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Movement by Perfection

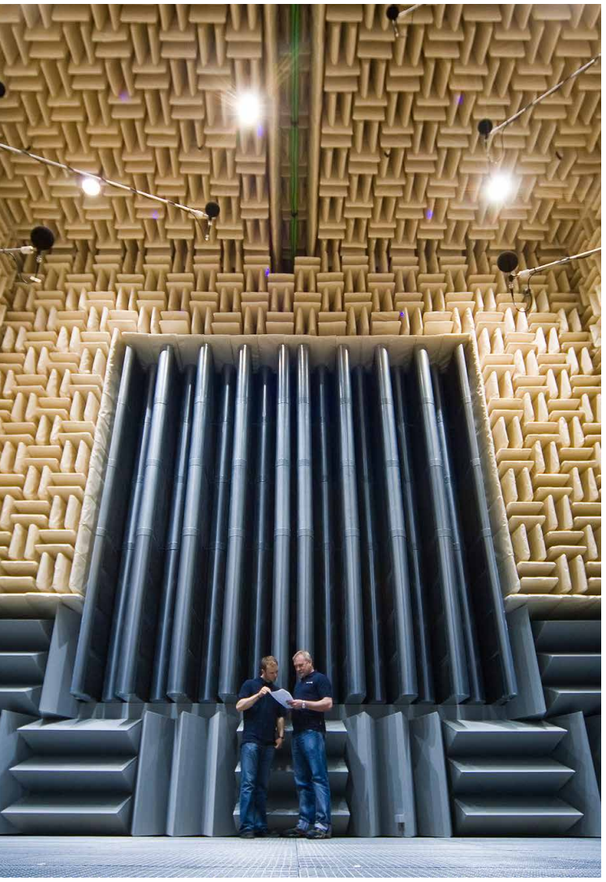
**Ventilation,** control and drive technology

# FAN360° Performance

A Guide to Standards, Efficiency, and Retrofit Solutions

ZIEHL-ABEGG

# How **Product Certifications** secure market leadership



*World's largest test rig for fans in the Technology Centre in Künzelsau, Baden-Württemberg, Germany*

Third-party certifications provide customers with greater confidence in a product's performance, quality, and reliability. They serve as an objective assurance that the product meets recognized industry standards.

## Different Levels of Certification across the Product Lifecycle

**Test Rigs – Regular Certification**
(AHU manufacturer associations, Eurovent, AMCA, VDE, etc.)

- Ensure that products are measured correctly in terms of air performance, electrical data, and acoustic characteristics.
- Multiple test rigs are often required, as a single rig cannot cover a wide range of air performance accurately across all classes.

**Fan Selection Software – Regular Certification**
(AHU manufacturer associations, Eurovent, AMCA, VDE, etc.)

- Ensures that fan performance calculations are accurate and reliable.
- The highest standard is "wire-to-air" certified calculation, reflecting real operational efficiency.
- Each fan series must be certified individually to account for specific aerodynamic and electrical characteristics.

**Production Processes – Regular Certification**
(ISO standards, AHU manufacturer associations, AMCA, etc.)

- Guarantees consistent manufacturing quality and safe production processes, ensuring long-term product reliability and performance stability.



## Fan Aerodynamic Measurement Methods (According to **ISO 5801**)

Aerodynamically, fans can be measured in different ways, as described in **ISO 5801.** The standard defines several measurement types depending on the inlet and outlet conditions of the fan.

## Types of Fan Measurements

**Type A – Free Inlet and Free Outlet**
Applicable to all fan types. Efficiency is calculated based solely on the static pressure increase, representing the basic air performance of the fan.

**Type B – Free Inlet and Ducted Outlet**
The outlet duct has the same cross-section as the fan housing. This configuration is commonly used for scroll housing fans, as it allows efficiency to be calculated using total pressure on the discharge side, often resulting in a higher efficiency value.

**Type C – Ducted Inlet and Free Outlet**
The inlet duct matches the fan housing cross-section. This setup is less common and typically used only for special axial fans.

**Type D – Ducted Inlet and Ducted Outlet**
Both inlet and outlet have the same cross-section as the fan housing. This type is frequently used for axial fans, especially high-pressure models where the discharge air velocity is high, leading to a higher total pressure increase and improved total efficiency.

**Why is wire to air performance data important?**

Wire-to-air performance data are important because they show the total efficiency of a fan system — from the electrical power input (wire) to the actual air performance output (airflow and pressure).

Wire-to-Air gives a true picture of energy consumption, which is crucial for system designers and end-users focused on total operating cost.

Shaft-to-Air is ideal for fan-to-fan comparisons, but it does not reflect motor or drive losses, so it can be misleading if used alone.

# Why multiple EC Fans deliver better results

**Better real-world (wire-to-air) efficiency across operating range.** EC fans combine motor + electronics optimized for the fan — they keep efficiency high at partial speeds, whereas a single AC motor + VFD often loses some efficiency at low speeds and through VFD + motor losses.

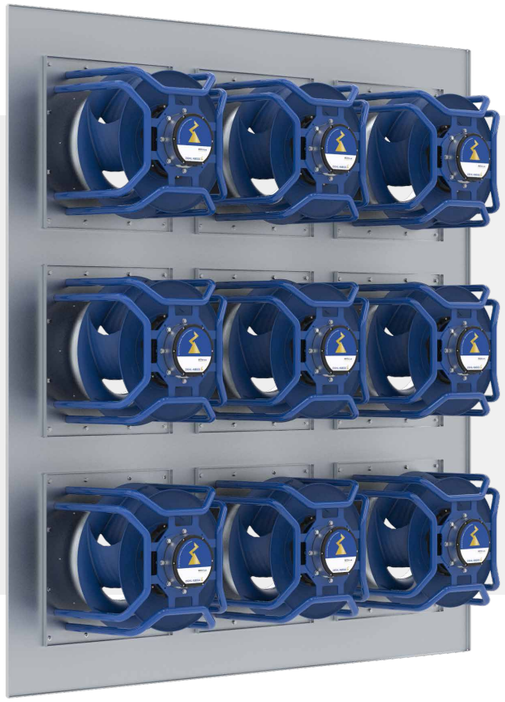
**Wider, smoother turndown with good efficiency.** You can stage fans (1,2,3...) and also vary each EC fan's speed to match loads with fine granularity — giving very efficient performance from low to high loads.

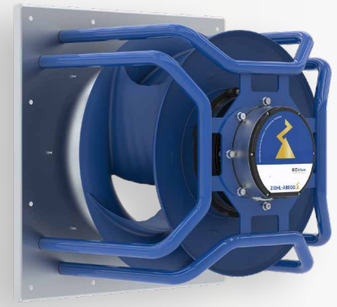
**Built-in redundancy/reliability.** If one fan fails, the AHU can still operate (reduced capacity) — critical for comfort/critical spaces. If the unit is powered by only one fan and this fan fails, than the unit deliveres zero air volume.

**Better adaptation to real operating conditions.** A fan wall with multiple EC fans can efficiently compensate for changes in system resistance over time. By adjusting the fan speed, the system maintains the required airflow while delivering consistent and energy-efficient performance.

**Improved part-load noise control.** Running several fans at moderate speed can sometimes be quieter than running one oversized fan at low speed — depends on fan selection and acoustics.

**Smaller mechanical footprint and easier handling.** Smaller fans are easier to install/replace; often fewer structural changes required.





# Flexibility in AHU Retrofit: Multiple EC Fans

In most AHU retrofit and variable-load AHU applications, multiple smaller EC fans are usually better than one single fan with a VFD – but it depends on priorities (efficiency, turndown, redundancy, space, cost, sound).

**Why Flexibility matters in Retrofit?**

- Limited space & difficult access
- Existing ducting and structural constraints
- Need for minimal downtime
- Energy performance improvement
- Integration with existing controls



## True flexibility for any Application

### Why can the real duty point differ from the design point?

Even if a fan is perfectly selected on paper, the actual operating point (airflow and static pressure) can differ from the design duty point due to several real-world factors:

### 1. System resistance deviation

- The calculated pressure drop of ductwork, filters, coils, and dampers is often based on estimates or clean conditions.
- In reality, installation variances, bends, leakages, and additional fittings can increase or decrease total pressure loss.
- As a result, the system curve shifts, moving the fan's operating point along its performance curve.

### 2. Air density and environmental conditions

- Fan performance depends on air density (which changes with temperature, altitude, or humidity).
- A fan designed for standard air (1.2 kg/m³ at 20°C) will perform differently in hot or humid environments.

### 3. Control system or speed setting differences

- Incorrect VFD settings, EC fan control signals, or system balancing may cause fans to run at speeds other than the design intent.

### 4. System aging and operational conditions

- Over time, filters clog, coils foul, or ducts leak, changing the static pressure profile. The fan's performance then drifts away from the original design point.

**More information** about our Retrofit Solutions.



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