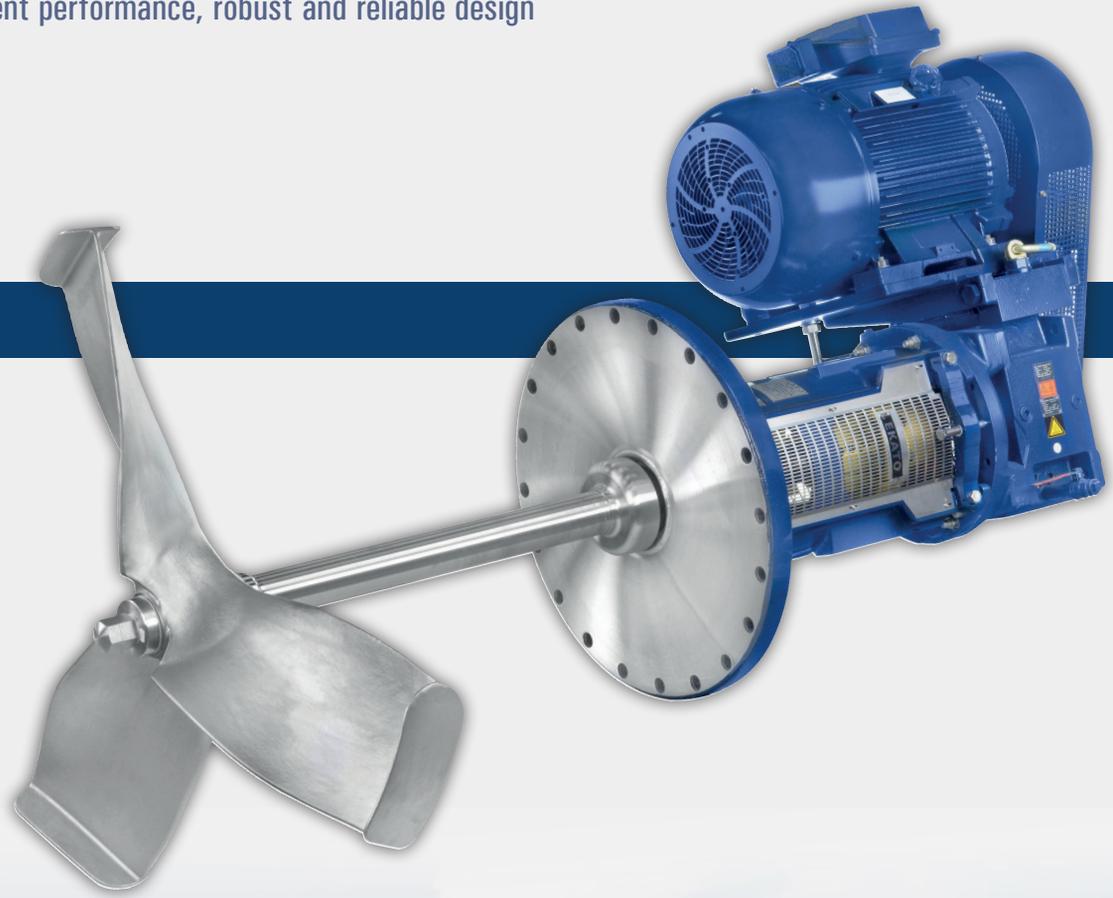


EKATO

EKATO FGD AGITATORS

EKATO Agitators for Flue Gas Desulfurization

Highly efficient performance, robust and reliable design



Advanced Process Solutions



EKATO the world market leader in mixing technology

Since 1933 EKATO is successfully designing and manufacturing industrial agitators utilized in all process-oriented industries. More than 250,000 agitators are operating worldwide in various industrial applications.

EKATO has been family-owned since its founding in 1933 and is represented worldwide with subsidiaries in Europe, Asia, Australia, South America, South Africa and the USA as well as a network of trading partners.

In the ultramodern research and development center at EKATO's headquarters, more than 1,000 m² of laboratories and testing facilities are available for analyses of customer processes. EKATO provides German engineering with the highest quality standards for manufacturing "Made in Germany".

A complete service package with database-supported spare parts and maintenance management, a worldwide 24-hour service hotline and comprehensive service range that covers start-up, modification and modernization up to process optimization complete the offer.



EKATO in FGD plants since 1979

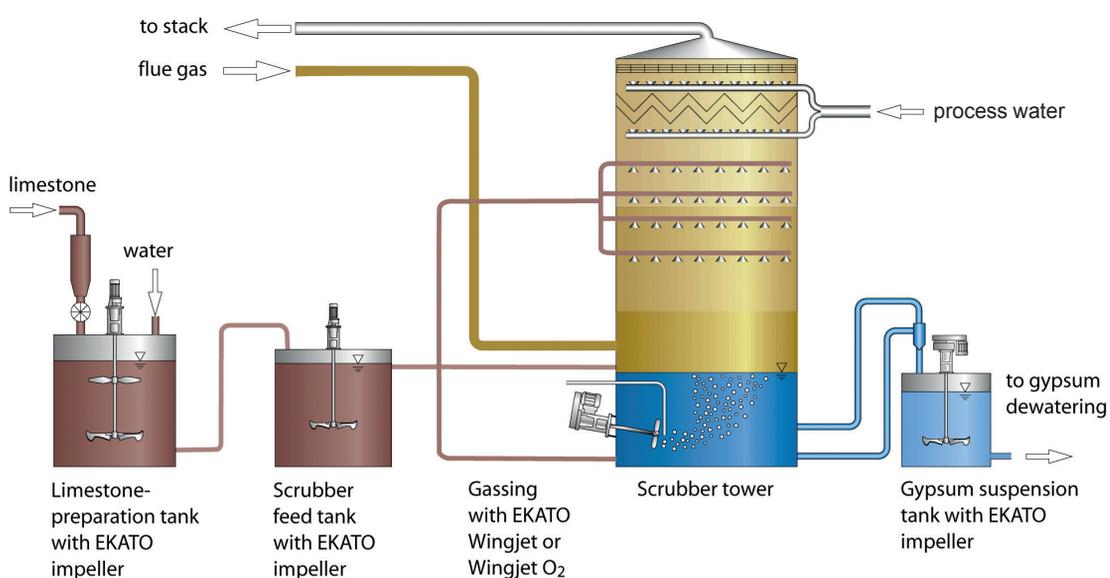
Since 1979, when the FGD market rose in Europe and the USA due to more stringent emission limits, EKATO equips coal fired power plants with agitators specifically designed for the extreme demands on the equipment and set the benchmark for today's used technology. With more than 12,000 agitators sold worldwide, EKATO is the No.1 agitator supplier in this market.

During the first years of the 1980s, the absorber tower of an FGD plant was generally equipped with a sparger grid to inject the oxidation air into the process. The little outlets of the pipes were easily plugged by the solids and led to significant investment, repair and maintenance costs.

Under this aspect EKATO developed in 1983, with numerous lab tests up to operational scale, the agitator gassing system with the oxidation-air lance placed in front of the impeller. With this new development EKATO set the first benchmark on the FGD market. Nowadays more than 90% of all modern FGD plants worldwide are using this kind of agitator lance system.

One other big challenge in the FGD process is the high abrasion on the impeller blades forced by high solid concentration and flue ash. Extending the lifetime was the goal for developing the EKATO WINGJET impeller. In 1994, EKATO discovered the innovative approach in the aircraft construction. At the wingtips of modern jets, you will find a so called winglet. Inspired by that, the EKATO WINGJET has a winglet at each blade which suppresses the vortex created by the pressure compensation at the blade tips, the main reason for abrasion.

This impeller design still remains the benchmark for today's FGD agitators.



Simplified process flowchart of a wet absorption plant with a dual-circuit absorber

The process

More than 90% of all desulfurization plants worldwide are using the wet desulfurization process, because of the absorbents lime and ammonia availability and the fact that the product of the wet process can be further utilized or easily disposed.

The sulfur dioxide (SO_2) contained in the flue gas is absorbed chemically in an aqueous washing suspension of limestone (CaCO_3), quicklime (CaO) or slaked lime (Ca(OH)_2) and afterwards oxidized with atmospheric oxygen O_2 in a series of steps to produce gypsum (CaSO_4).

Agitation technology

Vertical (top entry) agitators are mainly used for suspending the solids during the preparation stage of limestone and for dewatering the gypsum. A number of horizontally mounted (side entry) agitators are generally operating at the absorber tower. The structural conditions of an absorber tower mostly limit the installation of vertical (top entry) agitators.

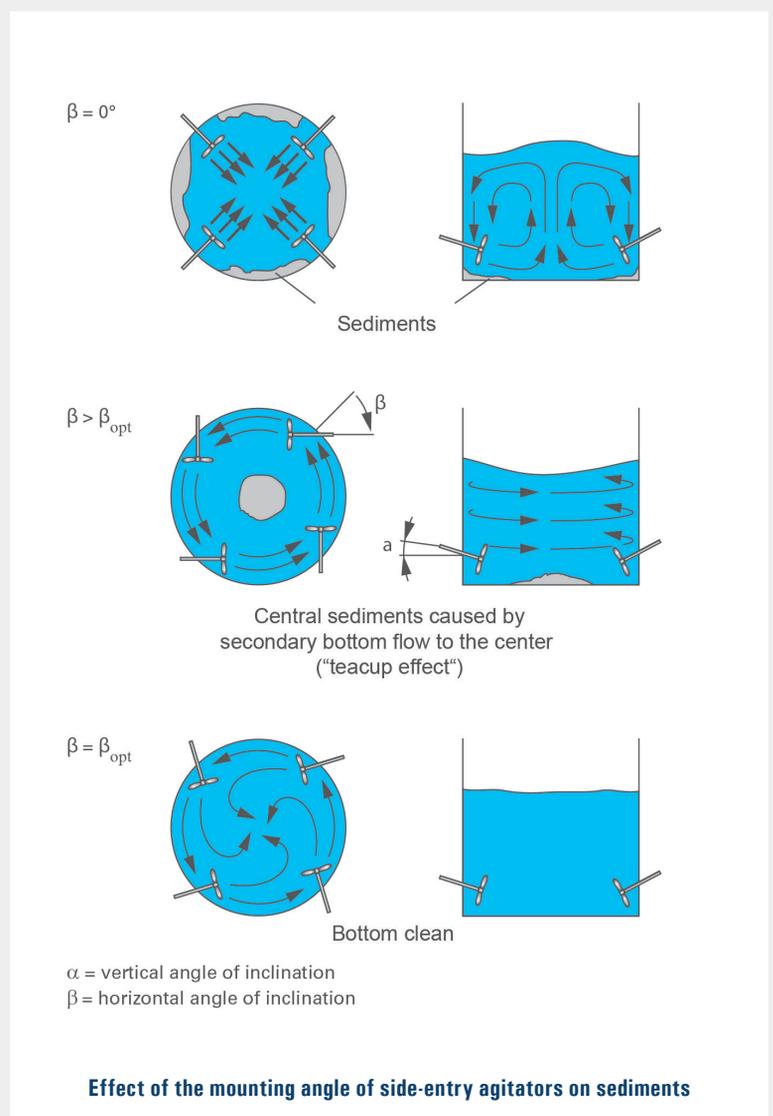
Suspension

The horizontally mounted agitators installed around the absorber tower will maintain a complete and reliable off-bottom suspension. Any sedimentations inside the absorber sump formed by gypsum particles have to be avoided to achieve a continuous operation of the absorber tower without any interruptions.

This will be achieved by optimal angular adjustments, both vertically (α) and laterally (β), plus strategic placement of the agitators around the absorber.

Without the correct angle adjustment and too much distance between the agitators, sediments can occur in the center of the vessel or on the vessel wall which can lead to plugging of the pump nozzles. The ideal angle adjustment depends on the scale.

Based on numerous CFD (computational fluid dynamics) studies, lab tests in our modern R&D center and proven in more than 1,500 FGD plants, we have the know-how to calculate and provide the right agitator setup for each absorber, to prevent the solids building sediments and guarantee a reliable operation.



EKATO's highly advanced R&D center

In our over 1,000 m² Research & Development Center we offer services for lab and pilot tests, the scale-up to production scale and flow simulation (CFD) for design basis and process optimizations.

The basic engineering for the main components, of agitators and complete vessels (with nozzles, baffles, gas-pipes etc.) is based on state-of-the-art tools like the Finite Element Analysis (FEA).

[FGD lab-absorber in EKATO's R&D center >](#)



Gassing

The agitator lance gassing system developed by EKATO represents a substantial optimization compared to crossed-pipe gassing. This system consists of one air lance placed within the jet stream created by the impeller to insert the oxidation air. The air gets dispersed into fine bubbles by the high flow velocities of the impeller. These air bubbles are distributed over the entire cross section of the vessel. This EKATO agitator lance gassing system soon became the standard in wet limestone FGD processes as it offers great advantages.

Advantages of the EKATO agitator lance gassing system:

- **Highly efficient oxygen mass transfer** which reduces the amount of oxidation air required by up to 30% compared to sparge grid gassing systems. The fine bubbles which are produced by the high flow velocities, have an extremely large aggregate surface area, creating a much more efficient oxygen mass transfer than a bubble column with large bubbles.
- **Long bubble residence time:** Most of the sparge grid gassing systems insert the air at a level above the agitators. The EKATO agitator lance gassing system inserts and distributes the oxidation air at a much lower level. Better coverage over the entire cross section of the vessel and an extended residence time due to the smaller bubbles enhance the oxygen utilization.
- **Minimum installation costs** thanks to significantly less piping in the vessel.
- **No risk of clogging:** The large pipe openings are very unlikely to clog up. As a result constant efficiency of the oxidation air dispersion in continuous operation as well as lower maintenance costs are achieved.



Agitator design

The agitators are designed and manufactured for fatigue strength, based on rated motor power and maximum dynamic loads. The reliability of these agitators is proven by over 1,500 FGD plants, under the severe process conditions in long term operation.

EKATO HWL-N side entry agitators

The most common agitator for absorber tanks worldwide with reliable V-belt drive that guarantees a smooth operation. Motor powers up to 90 kW are available for small and large absorber tanks $> \varnothing 25$ m

The unique CFD optimized impeller blade geometry offers following advantages:

- Maximized efficiency
- Bundled axial flow & increased pumping capacity
- Winglets suppressing the tip vortex for reduced impact corrosion

The EKATO WINGJET is constructed of highly corrosive and abrasive resistant Super Duplex materials that enable longer operational life and reduced maintenance costs.

1 EKATO WINGJET

This impeller with an integrated wear resistance has been specially developed for the use in absorbers of flue gas desulfurization plants. Available in diameters: 800 – 2000 mm

2 EKATO shut-off device

The shut-off device guarantees servicing or even replacing the mechanical seal during normal operation conditions and without emptying the absorber tower.

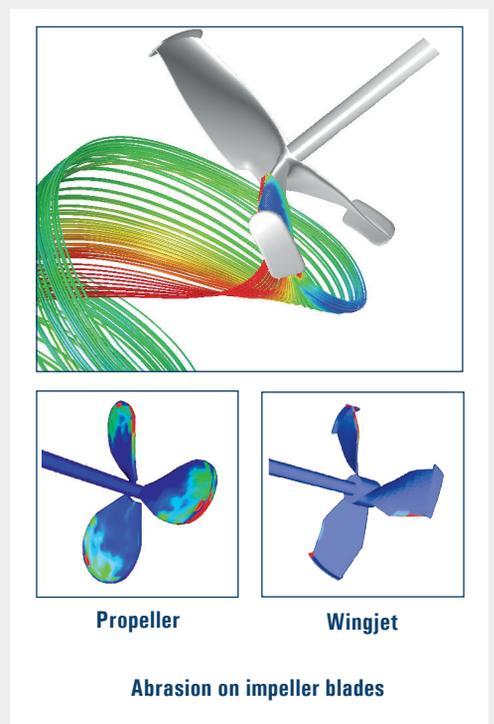
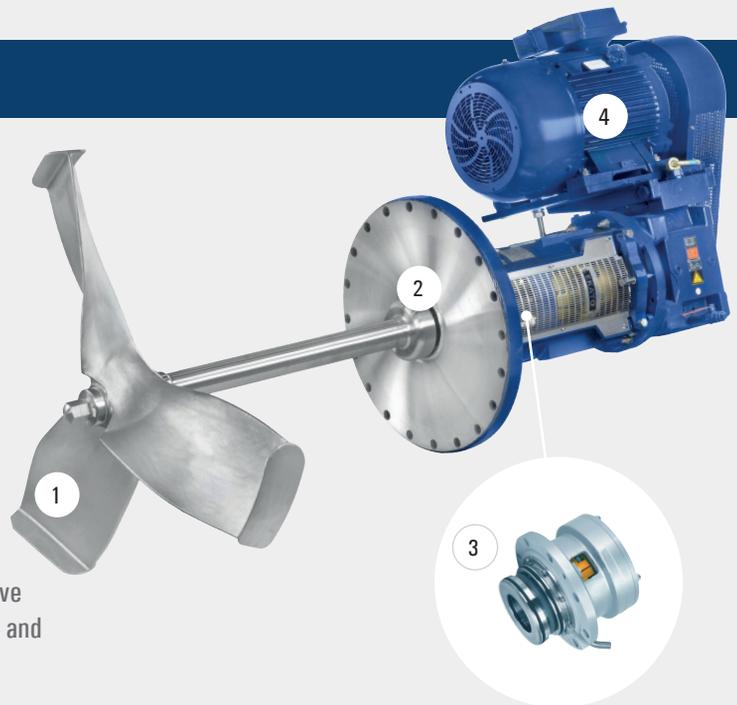
3 EKATO ESD 42L

This single-acting product lubricated mechanical seal is particularly designed for the FGD application with highly abrasive and corrosive products providing long lifetime and easy maintenance on-site.

4 Agitator drive

Our agitators are driven by strong and reliable drive units customized for this application. Depending on the requirements the following drive systems can be offered:

- Industrial gearboxes with reinforced bearings
- V-belt drives
- Bevel gearboxes



Quality "Made in Germany"

In addition to decades of expertise in FGD processes, EKATO provides an optimum mechanical design, the highest quality standards for manufacturing "Made in Germany", a competent and flexible after sales service with rapid response as well as a certified quality management according to ISO 9001.

EKATO HWL-A top entry agitators

The agitator for small and large tanks in FGD plants, motor powers from 3 to 160 kW, shaft lengths from 1 to 20 meters.

1 Agitator drive

Industrial gearboxes designed according to the latest DIN and ISO standards to guarantee long lifetime and reduced maintenance.

2 Product wetted material

Product wetted parts supplied for FGD applications made of rubber lined carbon steel, stainless steel or nickel-based alloys.

3 EKATO shaft design

The shafts are designed for maximum hydraulic forces, bending moments and torque to ensure the most reliable operation.

4 EKATO sealed hub

A unique hub design that does not require on-site welding or rubber lining.

5 EKATO VISCOPROP

The advanced hydrofoil impeller with excellent axial flow velocities provides best solid suspension even at high solid concentrations, no matter if off-bottom or homogeneous suspension is required.

Features:

- Single/multistage arrangement
- Two- or four-bladed impellers
- Variable blade angles
- Diameters up to 6,500 mm



Worldwide over 12,000 EKATO agitators prove their reliability every day in more than 1,500 flue gas desulfurization plants. As the world market leader EKATO set the benchmark in nowadays state-of-the-art FGD agitator systems.

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- More than 80 Years of Experience
- High Developed and Proven Equipment
- Reduction of Power Consumption
- Highest Equipment and Process Availability

You 



Side Entry Agitators
for FGD Absorbers



EKATO VISCOPROP
2-bladed



EKATO VISCOPROP
4-bladed



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