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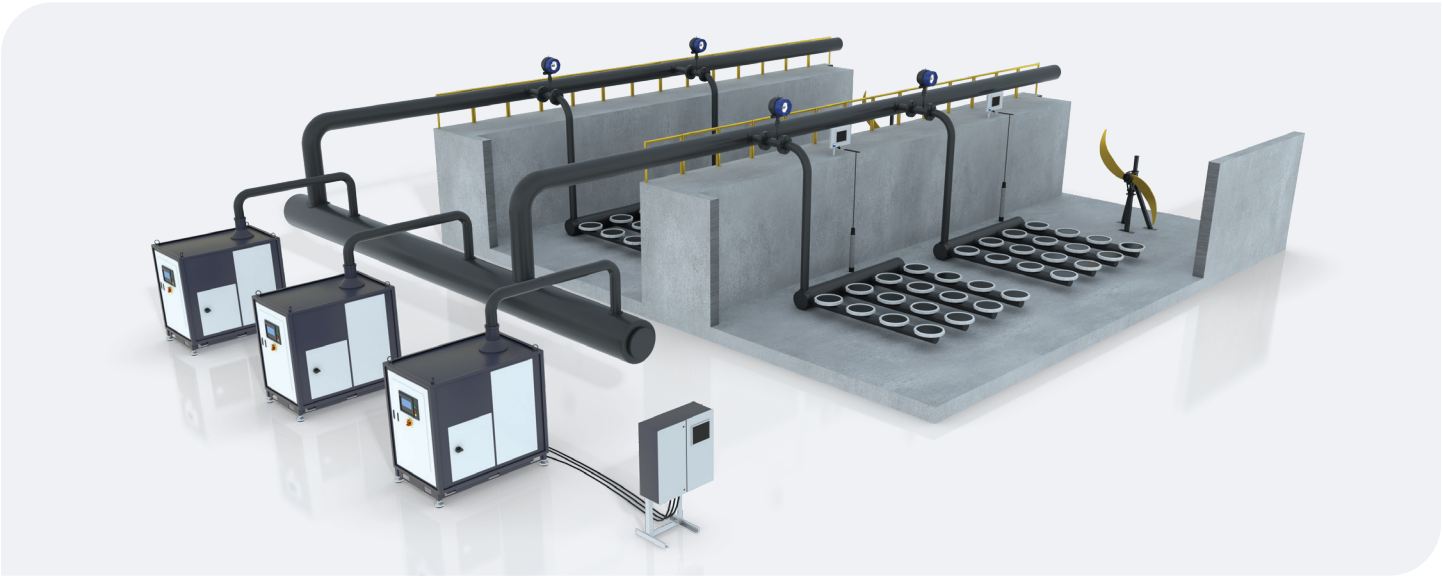
White paper
Blower efficiency

Honest efficiency ratings for blowers



Aeration is the heart of biological wastewater treatment systems. Blowers, diffused aeration and mixers work in sync to deliver oxygen and optimize biological nutrient removal.

The European Union's Revised Urban Wastewater Treatment Directive went into effect at the beginning of 2025. Among the stricter nutrient removal standards and micropollutants rules are also ambitious energy neutrality goals. More specifically, wastewater treatment plants serving a population equivalent of 10,000 people and above must ultimately reach 100% energy neutrality by December 2045.

The latest Directive puts Europe's over 30,000 wastewater treatment plants[1] in the market for renewable energy opportunities over the next two decades, such as biogas and heat capture. However, renewable energy can be difficult to source, expensive, and inconsistent based on climate conditions. For energy neutrality to be feasible, European utilities are considering how to minimize their plants' energy consumption. The less energy it takes to operate a plant, the more attainable the 20%, 50%, 70% and 100% energy neutrality milestones become.

A survey of wastewater treatment equipment quickly reveals what wastewater professionals already know: aeration accounts for 50 to 70% of wastewater treatment facility energy consumption. To meet the 2045 energy neutrality deadline, European wastewater utilities will be working to make their aeration as efficient as possible through technology, operations optimisation, and the latest industry blower efficiency standards.

Aeration is the heart of biological wastewater treatment. The dissolved oxygen that blowers deliver to aeration tanks enables a host of bacteria to convert ammonia into nitrate and by a combination of aerobic and anoxic zones can be denitrified, in order to remove organic pollutants and nutrients in the sewage to stop eutrophication in receiving waters. Because treatment performance is so dependent on bacteria "breathing", blowers are a global staple at nutrient removal wastewater treatment plants.

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Stuck in the past

Historically, positive displacement (PD) blowers have been the technology of choice to deliver air to aeration basins. However, low pressure, high efficiency turbo blowers and package systems have entered the market over the past decade, reducing overall facility energy use up to 40%. Currently, ISO standards 1217 for PD blowers and 5389 for centrifugal blowers are used by engineers and utilities alike to determine blower energy efficiency. But these standards are not designed to assess the newest generation of aeration technology and don't allow users to compare blower manufacturers during the decision-making process.

In addition, these older standards rate motors at their full load efficiency, applying it across the operating spectrum. Standards 1217 and 5389 neglect to consider the impact that partial energy loading, Variable Frequency Drive (VFD) losses, and system level losses have on system efficiency. These legacy standards ultimately mislead utilities on the operational costs associated with their most energy-intensive equipment.

To address these shortcomings, the American Society of Mechanical Engineers (ASME) developed Performance Test Code (PTC) 13, a performance test for packaged blowers of positive displacement blowers and centrifugal blower types. The new ISO 22484 is built on the ASME PTC13 and is now the global test standard for all types of blowers.

Comprehensive blower efficiency standard

PTC 13 and ISO 22484 come from a demand for side-by-side performance comparisons of low-pressure positive displacement and centrifugal blowers. The standard rethinks how efficiency is rated not only regarding belts and motors, but how air enters the system. For example, ISO standards 1217 and 5389 consider inlet flow measurements when rating efficiency. This method doesn't account for internal leaks, compression losses, and system inefficiencies. ISO 22484 assesses outlet air, corrected to inlet conditions.

Turbo Blowers from Xylem's Sanitaire brand deliver an energy efficient low maintenance aeration solution for wastewater treatment applications meeting ISO 22484 standards

As part of the latest Urban Wastewater Directive's energy neutrality goal, Europe's wastewater utilities must submit an energy audit by December 2032.[2] To gain a true sense of the wire to air performance of new and existing blowers, applying ISO 22484 instead of the legacy standards will give utility leaders a more honest sense of their blowers' performance, which in turn allows them to make smarter choices about their operations.

Honest performance results

As blower technology advances, the industry efficiency standards should match it. ISO 22484 empowers European wastewater utilities to compare the energy consumption and total aeration efficiency of low-pressure PD and centrifugal blowers. Designing with an increased number of diffusers for improved oxygen transfer can also reduce the required air flow and should be integrated with the blowers to optimise the system transfer kg O2/kWh efficiency. In the end, utility customers gain more accurate expectations for their equipment and can plan budgets, projects, and tenders accordingly.

1 European Commission—Urban Wastewater
2 European Union—Wastewater Directive

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