Smart EC fans withstand harsh environmental conditions

Team Players for Efficient Cooling Towers

Energy efficiency requirements for cooling towers for data centers, hospitals, hotels, office complexes and other industrial buildings have become more rigorous. In this context, the fans used in the towers, which are main components, play a key role. If modern EC motors are used in cooling towers instead of conventional AC technology, energy consumption and operating costs can be significantly reduced. It pays to convert to EC technology for other reasons as well. The EC fans from ebm-papst feature infinitely adjustable speed control, can be interconnected and withstand harsh environmental conditions.

FIGURE 1: **In cooling towers, fans are responsible for efficiently dissipating heat to the environment; in particular, heat generated when a process, system or building is cooled using water.**

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Fans in cooling towers are responsible for efficiently dissipating heat to the environment; in particular, heat generated when a process, system or building is cooled using water (Fig. 1, p. 5). At the same time, the fans that are used must be extremely rugged because they have to withstand high humidity levels, various environmental influences and rapid changes in temperature. And last but not least, they must be as quiet as possible – particularly if the cooling towers are located near residential areas or mixed-use zones.

More fans, more benefits

With conventionally structured cooling towers, it is becoming more and more difficult to satisfy these requirements completely. In order to generate high air flow, very large fans are typically used. They are driven by transmissions or belts from an AC motor. Due to the weight of the large single fans, they have a solid design and cannot be installed until they reach the construction site. This makes it virtually impossible to precisely balance the rotating impeller, which frequently leads to premature failures in operation. Such fans often run in two-phase, star/delta or on/off operation. In addition, the corners of the cooling tower do not have uniform through-flow and the towers also end up being very high because to achieve even through-flow, there must be a large space between the fan and the heat exchanger nozzles. The ebm-papst approach includes replacing the large fan with several smaller fans running in parallel operation (a FanGrid), which translates into several benefits in practice.

The individual fans can be stacked or arranged in rows to use the available space to maximum advantage (Fig. 2). Due to the fans' small diameters, cooling towers can be built more compactly and depending on the floor space, have a rectangular or square cross-section. Smaller fans are easier to handle than one large fan. The latter benefit makes transport and installation easier, but is also a major advantage when replacing the fans. And until a fan is replaced, the cooling tower

Several smaller fans provide benefits: flexibly arranged for a compact design and consistant air distribution.

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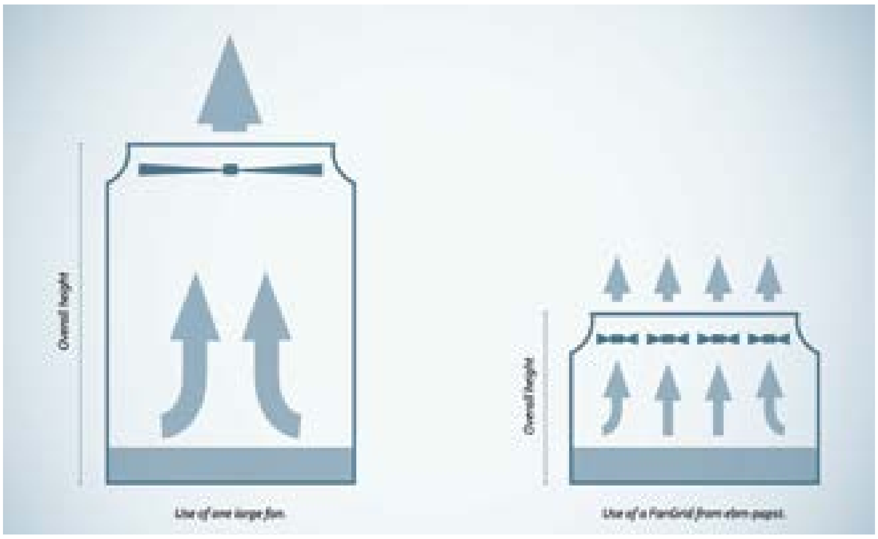

FIGURE 2: **Several smaller fans provide benefits: they can be flexibly arranged next to each other and the intake-side distance can be reduced, enabling a more compact design.**

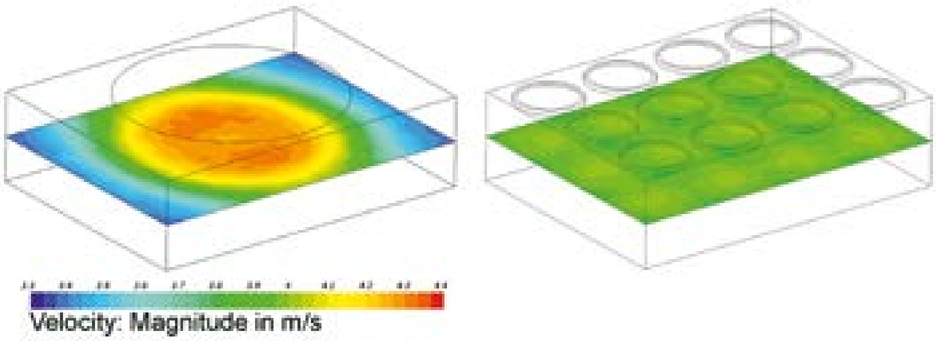

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FIGURE 3: **Air flow comparison: The air distribution in a FanGrid (right) is much more even; all components receive a more uniform flow-through.**

can operate normally. The speed of the other fans is simply adjusted to maintain constant air performance. During the design process, the relevant redundancy requirements can be taken into account. In addition, the air distribution is much more even when several fans are used (Fig. 3). Flow-through is more uniform for all components and disadvantageous dead zone are reduced.

Today, the benefits of a FanGrid can be leveraged in a wide range of applications. Motor and fan specialist ebm-papst provides FanGrid fans for cooling towers in axial or centrifugal design, for example (see Fig. 4, p. 8). This means that different requirements for pressure increase and air flow can be satisfied. Axial fans show their strengths when high air flow and moderate pressure increase are required: for inlet operation, for example. Centrifugal fans are designed for high back pressure and are recommended for pressure operation. A wide range of sizes with a variety of diameters is also available.

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FIGURE 4: **FanGrid fans for cooling tower applications come in either axial or centrifugal design.**

ebm-papst FanSout is a flexible selection tool helping to find the optimal combination of fans.

ebm-papst has a flexible selection tool to help customers find the optimal combination of fans for a wide range of applications: the ebm-papst FanScout (Fig. 5). Based on up to five application-specific operating points and the anticipated operating times, this software determines the most efficient FanGrid solution. The amount of installation space available, maximum number of fans required and redundancy requirements can also be taken into account. And there is also an option to determine the life cycle costs of the best combination. In this way, users receive a reliable, robust cost breakdown upon which they can base their investment and modernization decisions.

EC technology: energy efficient and quiet

The driving force behind cooling tower fans are modern GreenTech EC drives that function highly energy efficiently in full and partial-load operation, are designed for long service lives and feature infinitely variable speed control. This ensures a constant air performance under all conditions. With over 90% efficiency, the motors deliver much more than the values required in efficiency class IE4. The flow machine design also contributes to increased efficiency and quiet operation. Problems due to noise protection regulations are a thing of the past.

An example application shows that the energy savings pay in practice. Instead of one large fan with a diameter of 2,100 mm, four axial fans with a diameter of 910 mm each were installed in a cooling tower to generate the same air flow of 87,040 m^3/h at a static pressure of 100 Pa. This enabled power consumption to drop from 7.8 kW to just under 5.3 kW (four times 1.32 kW). In total, the retrofit meant annual energy savings of almost 22,000 kWh for the operator. For rotation monitoring, the fans can be continuously monitored via an ebm-papst cloud connection. In the process, internal measured values such as speed, motor temperature

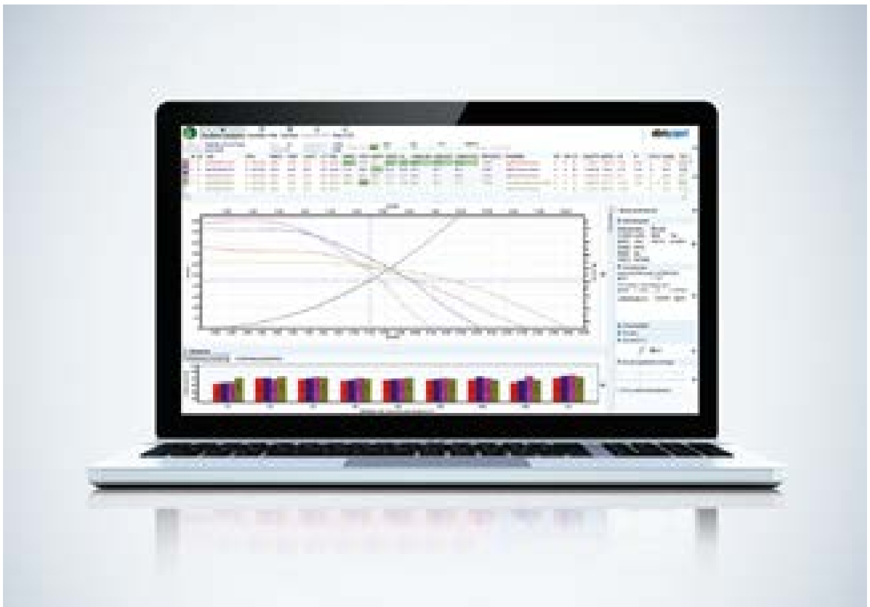

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FIGURE 5: **ebm-papst has a flexible selection tool to help customers find their optimal combination of fans: the ebm-papst FanScout. FanScout.**

and vibration values are read out and transmitted to the ebm-papst cloud. Users always have an eye on the FanGrid fans and if necessary, can plan preventive maintenance on their cooling towers.

Successfully tested under extreme conditions

To withstand the high humidity and rapid changes in temperature common for use in cooling towers, the fans have extremely rugged designs. All components are protected by special coatings. The fan series have proven their resistance under extreme test conditions. Salt spray tests, vibration and shock tests, and proprietary corrosion and moisture tests were used for qualification. ebm-papst created a custom environmental classification, H2+C, for its tests. And ebm-papst EC fans have reliably performed their function in cooling towers for years. O

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