Air Management for Food Applications

FläktWoods
Specialised solutions to meet the challenging requirements of food production, storage and preparation

Air quality has a direct impact on quality of food production, with the control of airborne particles, temperature and humidity all being key factors in the creation of a safe environment.

Great care must be taken to limit the risks to products from airborne contamination. Infectious pathogens (e.g. salmonella), toxigenic pathogens (e.g. staphylococcus) and spoilage micro-organisms (e.g. yeast) can all decrease the shelf life of food. Areas of particular concern include undesirable fermentation, aroma development, food poisoning and toxi-infections.

The air system can also play an important role in protecting people from infection in their working environment. In addition to the control of airborne contamination, the temperature, humidity and air distribution are all key variables.
The food industry is a complex application, because it usually combines strict hygiene levels with low temperatures. With experience from numerous installations in facilities for food production, storage and preparation, Fläkt Woods is the safe choice for air management systems. Our solutions provide ultimate function for the specific demands, whilst meeting the highest standards of energy efficiency to deliver low life-cycle costs for the entire building.

**HVAC systems have a major impact on:**
- Contamination of products
- Shelf life of products
- Odours
- Employees’ health

**Fläkt Woods’ solution:**
- Hygienic components
- Easy to disinfect
- Good filtration
- Reduced energy consumption

**Specific demands**
Where your building has specific demands, Fläkt Woods has dedicated solutions. Our product portfolio includes equipment and systems that meet the challenging requirements for air cleaning, leakage standards and infection control. Effective HVAC systems provide a comfortable environment, including temperature, air quality, humidity, odour and noise. It therefore affects not only the conditions of the staff, it also facilitates good conditions for the preparation and manufacturing of high quality food.

**Cleaning and maintenance**
Maintenance operations such as cleaning are always a major issue with any plant, mostly because of functionality issues. Within the food sector requirements are even higher due to the stringent hygienic demands. Every component within our HVAC systems has been designed to facilitate visual inspection, along with easy and effective cleanability.

**Certificates and standards**
Our systems have been designed and developed in accordance with the most stringent Hygiene standards in Europe. As an example, our eQ Plus AHU received the ILH certificate delivered by the German Institute for Hygienic Air. Fläkt Woods AHU’s are well designed according to the German standard VDI 6022 and the Swiss SWKI Richtlinie VA104-04 (04/2006). This guarantees that maintenance will be easy and effective and that the materials used are microbiologically inert. We also strive to extend the use of recyclable materials and operate in accordance with ISO 14001.
Fläkt Woods is not only an experienced HVAC systems integrator. We also produce many of the components ourselves. That puts us in the unique position where our systematic demands can be closely met by component features, and component development is always done with the functionality of the entire system in mind.

**Products you can depend on**

**Terminal diffuser with absolute filtration, DIF P and K**
These systems have a double function, passing the air through Absolute Filters before distributing it through carefully selected Air Terminals to provide optimal flow patterns.

**Exhaust for critical environment, DEC A and S**
Grilles designed specifically for controlled contamination environments. They are easy to clean, perfectly planed and maintenance friendly.

**Dirivent Air Distribution System**
Dirivent is an air distribution system capable of moving large volumes of air over long distances without the need for extensive duct installations. It consists of a small bore duct system with jet nozzles to direct the air. Supply air from the air treatment system is controlled and directed through strategically placed jet nozzles, making Dirivent particularly attractive for ventilation and heating purposes. The system can also be used for cooling. Dirivent provides full control over temperature and airflow in all types of premises with ceiling heights above 4 meters and up to 36 meters. Stratification, which would otherwise increase the overall heat loss and create cold draughts in working areas, is prevented.

**Displacement Diffusers**
Diffusers for displacement air distribution create quiet installations with both good air comfort and high ventilation efficiency. The system also permits economical and effective air cooling. Fläkt Woods has a large range of displacement air terminal devices with different forms and capacities.

**Activent**
Activent is a ventilation system for supplying and distributing air. Small air jets from the ducts mix with room air through induction. Low temperature air can be delivered into the space without causing draughts.
Specialist AHU’s for food applications
The food industry is a complex application, because it typically combines strict hygiene levels with low temperatures. The Fläkt Woods CC unit has a high standard specification to avoid condensation and to guarantee easy maintenance and cleaning.

The CC range provides:
- Constant t°C
- Controlled humidity
- No condensation
- Washable design

Econet Energy Recovery System
The components in Fläkt Woods’ innovative Econet system are connected together to provide a more reliable and more efficient AHU system. Heat recovery, heating and cooling are integrated into a common circuit as heating/cooling coils, pumps, valves, pipe systems, insulation etc. The result is a shorter and more compact ventilation unit. This is highly beneficial from an environmental point of view because much less energy is used to transport the air through unnecessary components. Further development of the principle of energy recovery has also led to increase in efficiency of 50% compared to traditional coil recovery systems. Econet is patented by Fläkt Woods and has been installed in more than 1000 sites in Europe.

- No risk of odour/bacteria transfer
- Supply and exhaust air units can be separated from each other
- Constantly optimised energy recovery
- Pump with sensors and frequency converter
- Exceptionally low temperature requirement for hot water
- Chilled water can be as high as 12°C
- Ideal for use with renewable energy resources
- Can recover cooling in summer months
- Ideal for indirect evaporative cooling
- Low life Cycle Costs (LCC)

Thermal Wheels with 3 Angstrom Technology
EQRS is a very powerful rotary heat exchanger that recovers both sensible (heat) and latent (moisture) energy. With an efficiency of up to 85%, EQRS is one of the most powerful rotors available on the market today. Our hygroscopic rotor has been specially developed for operation in contaminated air flows. The rotor medium is coated with a highly effective transfer media (3 Angstrom molecular sleeve) that eliminates the transfer of contaminated air, making it ideal for the food industry.

- Panels are painted or in stainless steel 304 or 316 L
- Polyurethane insulation
- Plastic tubes incorporated in the panels to give a thermal bridge free unit
- Special coils
  - Cu/Al – Epoxy – Cu/Cu
  - Heresite – Stainless Steel
  - Dip galvanized
- Fin pitch between 2,1 and 6 mm
- Fin thickness between 0,1 and 0,6 mm
- Drain tray in stainless steel
- Defrosting pin

Polyester bottom – double polyester bottom with excellent thermal insulation
Smooth angle for optimum hygienic solution
Withdrawable components for easy service, maintenance and cleanability
Panels are painted or in stainless steel 304 or 316 L
Polyurethane insulation
Plastic tubes incorporated in the panels to give a thermal bridge free unit
Special coils
- Cu/Al – Epoxy – Cu/Cu
- Heresite – Stainless Steel
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Optimised solutions for safe food production

For each type of product, a risk assessment should be carried out involving all aspects of production and storage, in order to highlight the critical control points. This assessment should consider all aspects of environmental hygiene, including the risk of potential cross-contamination from adjacent processes, enabling appropriate decisions to be made regarding pressure differentials between spaces.

A correctly designed air handling system is critical for the effective elimination of airborne contamination. For each of the intended operating standards (low, medium and high risk), an appropriate air supply system must be specified. This should cover:

- The microbiological quality of air
- The ability of the system to control air flow direction
- Temperature
- Relative humidity
- Overpressure

Consideration must be given to each of these points during the various operating states, including start-up, production, cleaning, non-production and maintenance.

Functions of an air handling system for a high risk area (example: cooked meat preparation)

<table>
<thead>
<tr>
<th>System function</th>
<th>Production</th>
<th>Cleaning</th>
<th>Non-production</th>
<th>Maintenance</th>
<th>Start-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove particles</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Slow microbial growth by reducing the temperature</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Slow microbial growth by reducing relative humidity</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Prevent ingress of microorganisms (by overpressure)</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Prevent turbulence</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Personnel comfort</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
</tbody>
</table>
Example: **Cheese production**

**Challenges:**
- Air system designed to prevent product contamination
- Dehumidification of cheese making process
- Washable AHU to limit the risk of contamination
- Constant T° C of air (typically 3 °C)
- Corrosion from lactic acid

**Recommended products and systems:**

**CC AHU**

**Coil:**
- Cooling coil with chilled water (0/5°C with 30% propylene glycol)
- Large fin pitch (6mm) to reduce risk of freezing

**Casing:**
- Cold-bridge-free AHU with 75mm of PU foam
- Undertray in stainless steel: excellent thermal insulation with no sharp corners, allowing easy-cleaning

**Energy recovery:**
- Econet high-efficiency heat recovery

**Filtration:**
- F9 or H10

**Diffusion**
- Laminar air flow with HEPA filtration for critical areas
- Displacement diffusers

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Example: **Cooked meats**

**Challenges:**
- Air system designed to prevent product contamination
- Constant T° C of air (typically 3 °C)
- Washable AHU to limit the risk of contamination
- Zero condensation in technical areas
- Low fresh air volume (about 10%)

**Recommended products and systems:**

**CC AHU**

**Coil:**
- Cooling coil with chilled water (0/5°C with 30% propylene glycol)
- Large fin pitch (6mm) to reduce risk of freezing

**Casing:**
- Cold-bridge-free AHU with 75mm of PU foam
- Undertray in polyester: excellent thermal insulation with no sharp corners, allowing easy-cleaning

**Energy recovery:**
- Econet high-efficiency heat recovery

**Filtration:**
- F9 or H10

**Diffusion**
- Laminar air flow with HEPA filtration for critical areas
- Displacement diffusers
**Example: Sweet production (inc. candies or chocolate glazing)**

**Challenges:**
- Control of humidity
- Washable AHU to limit the risk of contamination
- Constant T° C of air (typically 10 °C)

**Recommended products and systems:**
**CC AHU**
**Dehumidification:**
- Via absorption with desiccant wheel
  (better efficiency - weight of water about 2g/kg of air)
**Casing:**
- Cold-bridge-free AHU with 75mm of PU foam (no external condensation)
- Undertray in stainless steel 304 L, fully welded for optimum washability

**Diffusion:**
- Displacement diffusers

**Example: Low risk areas**

**Challenges:**
- In areas without specific hygiene requirements, the emphasis switches to one of cost and energy efficiency. Such areas might include administration offices, logistic areas etc.

**Recommended products and systems:**
**eQ AHU**
- Modular design and highly efficient. Automated manufacturing provide cost effective solutions.

**Energy recovery:**
- Thermal wheels

**Diffusion**
- Chilled beams
## Air system recommendations for different products and processes

<table>
<thead>
<tr>
<th>Risk</th>
<th>Products/In factory treatment</th>
<th>Air system recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low risk</strong></td>
<td>Packed without further disinfection:</td>
<td>Filtration: G4 – F5&lt;br&gt;- Physical separation of working area – Optional&lt;br&gt;- Temperature control – Optional&lt;br&gt;- Mini 4–5 changes/hour – Optional&lt;br&gt;- Control of dust ingress and circulation&lt;br&gt;- Hygienic disposal of condensation from air system and working area</td>
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<tr>
<td></td>
<td>• Fresh Salad&lt;br&gt;• Raw Meat&lt;br&gt;• Fish&lt;br&gt;• Vegetables</td>
<td></td>
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<tr>
<td><strong>High Care</strong></td>
<td>Packed without further disinfection:&lt;br&gt;- Pizzas&lt;br&gt;- Prepared salads with cooked ingredients&lt;br&gt;- Cheeses&lt;br&gt;Processed, packed and preserved to prevent microbial growth:&lt;br&gt;- Pickles&lt;br&gt;- Marinated fish products&lt;br&gt;In pack disinfected or sterilised:&lt;br&gt;- Fruit juices&lt;br&gt;- Beverages&lt;br&gt;Disinfected then packaged or heat processed, then clean or aseptic fill:&lt;br&gt;- Baked pies&lt;br&gt;- Bottled milk&lt;br&gt;- Sliced meat&lt;br&gt;- Soft drinks</td>
<td>Filtration: F5 – F9&lt;br&gt;- Physical separation of working area&lt;br&gt;- Controlled overpressure – Optional&lt;br&gt;- Temperature control&lt;br&gt;- Humidity control – Optional&lt;br&gt;- Minimum 4–5 changes/hour&lt;br&gt;- Control of dust ingress and circulation&lt;br&gt;- Hygienic disposal of condensation from air system and working area</td>
</tr>
<tr>
<td><strong>High Risk</strong></td>
<td>Packed without further disinfection:</td>
<td>Filtration: F9 – H12&lt;br&gt;- Physical separation of working area&lt;br&gt;- Controlled overpressure&lt;br&gt;- Temperature control&lt;br&gt;- Humidity control&lt;br&gt;- Minimum 6 changes/hour&lt;br&gt;- Control of dust ingress and circulation&lt;br&gt;- Hygienic disposal of condensation from air system and working area</td>
</tr>
<tr>
<td></td>
<td>• Recipe dishes&lt;br&gt;• Cooked, sliced meats&lt;br&gt;• Pasteurised dairy products&lt;br&gt;Frozen, blanched vegetables, to be eaten without further cooking</td>
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Selecting the right air management technology provides impressive scope for cutting energy consumption and costs. Even in a standard, non-domestic building, 68% of energy needs are typically generated by the needs of heating, cooling, and ventilation, but in a Food environment the opportunities for savings are even greater. Achieving optimum air conditions consumes energy, so preserving those conditions and recovering the associated energy expended through the process of heating or cooling, is essential.

Highly efficient heat and cooling recovery
A great deal of energy can be recovered from extract air which can be used to reduce energy costs. With Fläkt Woods systems, it is typically possible to recover around 70% of the energy, providing a substantial reduction in the heating or cooling load of the building.

Further savings can be achieved by recovering humidity from the extract air. With the higher efficiencies now available from Fläkt Woods' equipment, the amount of cooling energy recovered can be significant, and as chillers are often one of the major users of energy within a Food factory, any reduction in the chiller load has a dramatic positive effect on savings.

Moreover, with the right system selection, when dehumidification is needed, Fläkt Woods can dramatically reduce not only the cooling demand, but also the need for post heating.

Life Cycle Cost (LCC)
Fläkt Woods has created a model for calculating both the annual energy consumption and the LCC. Fläkt Woods' selection tool, Acon, can calculate the annual energy cost and the Life Cycle Cost of Energy for the selected air handling unit over a pre-determined number of years.

Unlike some less sophisticated models, the Acon model will consider all major energy consumers, including fans, pumps, drive equipment for heat exchangers, heaters and coolers. It also accurately reflects the performance of different kind of heat exchangers.

Comparing the benefits of Fläkt Woods energy recovery technology
Increased efficiency provides greater energy recovery (pink and light blue areas) and reduced post heating needed for dehumidification (purple area).
## Reference projects

<table>
<thead>
<tr>
<th>Country</th>
<th>End customer</th>
<th>Name of project</th>
<th>Town</th>
<th>Year</th>
<th>Products - systems</th>
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<tbody>
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<td>Portugal</td>
<td>Restaurante Montage Grill</td>
<td>Porto</td>
<td>2006</td>
<td>ATD</td>
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<tr>
<td>Portugal</td>
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<td>Porto</td>
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<td>Portugal</td>
<td>Cervejaria Portugália Chiado</td>
<td>Lisboa</td>
<td>2008</td>
<td>FAN</td>
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<tr>
<td>UAE</td>
<td>ADEAREST</td>
<td>Delmote Foods</td>
<td>Dubai</td>
<td>2006</td>
<td>AHUs</td>
</tr>
<tr>
<td>UAE</td>
<td>HEAS</td>
<td>WILD Flavours ME</td>
<td>Dubai</td>
<td>2006</td>
<td>AHUs</td>
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<tr>
<td>UAE</td>
<td>Nestle</td>
<td>NIDO Manufacturing facility</td>
<td>Dubai</td>
<td>2008</td>
<td>Turnkey project including design, engineering, supply, installation and commissioning &amp; testing</td>
</tr>
<tr>
<td>UK</td>
<td>Food Enterprise centre</td>
<td>Shrewsbury</td>
<td>2008</td>
<td>AHUs</td>
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<td>UK</td>
<td>Marlow Foods</td>
<td>Marlow Foods</td>
<td>Marlow</td>
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<td>Stafford</td>
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<td>AHUs</td>
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<td>Mondial Frigo</td>
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<td>Tipiak</td>
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<tr>
<td>Germany</td>
<td>Nestle</td>
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We Bring Air to Life

Fläkt Woods is a global leader in air management. We specialise in the design and manufacture of a wide range of air climate and air movement solutions. And our collective experience is unrivalled.

Our constant aim is to provide systems that precisely deliver required function and performance, as well as maximise energy efficiency.

Solutions for all your air climate and air movement needs

Fläkt Woods is providing solutions for ventilation and air climate for buildings as well as fan solutions for industry and infrastructure.

- **Air Handling Units (AHUs)**
  Modular, compact and small AHU units. Designed to ensure optimisation of indoor air quality, operational performance and service life.

- **Air Terminal Devices and Ducts**
  Supply and exhaust diffusers and valves for installation on walls, ceiling or floor are all included in our large range and fit all types of applications.

- **Chilled Beams**
  Active induction beams for ventilation, cooling and heating, and passive convection beams for cooling. For suspended or flush-mounted ceiling installation – and multi-service configuration. With unique Comfort Control and Flow Pattern Control features.

- **Residential ventilation**
  A complete range of products for residential ventilation. Consists of ventilation units, exhaust air fans and cooker hoods designed to optimise indoor comfort and save energy.

- **Energy recovery**
  Desiccant-based product and systems that recover energy, increase ventilation and control humidity.

- **Fans**
  Advanced axial, centrifugal and boxed fans for general and specialist applications. Comprehensive range including high temperature and ATEX compliant options. Engineered for energy efficiency and minimised life cycle cost.

- **Chillers**
  Air-cooled and water-cooled chillers with cooling capacity up to 1800kW. Designed to minimise annual energy consumption in all types of buildings.

- **Controls and drives**
  Variable speed drives and control systems, all tested to ensure total compatibility with our products. Specialist team can advise on energy saving and overall system integration.

- **Acoustical Products**
  A complete line of sound attenuating products, including rectangular and round silencers, Media Free silencers, custom silencers and acoustic enclosure panels.

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