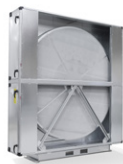


» AIR TREATMENT

TWIN WHEEL

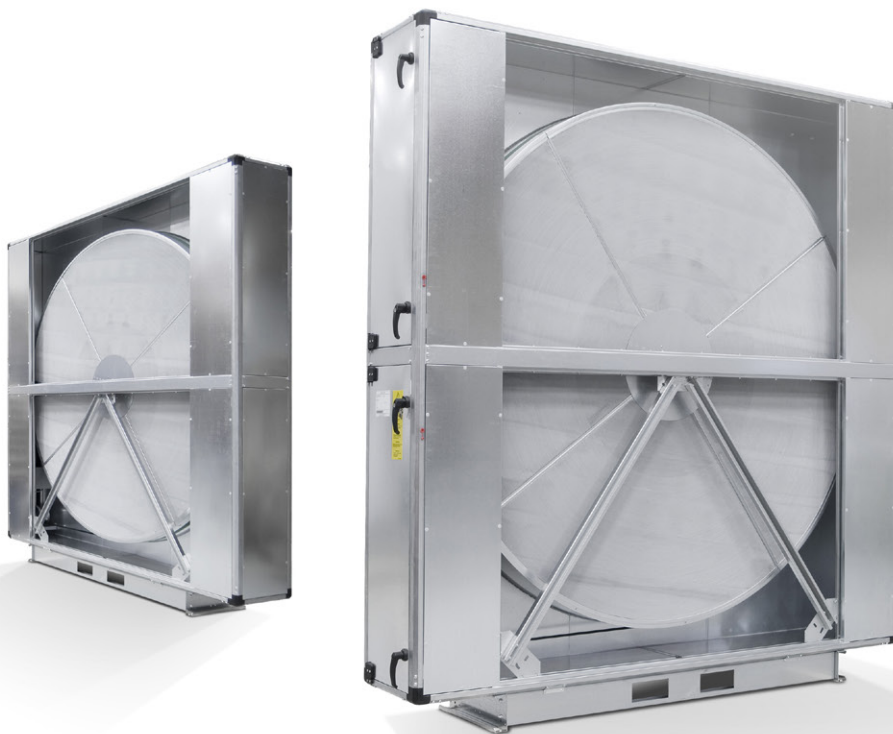
TWIN WHEEL

» REDUCING THE COST OF HUMIDITY CONTROL



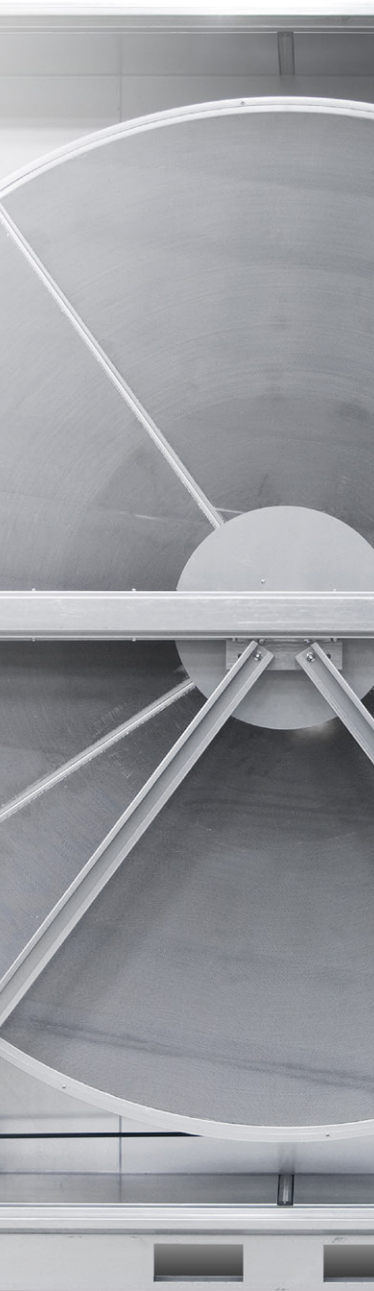
Twin Wheel system

– humidity control and energy saving



The Twin Wheel might not be as important to humanity as the wheel. But within the air treatment business we still consider this system a landmark innovation, and it creates a high indoor air quality as well as energy savings for the benefit of our common environment.





Air quality

Today we demand a comfortable environment when inside a building. One important parameter for a good indoor environment is the air quality. Good indoor air quality in turn is a combination of factors like oxygen level, humidity, absence of odor and pollution - and obviously the right temperature.

Energy costs

Cooling and heating processes typically demand high levels of energy supply. In modern buildings air treatment is often the biggest consumer of power. This fact, together with constantly increasing global energy prices, call for systems optimized for best overall efficiency. At FläktGroup we combine our experience with advanced technology to

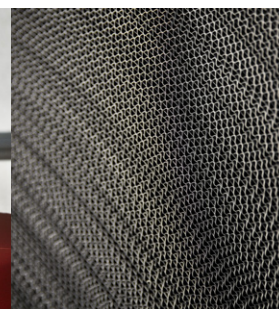
achieve intelligent system solutions. They are sound investments with short break-even and dramatic savings in the long run.

Environment

The environment is also a winner with our solutions. For nature, regardless of energy source, the least harmful kilowatt of energy is the one saved and never produced.

Controlled humidity

Control over the humidity content of the air is one factor to reach good indoor air quality. Humidity control is also essential for use of 'chilled beams', an air cooling technique with good efficiency and high levels of comfort.

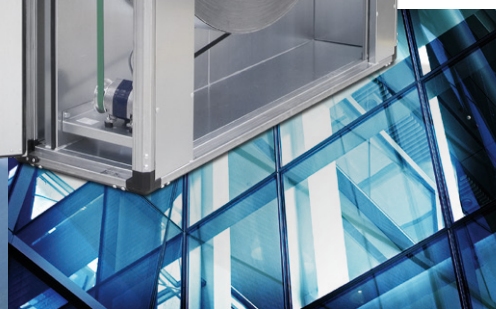
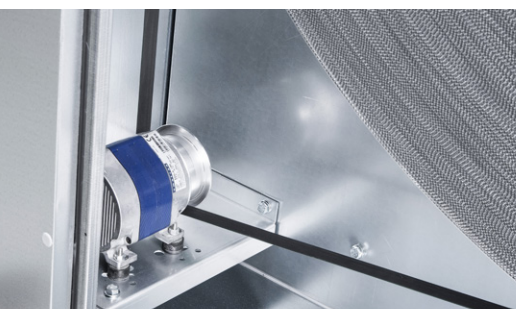


This makes the Twin Wheel such a good idea:

- The outer rotor pre-cools supply air. The system thereby lowers the requirements on both cooling coil and chiller.
- The outer hygroscopic rotor also transfers humidity from supply to exhaust air flows. This leaves less moisture to remove for the cooling process, which makes it possible to downsize coils and chillers even further.
- Need for heater dramatically reduced. The inner rotor recovers enough heat from the exhaust air flow – heating for free for most of the year!
- The Twin Wheel is a perfect match for chilled beams and fan coils. It lowers the risk for condensation on the chilled beam through an energy efficient mechanism. Chilled beams are themselves efficient parts of a circulating liquid-based flow, that besides energy savings also lowers noise, amount of duct-work and required capacity of main Air handling unit.

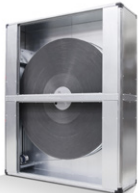
How does the Twin Wheel system work?

FläktGroup has designed the Twin Wheel system to improve on cooling and humidity control versus other solutions on the market. The purpose is to produce cool and dry air while lowering the cost for these processes compared to conventional systems.



The components of a Twin Wheel system

Rotary heat exchanger



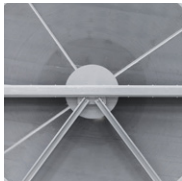
Rotary heat exchangers are used for heating and cooling recovery in air handling systems and typically enhances their efficiency. The rotary heat exchangers main component is the rotor, which is made of either thin folded sheet aluminium or micro-glass, formed as triangular pipes.

Sensible rotor

When spinning, the rotor transfers heat or cold between supply and exhaust airstreams. In this case, where the exchange is restricted to temperature transfer, it is called a 'sensible' rotor.

Hygroscopic rotor

Through surface treatment the rotor can also be given moist-transferring abilities. It is then called a 'hygroscopic' rotor.



FläktGroups RegAsorp is a hygroscopic rotor with a proprietary zeolite surface treatment of 4 Å (angstrom). This rotor is more efficient than traditional types in absorbing moisture. The molecular grid of 4Å permits water vapour to be transferred while pollutants, which typically have

larger molecules, are not carried over.

Cooling recovery

The Twin Wheel controller operates the two rotors in sequence, resulting in lowered requirement effect on the cooling coil.

Cooling coil

The purpose of the cooling coil is to cool and/or dehumidify air. Cooling is achieved when warm air passes through the cooling coil, which consists of parallel pipes. When there is also a demand for dehumidification, the temperature of the battery is lowered until the passing air reaches its dew point. The condensed moisture is then extracted by a drip separator. The outcome of this process is air with lower temperature and lower humidity.



Controls

The Twin Wheel is equipped with a pre-programmed integrated control system, specifically developed to meet the requirements for cost effectiveness, user friendliness, reliability and energy efficiency. The control system is based on a powerful digital controller with Modbus communication and an integrated web server as standard. The user interface includes an operator panel, with an easy to use "push and pull" navigation through a logical menu structure. The control system is automatically selected and configured in ACON and thereby simplifies the design process reduces time and money spent on engineering and documentation.

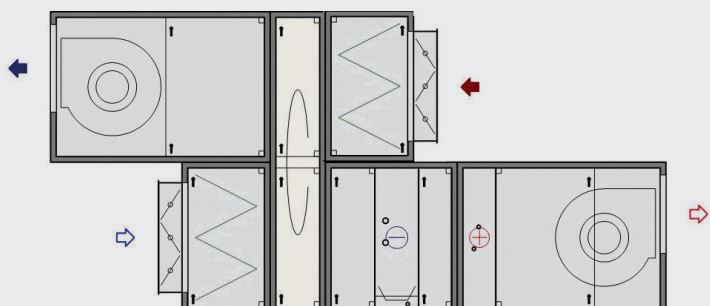


Humidity control

The Twin Wheel controller operates the hygroscopic rotor and cooling coil in sequence to a dew set-point value, thereby limiting the supply air humidity level. During the course of the year, the system will limit indoor humidity.

The traditional system

In a conventional system, cooling and drying is achieved by condensating away excess moisture on a cooling coil. In the next step the air is re-heated in a heating coil to reach the desired temperature. Both cooling and heating typically require considerable amounts of energy, leaving room for improvement in both cost and environmental aspects.



Twin Wheel advantages in overview

The Twin Wheel system contains three main parts; the hygroscopic rotor, a cooling coil and a sensible rotor.

1

When outdoor air is warmer than the exhaust airflow there is a need for cooling. The hygroscopic rotor then reduces temperature of the incoming air. Simultaneously it transfers moisture from the inbound to the outbound air flows (in cases where absolute humidity is higher outdoors)

2

After passing through the hygroscopic rotor the air passes through the cooling coil, where the temperature is reduced further and moisture is condensated down to required levels. Since the air has already been cooled by the hygroscopic rotor, the demand for cooling is lowered. The saving can be up to 50% of the nominal required cooling effect, while at the same time the need for a following re-heating battery in most cases disappear.

3

The now dehumidified and cooled air continues to the sensible rotor, where heat from exhaust air is recovered and used to re-heat it. The air then is supplied to the building, which controlled levels on both temperature and humidity. Note that the temperature exchange in the sensible rotor, where exhaust air is cooled, further improves the cooling recovery of exhaust air in the hygroscopic rotor!

Exhaust air

Extract air

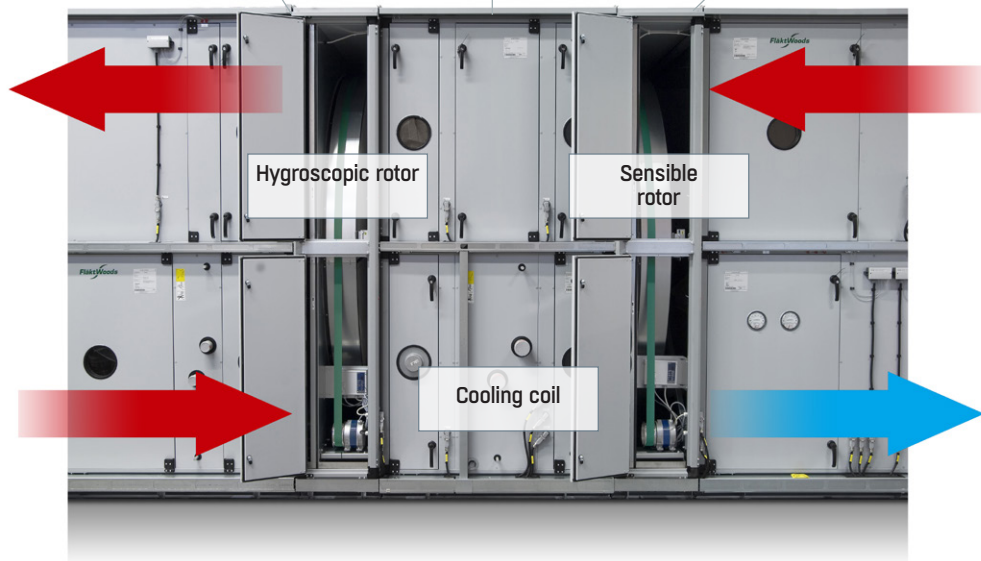
Outdoor air

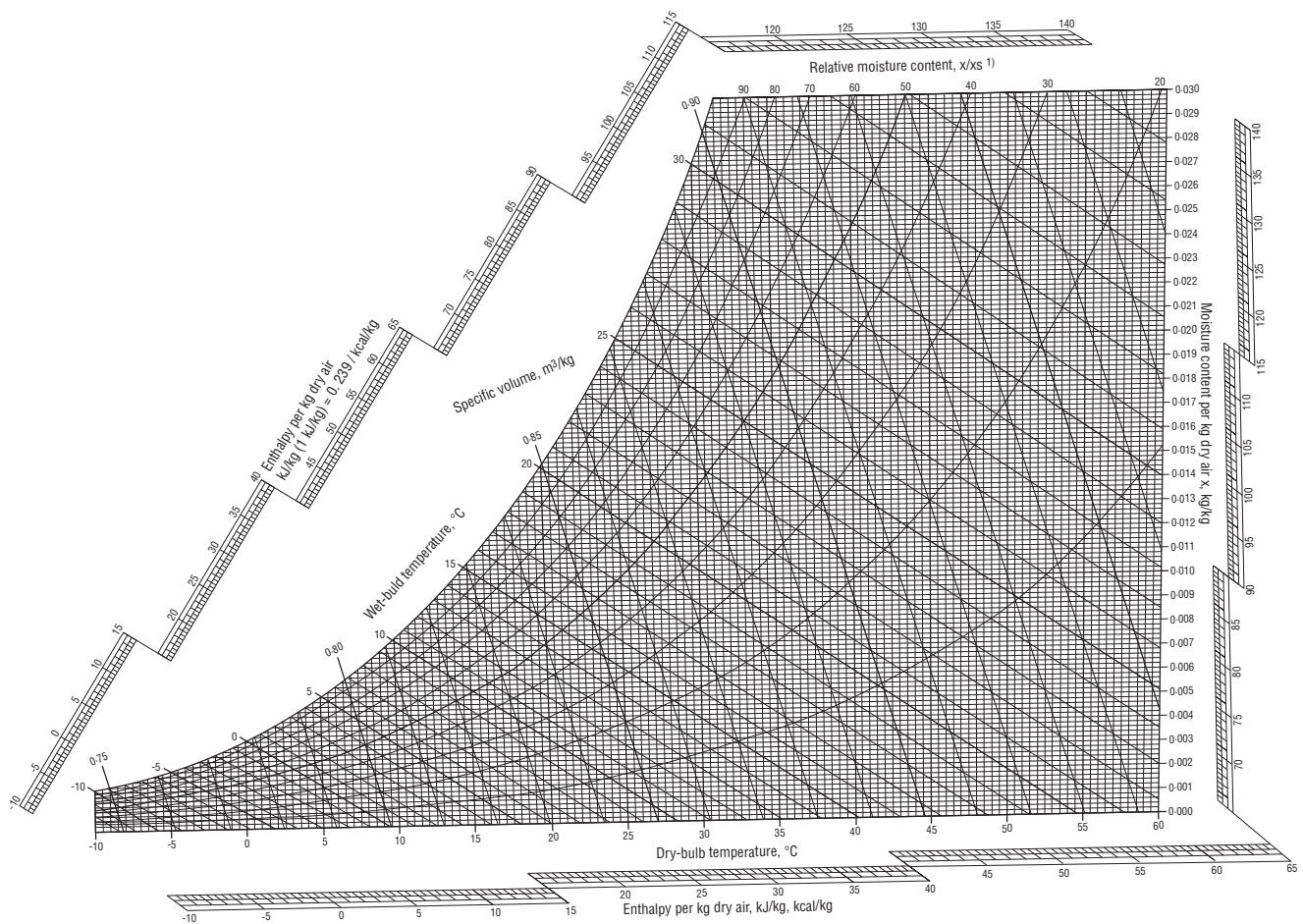
Supply air

Hygroscopic rotor

Sensible rotor

Cooling coil

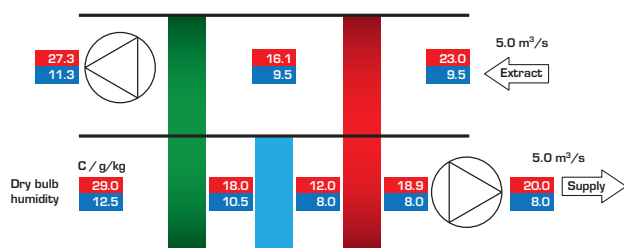




Count on savings

Now let's see what the Twin Wheel system can achieve in real life! The situation is a typical setup where there are specific demands on both temperature and humidity to maintain a good indoor climate.

Air flow rate $5 \text{ m}^3/\text{s}$ • Outdoor condition: 29°C dry bulb, 50% relative humidity
 Required supply air condition: 20°C with 8 g/kg absolute humidity
 Exhaust air design condition: 23°C with 9 g/kg absolute humidity



The total cooling demand is 184.4 kW and the reheat demand is 56.5 kW .
 With the twin wheel system the first rotary heat exchanger (green) recovers 100 kW of cooling leaving just 84.4 kW for the cooling coil. The reheat demand is furnished by the second rotary heat exchanger (red) and the supply fan.



Laboratory tested

The Twin Wheel system has been tested in our laboratory under defined and accurately measured conditions.

Eurovent Certified Performance

All FläktGroup eQ Air Handling Units are Eurovent certified.

When the pieces fit, you get the big picture

With our broad range of products and century-old experience, one thing is obvious to us; You have to look at the big picture. It is by carefully combining products into systems, utilizing smart controls, one can achieve the best energy solutions.

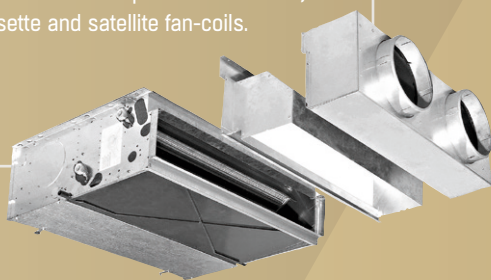
Air handling units

Our comprehensive Air Handling Unit offering allows us to deliver optimised solutions for any customer. Our R&D work focuses on reducing energy consumption and creating factory complete air handling system solutions with controls. Our experience in the marine, off-shore, pharmaceutical and hospital markets makes us the perfect partner for such applications.



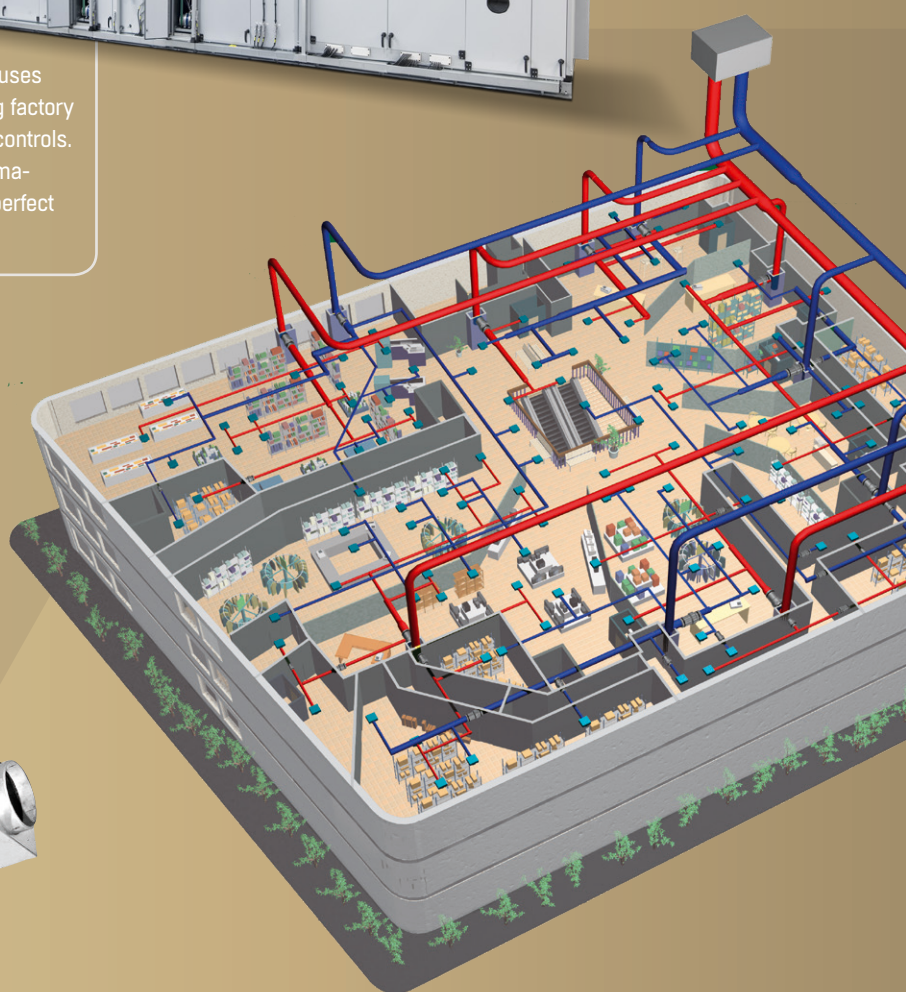
Fan coils

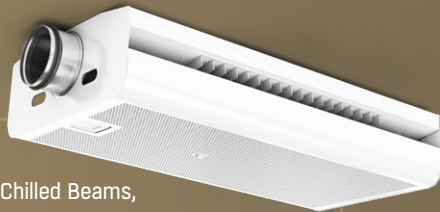
Fan coils are most commonly used in areas where individual room control is essential, such as hotels, private and public office buildings, hospitals and schools. FläktGroup can offer classic, cassette and satellite fan-coils.



Controls

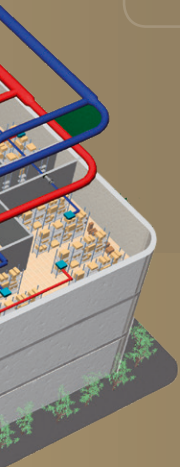
FläktGroup offers a wide range of integrated control solutions for air handling and indoor climate systems. Factory mounted and pre-wired controls will reduce installation time and simplify on-site logistics. Preprogrammed and factory tested control applications based on FläktGroups extensive experience also means a fast commissioning process and will secure a reliable and energy efficient operation of the system. Based on support for open standard communication protocols, integration to a building management system can easily be carried out by an independent system integrator.





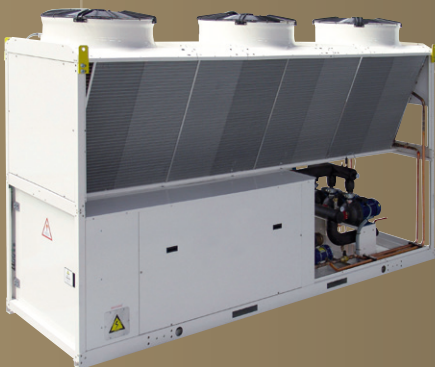
Chilled beams

In systems with Chilled Beams, the indoor air is cooled by means of cold water. Chilled beams create a stable and comfortable environment by supplying draught free cooling. By using Chilled Beams up to 75% of the total cooling capacity will be handled by the water. Apart from the energy saving it also means less ductwork for air, smaller air handling units and lower noise.



Chillers

The FläktGroup range of chillers are designed to minimise the overall annual energy consumption in all types of buildings. FläktGroups' heat and cooling recovery systems (e.g. Econet) allow for the deployment of smaller chillers than would otherwise be the case. This leads to significantly reduced investments and operational cost.



FläktGroups Integrated advantages

Following the Kyoto protocol the European Union has set a target to reduce energy consumption. For buildings the target is set at a 30% reduction by 2030. It's called the EPBD directive.

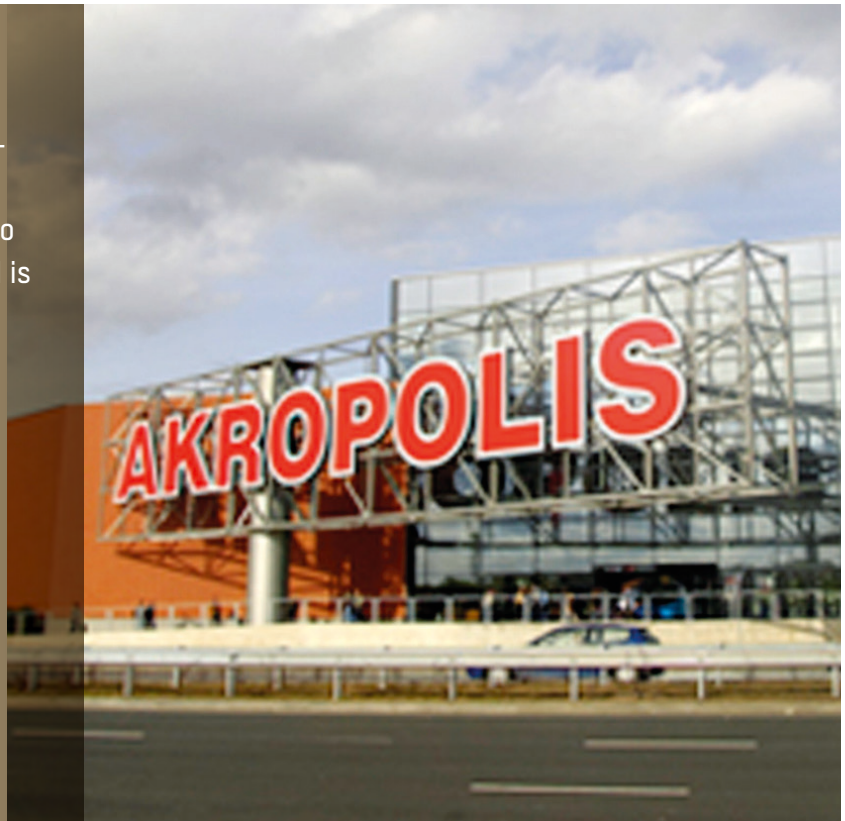
To address the needs created by the EPBD directive, FläktGroup has poured a lot of effort into creating optimised energy efficient solutions. Our solution is a broad approach leaving no stone unturned to achieve optimum results.

High-performing components are an obvious start-out. But it is by combining products into a system, utilizing smart control, one can achieve the best energy solutions.

References



By means of the twin rotor system the cooling demand on the chiller is reduced by one third to 300kW and the reheat demand is eliminated.



Akropolis shopping center Kaunas, Lithuania

Kaunas AKROPOLIS will be the biggest shopping centre in Kaunas and in central Lithuania, with a wide selection of national and international stores.

The AKROPOLIS shopping centre in central Lithuania will attract customers from all over Lithuania and neighbouring countries. The Akropolis shopping centre in Kaunas, Lithuania includes an ice rink. To avoid fog in the area around the rink it is necessary to supply air at a temperature of 16°C and an absolute humidity of 8 g/kg. The outdoor design condition is 27°C and 55% relative humidity (12.3 g/kg).

Two EU air handling units each equipped with two rotary heat exchangers supply a total of 15.4 m³/s. The total cooling demand is 448 kW and the reheat demand is 53 kW. By means of the twin rotor system the cooling demand on the chiller is reduced by one third to 300kW and the reheat demand is eliminated. Not only is the running cost reduced but also the size of the chiller plant.

FACTS ABOUT KAUNAS AKROPOLIS

- 73,063 m² total area
- Supermarket "hyper-Maxima" - 6,778 m²
- More than 220 operators
- More than 2,500 fast food and restaurant seats
- Over 2,759 parking spaces
- 9 million visitors a year are expected
- Multiplex cinema – 7 screens, more than 1,418 seats



Further references

Unilever, Kingston, UK
Manchester Metropolitan University, UK
Fitzrovia, London, UK
M W Kellog, London, UK
227 Tottenham Court Road, London, UK
Bidborough House, London, UK
Greenwich Peninsula, London, UK

John Dalton Building Manchester, England

Four Twin Wheel systems were supplied to the John Dalton Building at Manchester Metropolitan University. This building is for the Department of Computing and Mathematics which houses their own teaching and research laboratories offering person-centred working and learning environment for staff and students. Research is carried out in computer science, intelligent systems, computational fluid dynamics, information systems and mathematical modelling.

Energy efficiency and indoor quality control were a vital factor for this Project and the consultant RMJM designed a system for the laboratories incorporating chilled beams and Twin Wheel air handling units, the air handling units providing fresh air to the chilled beams. We were able to show the client through our development a calculation method to enable performance of the twin wheel units to be predicted, along with energy usage at all conditions to enable payback periods to be calculated. The Twin Wheel system showed a marked efficiency improvement in the summer cycle reducing chiller sizing by up to 50% and also better in the winter cycle than most systems with heat recovery.

FACTS ABOUT JOHN DALTON BUILDING

- Assembly hall lecture theatre with the capacity of 234
- Tiered Lecture theatres with the capacity of 60–234
- Meeting rooms with the capacity of 20–60
- Computer training suites with the capacity of 20–40

EXCELLENCE IN SOLUTIONS

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TWIN WHEEL 8763 GB

FläktGroup is the European market leader for smart and energy efficient Indoor Air and Critical Air solutions to support every application area. We offer our customers innovative technologies, high quality and outstanding performance supported by more than a century of accumulated industry experience. The widest product range in the market, and strong market presence in 65 countries worldwide, guarantee that we are always by your side, ready to deliver Excellence in Solutions.

PRODUCT FUNCTIONS BY FLÄKTGROUP

Air Treatment | Air Movement | Air Diffusion | Air Distribution
Air Filtration | Air Management | Air Conditioning & Heating
Controls | Service



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