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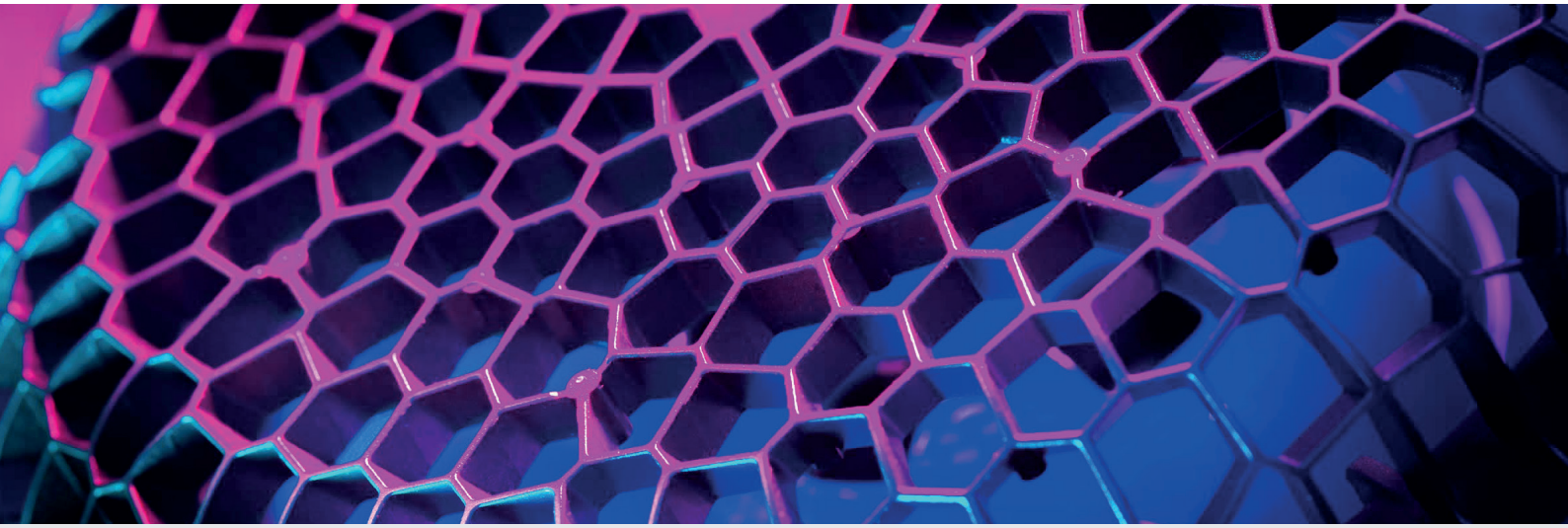
Movement by Perfection



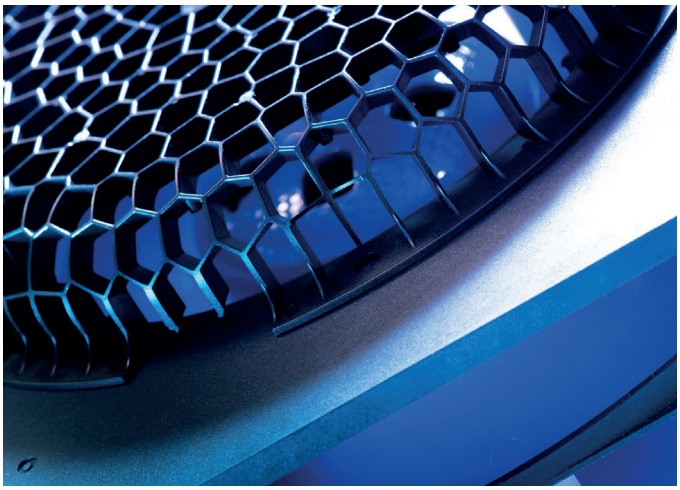
The Royal League in ventilation, control and drive technology

Technical report

ZAflow fans do not have to be loud

ZIEHL-ABEGG

ZAflow - Fans do not have to be loud



The new ventilation system is installed, works reliably and creates a healthy room climate. But unfortunately, too much noise from the fan clouds the positive overall impression of the installed system.

Why is a fan noisy?

When used in ventilation, air conditioning or refrigeration technology, the built-in fan sometimes does not run as quietly as expected. Why does a quiet fan suddenly become noisy when installed? What is the reason for this and what are the possible solutions? In principle, small ventilation devices are more problematic than large devices when it comes to acoustics. These are usually installed near the rooms in which people are present, for example, in residential buildings, hotels or conference rooms. Here, noises are quickly perceived as annoying. Turbulence and unstable flow situations can lead to clearly perceptible droning, pumping or pipe noises and disturb people's well-being.

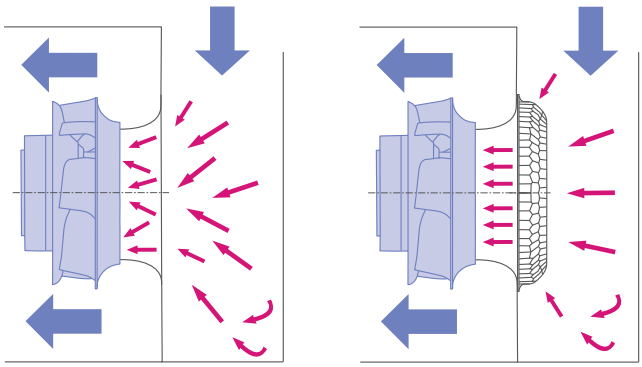


Figure 1 - Flow behaviour on the impeller, without and with ZAflow

Noise problems arise from compromises in the installation situation

Noises are mainly caused by **failures in the guiding of air to the fan impeller.** In principle, the suction side is more critical than the turbulent pressure side of the fan. It is not always possible to position fans optimally in terms of flow. The compromise between functionality, dimensions, structural conditions and costs can lead to an unfavourable installation situation.
This results in disruptions in the flow to the fan with additional noise developments. However, the air flow is also reduced by additional components such as a heat exchanger. Therefore, the air movement to the fan can have a high level of unevenness and non-stationary components.
In simple terms, the less space in front of the impeller and the more the inlet air is deflected or disturbed by other obstacles in the air flow, the higher the noise level.

Noise insulation often doesn't bring the desired result

Reducing the noise level by means of insulation measures or silencers is time-consuming and often does not bring the desired result. Silencers are more effective at higher frequencies and only achieve a good level of effectiveness against the lower sound frequencies with their long wavelengths at larger installation lengths.
Larger or longer silencers also require more installation space and thus increase the overall costs of the system. The challenge now lies in minimising disturbing individual frequencies and the propeller noise that is perceived as particularly unpleasant in the low frequency range. To counteract this, the air movement in front of the impeller must be homogenised or “equalised”. The measures should have as little influence as possible on the air handling capacity or the input power of the drive.

The inlet guide grille, reimagined

ZIEHL-ABEGG has therefore developed an inlet guide grille for its centrifugal fan series with the brand name “ZAflow”, which can reduce noise, especially in unfavourable installation conditions.

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Honeycomb provides inspiration for the solution

Abbildung 2 - Bionic insights: ZAflow

The specialists in the developing fans, control and drive technology are known for developing their products on the basis of bionic insights. This means looking for solutions based on biological inspiration. The ZAflow inlet guide grille was based on the structure of honeycombs.
However, nature does not use this structure for flow rectification. According to scientific findings, however, this honeycomb shape offers the greatest possible capacity and a maximum amount of converted space with the lowest material consumption and highest stability at the same time. ZIEHL-ABEGG engineers adapted these findings to create a lightweight, trihexagonal prismatic grid that offers the greatest possible air conduction function with minimal obstruction of the air flow.
ZAflow is manufactured from the thermoelastic plastic POM (polyoxymethylene). It is mounted in front of the impeller and homogenises the air movement without significantly affecting the system's intake and air handling capacity.
And this improved, rectified airflow to the impeller results in a significant reduction in sound and noise levels over the entire frequency range

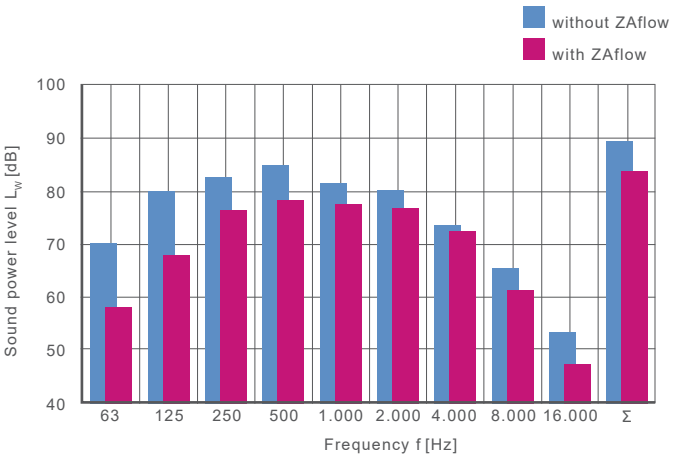

Figure 3 - Octave spectrum of the suction side of a tested system with radial supply, with and without ZAflow

Effectiveness is dependent on the installation situation

Now it is not possible to say in general whether and by how much the noise level can be reduced. In tests with typical ventilation systems, a noise reduction of 3 to 6 dB was achieved by using ZAflow.
The effect generally depends on the actual installation situation. The suction side, which is much more critical for the fan, should be designed with an undisturbed, uniform air flow in the device. If this is not possible for structural or other reasons, ZAflow can be an effective measure for noise level reduction.

Additional advantages

At the same time, the use of ZAflow can result in further advantages. If passive sound insulation measures such as insulation or silencers can be minimised due to noise reduction, the overall system can potentially be designed more compactly. In addition to improving noise levels, this also reduces the system pressure drop and improves overall system efficiency. This also makes ZAflow a cost-effective and easy-to-implement option for optimising an overall ventilation system.
In the case of newly planned systems, insulation measures can be reduced if necessary and systems can thus be implemented more compactly and more economically.

A test brings clarity

If there is an inhomogeneous inflow on the suction side, the noise level will improve after the installation of ZAflow. If the noise level does not change, the flow to the impeller is already ideal and other measures for noise reduction must be considered.
ZAflow is currently available in seven sizes and in the "S" and "M" versions. ZAflow can be used on all fan series in sizes 175 to 630 (e.g. ZAbluefin, ZAvblue, Cpro,C,...).
In addition, ZAflow in the "S" version meets the specifications for effective protection against tampering with the impeller, as the grid dimensions are correspondingly small and there is sufficient distance to the rotating fan (in accordance with DIN EN ISO 13857, Table 4). The "M" version, on the other hand, does not require contact protection. Due to the small grid dimensions, the obstruction of the air flow would become too large here.

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Conclusion

With the “ZAflow” inlet guide grille, ZIEHL-ABEGG has developed a very interesting product that should definitely be examined in more detail.

ZAflow can help to improve system acoustics in ventilation systems and reduce noise levels. Especially if there is inhomogeneous air movement on the suction side due to the installation situation.

The possibility of implementing a more compact overall system with improved system efficiency through ZAflow also brings economic advantages.

The fact that you can easily try it out without much effort is particularly interesting.

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