

RETROFIT SOLUTIONS

Energy optimisation in ventilation systems: comparison between BOX BV and ENKELFAN EEC

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WHAT IS RETROFIT?

In the context of ventilation systems, retrofit refers to the modernisation or upgrading of existing equipment by incorporating more efficient and advanced technology, such as fans with electronic or EC motors. This process enhances energy performance, reduces operating costs, and ensures compliance with stricter environmental regulations without the need to replace the entire system, offering a **cost-effective and sustainable** solution.

INTEGRATING EC PLUG FANS

Plug fans, such as the ENKELFAN EEC from Casals, feature a compact design and high-efficiency electronic motors, making them an ideal choice for retrofit projects

Key benefits:

- ° Full control to adapt to different operational needs.
- ° Compliance with ErP 2026 ecodesign requirements.
- bility to configure in parallel grids, achieving higher efficiency and performance.

Integrating fans like the ENKELFAN EEC in retrofit projects not only modernises old systems but also provides versatility for applications such as **air handling units (AHUs)**, **air purifiers, filtration systems, and more**.

TRANSMISSION FANS VS. DIRECT DRIVEN EC MOTOR FANS

In the past, systems like the BOX BV, a belt-driven centrifugal fan, were the standard solution in air handling units (AHUs). However, newer, more advanced technologies have emerged, such as ENKELFAN EEC fans, which feature direct drive with electronic motors.

KEY DIFFERENCES

Below are the key differences between a transmission-driven fan and a direct-drive fan with an electronic motor:

1. Energy efficiency

- Belt driven fans (BOX BV):
- Traditional motors with lower efficiency and higher energy consumption.
- Additional energy losses due to belt friction, which can be around 8%.
- Direct driven EC motors (ENKELFAN EEC):
- • High-performance electronic motors (EC) with precise speed control.
- Significant reduction in energy consumption, compliant with **ErP 2026 regulations**.

2. Maintenance

- Belt driven fans (BOX BV):
- Belts wear out over time and require periodic maintenance and replacement.
- Limited accessibility and complex manoeuvrability due to larger equipment size.
- Direct driven EC motors (ENKELFAN EEC):
- Designed for reduced maintenance due to direct drive.
- Elimination of belts and pulleys, reducing failure points and particle generation.
- Compact design simplifies installation, manoeuvrability, and replacement.
- · Easy maneuverability without loss of efficiency.

3. Sustainability and environmental savings

- Belt driven fans (BOX BV):
- Higher energy consumption and greater CO₂ emissions.
 Direct driven EC motors (ENKELFAN EEC):
- Help reduce **emissions** and comply with current and future energy efficiency standards.
- Lower environmental footprint and reduced lifecycle impact.







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CASE STUDIES

Below are two practical case studies demonstrating how retrofitting with plug fans improves energy efficiency and operational performance in very different ventilation applications—from the pharmaceutical industry to data centres, where transmission-driven fans were previously the go-to solution. In both cases, **energy consumption was reduced by 30-35%**, **leading to an efficiency improvement of nearly 50%**.

Ventilation in a pharmaceutical production plant



Application

In a pharmaceutical manufacturing plant, ventilation is critical to ensuring air quality in clean rooms. The climate control system originally used a BOX BV fan in an air handling unit (AHU), which supplied filtered air at a controlled flow rate and pressure to maintain stable temperature and humidity conditions.

Problem

The BOX BV fan had high energy consumption and operated at a constant speed, preventing efficient adaptation to variations in thermal load and room occupancy.

Solution: Retrofit with ENKELFAN EEC

- The BOX BV fan was replaced with 4 units of ENKELFAN EEC plug fans, achieving:
- 30% energy consumption reduction due to speed modulation based on demand.
- [°] Better airflow control and improved distribution within the system.
- Lower maintenance requirements, as plug fans do not use belts or pulleys.

Operating point values

- ° Maximum **air-flow**: 8.400 m³/h
- Required static pressure: 400 Pa

BOX BV 15/15 4kW 1050rpm data

- ° Max air-flow.: 8.694 m³/h
- ° Static pressure: 428 Pa
- * Absorbed power: 2,91 kW

Retrofit with 4x ENKELFAN 310 EEC data

- ° Max air-flow: 8.432 m³/h (-3,01% vs BOX BV)
- ° Static pressure: 403 Pa (-5,84% vs BOX BV)
- Absorbed power: 1,96 kW (-32,65% vs BOX BV)

Energy consumption reduction calculation:

$$\frac{2,91-1,96}{2,91}$$
 x 100 = 32,65%

Energy consumption reduced by 32,65% with ENKELFAN EEC retrofit

Efficiency improvement calculation:

 $\frac{2,91}{1.96}$ = 1,48

The retrofit system is 48.47% more efficient than the BOX BV fan.



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Ventilation in data centre server rooms



Application

A data centre requires an efficient ventilation system to dissipate the heat generated by the servers. Initially, the system used a BOX BV fan in an AHU, providing constant airflow to maintain the optimal temperature within the server rooms.

Problem

The system was inefficient because the fan always operated at full capacity, with no ability to adjust according to real thermal load, leading to higher energy costs and unnecessary cooling during low-demand periods.

Solution: Retrofit with ENKELFAN EEC

The BOX BV fan was replaced with 4 units of ENKELFAN EEC plug fans, achieving:

- ° **35% reduction in energy consumption**, as the fans adjust speed based on temperature and server load.
- Extended lifespan of equipment, preventing overcooling and reducing strain on climate control systems.

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Operating point values

- ° Maximum **air-flow**: 18.000 m³/h
- Required **static pressure**: 400 Pa

BOX BV 22/22 11kW 670rpm data

- ° Max air-flow: 18.435 m³/h
- ° Static pressure: 419 Pa
- ° Absorbed power: 5,7 kW

Retrofit with 4x ENKELFAN 310 EEC data

- Max air-flow: 18.136 m³/h (-1,62% vs BOX BV)
- Static pressure: 403 Pa (-3,82% vs BOX BV)
- Absorbed power: 3,88 kW (-3,93% vs BOX BV)

Energy consumption reduction calculation:

Energy consumption reduced by 31,93% with ENKELFAN EEC retrofit.

Efficiency improvement calculation:

$$\frac{5,7}{3.88}$$
 = 1,46

The retrofit system is 46,91% more efficient than the BOX BV fan.



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BOX BV



BOX BV 7/7-18/18



BOX BV 20/20-30/28



Serie BOX BV

- [°] Belt driven centrifugal fan in soundproof cabinet
- ° Sizes: 7/7 30/28
- ° Air-flow: 3.170 54.010 m³/h

ENKELFAN EEC



ENKELFAN 155-190 **EEC**



ENKELFAN 250-450 EEC



Air-flow: 460 - 18.600 m³/h



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