RETROFIT: HOW TO CHOOSE THE MOST ENERGY-EFFICIENT FAN

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Energy efficiency is at the forefront of everyone's mind, and there is major potential in optimisation of our ventilation systems. One obvious option is to retrofit existing centrifugal fans to reduce energy consumption and CO2 emissions.

Right now, many centrifugal fans face replacement or retrofit. Not only are they at the end of their lifespan, but they are simply not energy efficient enough. But which type of fan is the best and most efficient alternative? To find the answer to this, we need to look at the total fan pressure and not just the static pressure. And that requires a little explanation.

For decades it has been common to focus on static pressure in connection with fan selection. The advantage is that it is relatively straightforward to measure and correspondingly easy to select a fan that matches the desired static pressure.

But there is a significant downside. If you fail to look at the total pressure and just take the static pressure into account, it means omission to look at the overall system design. The static pressure is in other words an insufficient basis for selection of the fan. It is also important to consider the dynamic pressure, which in this instance is the velocity energy. Otherwise, you are likely to miss out on significant savings and even risk that the fan cannot deliver the airflow necessary for the system.

THE PRESSURE THAT VANISHED INTO THIN AIR

The next question to ask is: Why does the static pressure get all the attention? There are two main reasons for this. Allow me to explain.

In the 1990s, centrifugal fans, which also utilise dynamic pressure, were very common. However, after the turn of the millennium, plug fans came onto the market, and they significantly outperformed systems with centrifugal fans as they were more efficient in terms of installation, cost and performance.

The flip side of using plug fans is that the velocity energy is lost. These types of fans are without housing and are not connected to a duct system, but instead pressurise a chamber. The full energy potential of the airflow therefore vanishes.

When using plug fans, it is obvious to focus on the static pressure, given that the dynamic pressure is irrelevant as the air will not travel through the system. This is one reason why, for many years now, the focus has been on static pressure rather than total pressure.

Centrifugal fan from the 1990s characterised by relatively poor energy efficiency due to outdated technology.

NOVENCO ZerAx axial fan as of 2024 – here the supplied energy is much more optimally utilised, since the static pressure is kept, and the total pressure is increased due to the high dynamic pressure.
The space-performance ratio is relatively small, and the air volume is high.

TAKE ADVANTAGE OF THE VELOCITY ENERGY

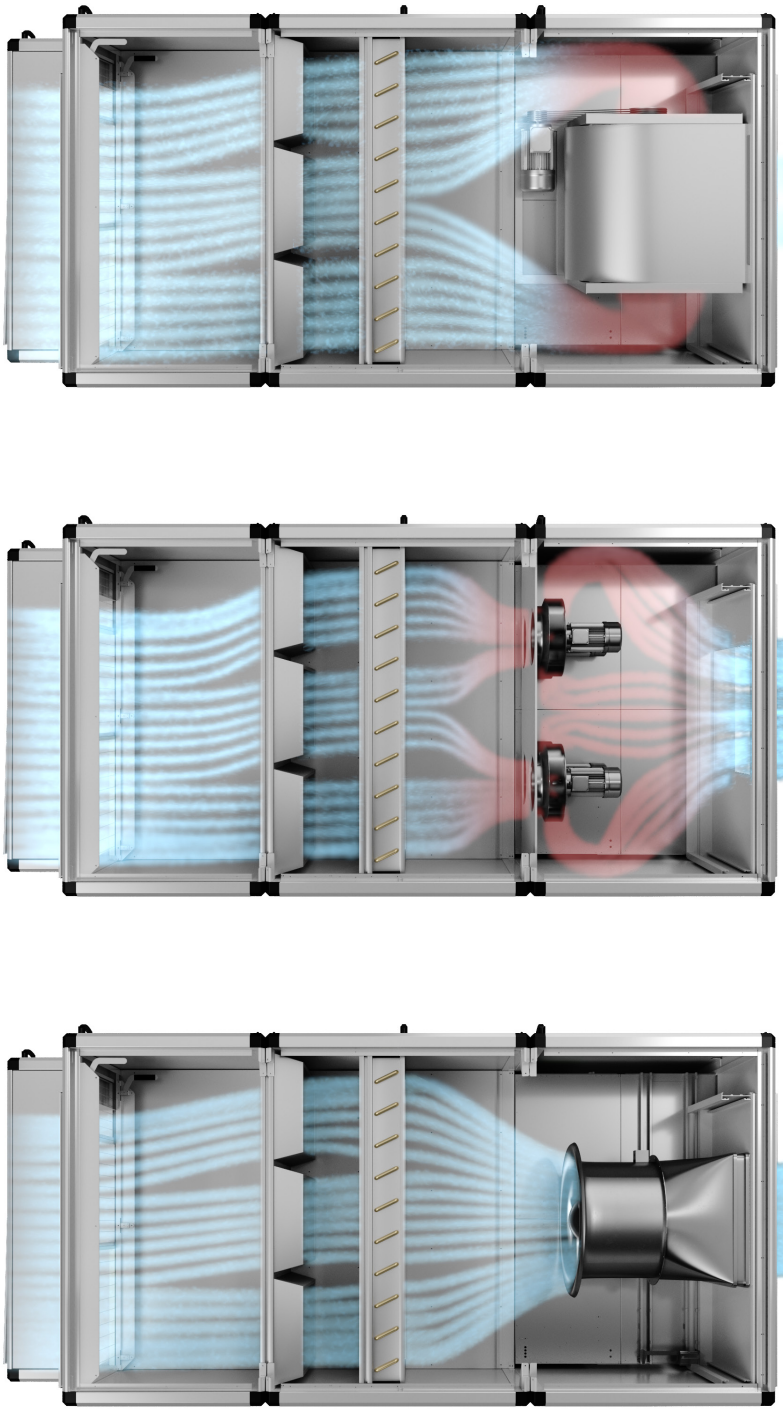
Dynamic pressure eventually vanished with the advent of plug fans. But now as many centrifugal systems of the 1990s are ripe for retrofit, dynamic pressure is again relevant. This is because centrifugal systems cannot utilise dynamic pressure as effectively as axial fans.

Whereas a plug fan sends the air into a pressurised chamber, a centrifugal fan sends the air into a duct system. Sometimes the duct system functions like a wide motorway where the velocity energy can be maximised. Other times the duct may be more like a mountain road with hairpin bends, where the velocity energy loses its speed at a greater rate.

Thus, when assessing the benefits of dynamic pressure, we must also consider the layout of the duct system after the fan. Compared to the static pressure, which we can measure relatively easily and accurately, the dynamic pressure presents more of a challenge. And here we return to the second reason why the focus on static pressure has been so prevalent for so many years.

THE OPTIMAL RETROFIT OF A CENTRIFUGAL FAN

When a centrifugal fan is due for replacement, the dynamic pressure, and thus the total pressure, should be included when it comes to fan selection. But there are other factors to consider as well.



Airflows in a centrifugal fan, a plug-fan, and NOVENCO ZerAx axial fan – note the complete absence of turbulence (red airflow) in the axial fan at the bottom, which provides a significant increase in pressure due to the high dynamic pressure.
Also, note the simpler and reduced installation requirements for the axial fan, which also has less space requirements for a fan with equivalent performance to the centrifugal or plug-fans.

To retrofit a centrifugal fan with a plug fan requires extensive customisation. Among other things, the construction of a pressurised chamber and many hours for adaptation of the duct system.

If a centrifugal fan is replaced with an axial fan, it is still possible to benefit from the advantages of the velocity energy and usually only make minimal adjustments to the ductwork and unit.

Although a plug fan usually has a lower unit price than an axial fan, axials are financially more attractive from a perspective that looks a few years ahead. This is partly because axials have greater performance levels. This means that, for example, where four plug fans are needed, a single axial fan may suffice. In addition, there are lower costs for f.x. customisation of the duct system compared to that of a plug fan.

THE ENVIRONMENT KNOCKS

In these times, environmental concerns knock louder and louder on the door, and we cannot justify waste of energy. The good news is that there are more benefits to the green transition when we begin to focus on utilisation of the dynamic pressure in our fan solutions again:

- Greater energy savings by utilisation of velocity energy.
- The lifetime cost is attractive compared to other fan types.
- Increased energy efficiency contributes to the company's sustainability strategy.

When retrofitting a centrifugal fan, it is therefore crucial to choose the new fan based on the correct system pressure, which in the case of centrifugal fans is the total pressure. This is the only way to achieve the optimal operating point and maximise energy utilisation.

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