rührer GmbH  
and Schmack Biogas AG

**NORD**<sup>®</sup>  
**DRIVESYSTEMS**  
Our Solution. Your Success.

# PRG Präzisions- Rührer



## Agitators

For Europe's largest biogas fermenter



## Industrial gear units

Robust gear units from the MAXXDRIVE® series

## Project requirements

In Friesoythe in Lower Saxony, a gigantic biomethane plant is being built. In the first expansion stage, 18 fermenters (final expansion stage: 40 fermenters), each with a width and height of 25 metres, will process one million tons of dung and liquid manure from the region. For this, the biomass – up to 9,500 m<sup>3</sup> per container – must be continuously stirred. The agitators also have similarly spectacular dimensions: Special agitators with a diameter of five metres are attached to 22-metre-long agitator shafts; the agitator weighs 7.5 tons without the gear unit.

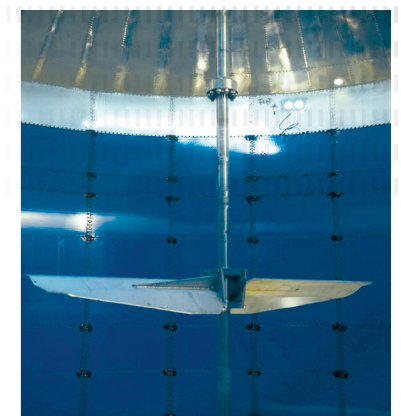
Therefore, great demands are placed on the drives of these huge devices. In addition to the high performance, this means maximum operational reliability for smooth 24/7 operation, 365 days a year. The greatest possible freedom from maintenance and a robust design are also required; after all, the agitators along with the tanks are exposed to the weather 24 hours a day. In view of the flammable methane gas, the drives also need to be explosion-protected according to ATEX directives.

## Application solution

For its agitators, PRG Präzisions-Rührer GmbH relies on industrial gear units from the MAXXDRIVE® series by NORD DRIVESYSTEMS. They are designed for maximum load capacity and operational reliability and provide output torques from 15 to 282 kNm. Even under extreme conditions – such as in the biomethane plant – they work reliably. Thanks to the torsionally rigid, one-piece UNICASE housing, they achieve a longer bearing life than gear casings manufactured from jointed parts.

Tailor-made and quiet running. Gear unit option VL3 ensures extremely high radial and axial load capacities, and a long service life. High-precision axis alignment ensures quiet running. All agitator and mixing drives from NORD are tailor-made and adapted exactly to the respective requirements of the customer application. To this end, NORD

engineers are working closely with the PRG experts. Furthermore, the SAFOMI-IEC adapter (Sealless Adapter for Mixers) from NORD ensures greater operational reliability. It was specially developed for agitator drives and combines the functions of a standard IEC adapter with those of an oil expansion chamber. Therefore, there is no need for oil tanks and hoses or the radial shaft seal between the gear unit and the IEC cylinder, which is prone to leakage and wear. This results in a longer lifetime and less service work. With these optimisations NORD has succeeded in further increasing the drive unit's reliability and extending the maintenance intervals of the components. Overall revision is thus required after 10 years.

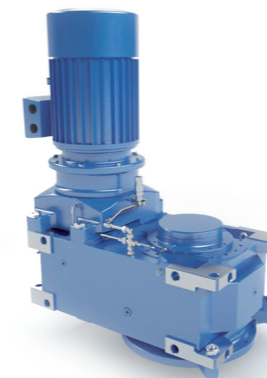


**Gigantic forces at work**  
An agitator with a diameter of five metres is attached to a 22-metre-long agitator shaft



## Customer profile

PRG Präzisions-Rührer GmbH is one of the world's leading suppliers of agitating technology. The company's agitators and agitating plants are used in industries such as cosmetics, chemicals, food, pharmaceuticals, biotechnology and biogas. The supplier from Warburg in North-Rhine Westphalia with around 150 employees is valued by its worldwide customers for the quality and reliability of its products.



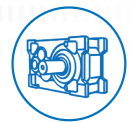
## The project at a glance

MAXXDRIVE® industrial gear units are used for the powerful and totally reliable drive of the agitators in the methane gas plant.

- ▶ Output torques: 15 to 282 kNm
- ▶ Speed ratios: 5.54:1 to 400:1
- ▶ Efficient power transmission, high tolerance for peak loads and impacts
- ▶ Torsionally rigid, one-piece UNICASE housing
- ▶ Durable and low maintenance
- ▶ Additionally: SAFOMI-IEC adapter for more operational reliability



Biogas



Geared motors  
MAXXDRIVE® industrial  
gear unit

### Energy from the agitator

To produce methane from a substrate of maize or grass silage and other components, the mixture must be continuously stirred to achieve optimum fermentation under the exclusion of air. For this purpose, Schmack systems use huge agitators driven by parallel shaft geared motors from NORD DRIVESYSTEMS. Biogas provides three types of energy: electricity, heat and fuels. The company from Schwandorf is convinced that in the long term, biogas has the potential to replace a large proportion of the global consumption of natural gas. "The fact that biogas can be stored, it assumes a leading role in the renewable energies mix", emphasises company founder Ulrich Schmack. The entire operational technology of a biogas plant must be designed in a way that it produces as much energy as possible while consuming minimal energy itself. In terms of geared motor design, this requirement implied a

connection power as low as possible. Consequently, two 2.2 kW three-phase standard motors suffice to drive the horizontally installed agitator in the EUCO® main fermenter, which may be up to 26 metres long. The required torques of up to 30,000 Nm are achieved via a 5-stage SK 9382 parallel shaft gear unit. The agitator paddles on the shaft in the container rotate at around 0.8 rpm. The speed-controlled motors must be robust to ensure maximum availability in a continuous biological and chemical process, which does not permit standstills.

### Churning under the cover

The substrate is then pumped via a conveyor screw into the post-fermenter – the pit storage fermenter – which is also used to store the biogas from the first stage.

It is this part of the system, which gives the biogas plants their characteristic appearance, where its dome, is visible from a great distance. The relatively large volumes place special demands on the agitator technology according to the size of the plant, which usually vary between 1,200 and 2,400 m<sup>3</sup>. Based on the paddle agitator in the EUCO® TS, Schmack Biogas has developed the modified REMEX large-blade agitator, which is also driven by parallel shaft geared motors from NORD. The agitators ensure a broad-based, three-dimensional mixing of the substrate. Because they are arranged in opposition at various levels, they cover large areas of the fermenter, keep the substrate at a constant temperature, prevent segregation and therefore achieve consistent biogas production. As with the plug-flow fermenter, the geared motors are designed with a hollow output shaft to cater for the supply of heat via hot water.

Supported by static heating surfaces on the walls of the container, it is thus easy to bring the shaft up to temperature. In both processes, the geared motors are mounted via side glands on the outside of the container. The parallel shaft gear unit version results in a compact design of the geared motor holder on the concrete wall. A cover protects the drive unit from the weather. Connection powers of a maximum of 6 kW per motor and agitator speeds of up to 10 rpm are sufficient to keep the "boiler" bubbling. The speed of the two synchronised agitators can be precisely preselected. The speed control also has the advantage that especially during system start-up, torque peaks can be safely compensated. This solution prevents high start-up currents, while protecting the bearings and mechanical components from torque fluctuations. >



Geared motors  
MAXXDRIVE® industrial gear unit



### Customer profile

Together with BIOFerm GmbH, Schmack Biogas GmbH from Schwandorf in Upper Palatinate is the biogas specialist in the Viessmann Group and one of the leading suppliers of biogas plants in Germany. With their innovative technologies, they make an active contribution to CO<sub>2</sub>-neutral energy production. The company was founded in 1995 and has been a member of the Viessmann Group since January 2010. It now provides its services in the business areas of planning and construction as well as service and operation, and is therefore one of the few complete suppliers in the sector. In addition to technical support, they focus on providing a comprehensive microbiological service.



### Agitator drives

In the pre-fermenter	Geared motor type	SK 9382AZ 132S/4-2 TF 4,7
	Power	5.9 KW
	Output speed	5 – 10 rpm
In the post-fermenter	Geared motor type	SK 9382/52 AZ 100L/4 TF
	Power	2.2 KW
	Output speed	0.8 rpm

# Schmack Biogas AG



## Paddles with heated shafts

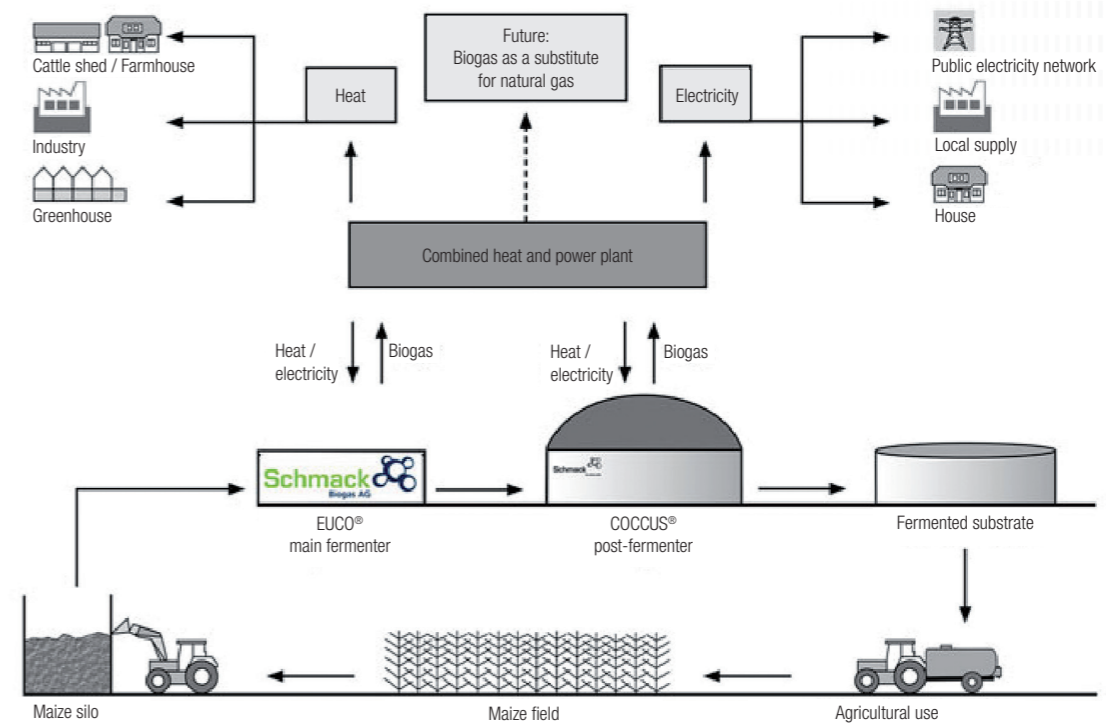
The so-called plug-flow fermenter is designed as a concrete fermentation tank with a maximum proportion of dry matter for the processing of biomass. Even dry fermentation is possible. Its design ensures optimum, gentle mixing and an even distribution of heat – the prerequisites for a stable fermentation biology. This prevents unwanted floating and sinking layers. At the same time, the position of the shovel-like agitator paddles on the heated shaft ensures the slow, continuous transport of the fermenting substrate. Designed for loads of about 30,000 Nm, this process demands high performance from the gear units. For this, a hollow shaft version of the SK 9382 is installed, making it easy for the company from Schwandorf to heat the shaft

through the gear unit. “We operate the fermentation at over 40 °C and provide the micro-organisms with optimum conditions for the best possible production of biogas”, explains engineer Norbert Hutzler.

## Renewable energy in the pipeline

In comparison with other important types of renewable energy such as electricity generated by solar energy, biogas has the advantage that it can be stored easily and cheaply. It can later be converted to electricity and heat in combined heat and power plants (CHPs) as necessary. In the future, biogas will increasingly be able to be fed directly into the gas network. In Pliening, in the east of Munich (district Ebersberg), the

construction of one of the first biogas plants of this type was completed about two years ago. With an annual processing capacity of about 3.9 million Nm<sup>3</sup> (standard cubic metres) of biomethane, the Pliening plant is the largest in Bavaria and one of the largest in Germany. The biomethane plant has an energy input capacity of about 40 million kWh, which roughly corresponds to the annual consumption of natural gas by about 1,300 four-person households. With the biomethane directly fed into the Munich utilities' natural gas network, E.ON Bayern operates two combined heat and power plants (CHPs) in Poing and Puchheim. They generate electricity and input the produced thermal loss into a district heating network throughout the year.



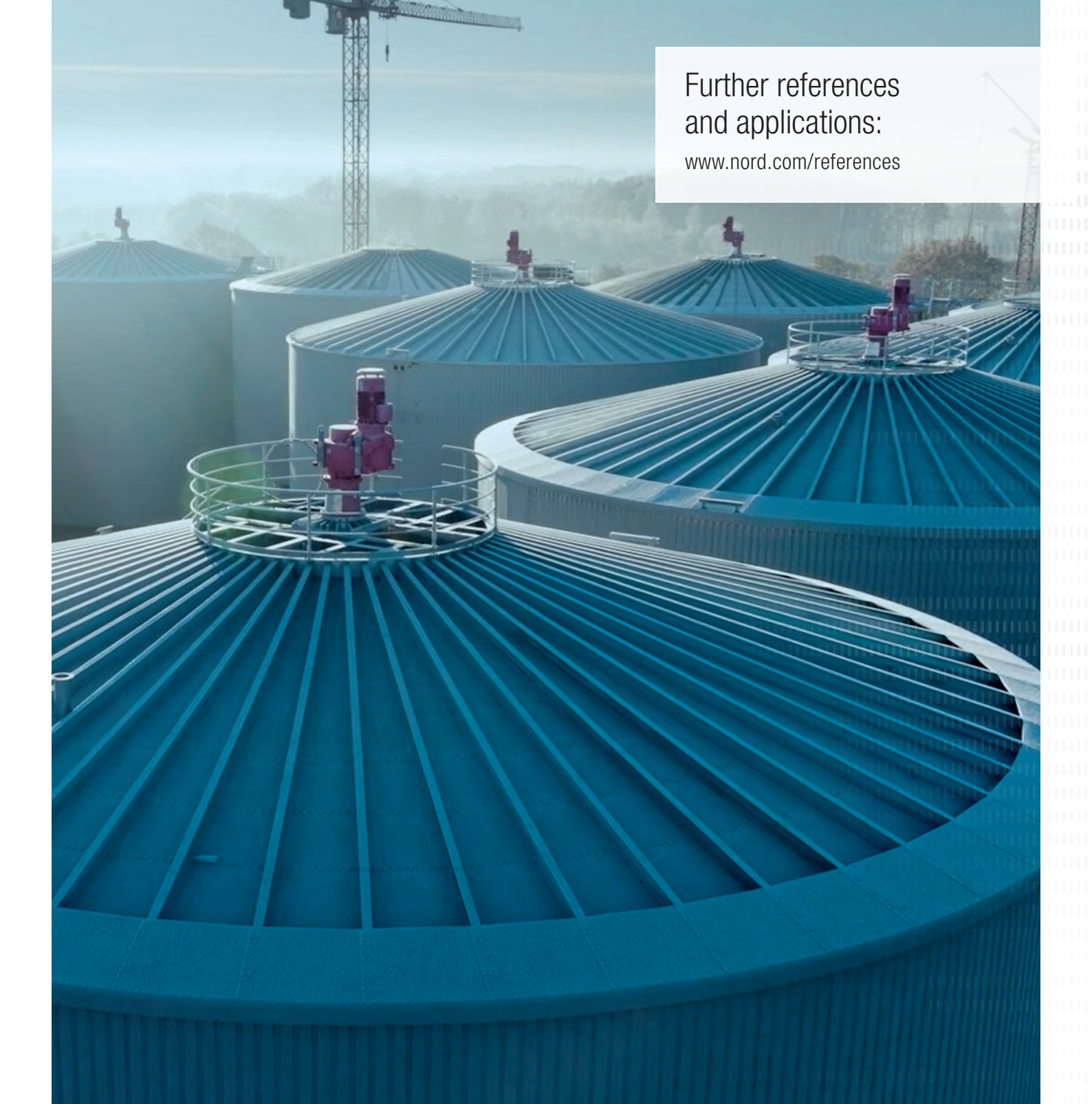
## Energy from biogas

Biogas is largely a mixture of methane, carbon dioxide and water vapour. Various types of anaerobic microorganisms are involved in the process for the controlled production of biogas. Their relative proportions are influenced by raw materials, pH value, temperature and digestion. Due to the ability of these microorganisms to adapt to the

process conditions, almost all kinds of organic substances can be decomposed by digestion. Hydrolysis, acidogenesis, acetogenesis and methanogenesis are the four biochemical processes necessary to ferment the biomass to produce biogas. It is then cleaned and desulphurised, so that it can be refined and compressed to the quality of natural gas.

“In view of the dangers of climate change and the hunger for energy throughout the world, we are standing at an historical crossroad. In order to reduce the emission of greenhouse gases in Europe and the other industrialised countries by at least 30 percent by 2020 compared with 1990, we need rapid progress in renewable energies and a much more efficient use of energy in Europe”,

commented the Federal Minister for the Environment Siegmund Gabriel in February 2007 on the decision of the European Energy Council to bindingly increase the proportion of biofuels in the overall fuel consumption to at least 10 percent by the year 2020. Gabriel also demanded that by this date the proportion of renewable energies should be brought up to 20 percent of the total energy consumption.



Further references  
and applications:

[www.nord.com/references](http://www.nord.com/references)

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