



AIR MANAGEMENT TECHNOLOGIES, INC.
Building Energy & Environmental Services
www.airmanagement.com

Reducing Energy Expense and Improving Product Quality with Spiral Cooling Systems.

White Paper for Fermented Bakery Products

Air Management Technologies, Inc.

Scott G. Houtz, CEM, CIAQP

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Advantages

Air Management Technologies' Spiral Product Conditioning Systems are designed to help wholesale bakeries achieve significant energy savings while providing a controlled environment promoting superior food safety and consistent goods quality.

Systems Application:

Traditionally wholesale bakeries have cooled products on open conveyors exposed to variable facility temperatures with limited protection from airborne contaminants. A desire to eliminate these variables and improve product quality brought the development of the enclosed spiral cooler. Inside the cooler a dedicated environmental system engineered for bread cooling applications manages temperature, humidity, and air movement providing consistent conditions. Food safety is enhanced through air filtration removing greater than 90% of mold spores, and pressurization control preventing contamination from infiltrating the enclosure and landing on unprotected product. Considering baked products spend more of their time exposed to atmosphere during the cooling process these measures help provide consistent quality product, reduced mold complaints, and less waste.

Qualifications:

For over twenty years Air Management Technologies has been a trusted partner to the baking industry in North America. Our team is appreciative of the reputation earned as the "go to guys" for innovative single source energy, thermal, and environmental solutions.

Fifteen years ago we developed a new spiral cooler environmental system which uses less than one third the energy required by traditional cooler evaporators. Our design is so efficient existing spiral refrigeration systems can often be replaced with a payback in less than 5-years while providing an immediate return on investment for new cooler applications.



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Sustainability and Energy Savings:

Our systems achieve energy savings ranging from 50% to 90% compared to typical systems by utilizing special control logic optimizing use of outside air. Mechanical cooling typically only operates when outside air temperatures exceed specific thresholds determined by product composition and required cooling dwell time. The control logic also allows a smaller cooling system reducing facility refrigeration requirements and initial capital investment.

Additional energy savings and enhanced bakery controls are provided by variable speed motors programmed to modulate based on product loading. The sum of these technologies results in a self-funding cooling system providing consistent product quality, reduced facility carbon footprint, and superior food safety.



Energy Savings per high capacity bread line may exceed annual savings of \$50,000 each.

Greenhouse Gas Reductions equivalent to several hundred tons of emissions per year are possible.

Reduced Refrigeration Requirements lower facility ozone depleting chemical refrigerants inventories.

Utility and Government Incentives may be available to shrink initial investment.

LEED and Energy Star qualifying assistance is available for facilities striving to achieve sustainability certifications.



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Operations and Maintenance:

Annual operations and maintenance costs are reduced when compared against traditional systems. Our systems operate with compressor runtime as low as ten percent of typical evaporators meaning normal wear and tear is minimized. When preventive services are required facility staff enjoy easy access to the entire system which is conveniently located outside of the product zone.

Utilizing our inventive control logic, premature evaporator coil failures resulting from the corrosive process conditions in bread cooling are also significantly diminished without the high cost, significant weight, increased space requirements, and lower heat transfer properties of specialty materials. This operational mode allows discharging of excessive humidity in the summer when not desired and reclaiming of humidity in winter months to minimize product drying.



Lower Maintenance costs result from greatly reduced compressor runtime minimizing wear and increasing system life expectancy.

Preventative Services can be easily performed as required as equipment is located outside of production space.

Long Coil Life resulting from corrosive compounds in the return airstream are significantly reduced providing exceptional reliability.

Extended Reliability utilizing industrial duty equipment with premium motors and controls to minimize potential downtime.

Ease of Sanitation is integrated into all designs with large access door openings and full internal drain pans to facilitate wash down.



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Food Safety and Product Quality:

Food safety and product quality is enhanced by designing systems capable of providing consistent temperatures and reducing environmental contamination not otherwise possible in an open production facility. Additionally the entire product conditioning system is designed to provide easy access promoting complete sanitation.

Our unique designs include supply and return air plenums which simplify distribution, are convenient to clean, and may reduce footprint of the entire spiral cooler. Thoughtful options where plenums may not be practical include food safe inflatable fabric ducts which may be easily removed increasing access during periods of spiral conveyor maintenance. Additionally these economical distribution systems can be changed periodically by maintenance staff and sent for commercial cleaning.



Prevent Infiltration of flying insects, molds, and airborne particulates in the surrounding environment by pressurization.

System Filtration is capable of removing greater than 90% of atmospheric molds with optional increased capabilities available.

Product Moisture Management with temperature and indirect humidification measures providing all year product consistency.

Ultra Violet Lighting option which has the ability to decrease potential mold growth on internal cooling coils.

Separation of Bakeshop and spiral cooling conveyors may reduce space conditioning requirements on the production floor.



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Product Considerations:

Successful design is based on many factors which influence product cooling and ultimately determine the system's final design conditions. For example; surrounding air temperature in a bread cooler is typically designed for 75 degrees. This temperature provides a proven balance between maintaining optimum product quality and providing a satisfactory cooling rate.

Caution is required as the enclosure temperature is not the same value as the product surrounding air temperature. Cooling profiles must be calculated using the conditions surrounding the product and not overall space temperature. The product itself is a significant heat source and will have a higher surrounding air temperature than elsewhere inside the cooler as it radiates away heat gained from the baking process.

Actual product testing is highly recommended. If field testing is not available we have an in house environmental chamber capable of replicating various temperatures, distribution designs, airflow velocities, and belt orientations to assist in calculating cooling requirements and dwell times.



Physical Geometry of the Product including orientation in relation to air flow will impact ability to release heat.

Product Formulation including macronutrients influence density and resistance to heat flow.

Product Air Velocity has some impact but is not a driving factor. Care must be taken to balance flow with potential quality issues.

Enclosure Air Exchange rates must be sufficient to manage the heat and moisture released with typical limitations of a twenty degree rise.

Time Is The Most Essential Component to product temperatures. Time cannot be bypassed by adding additional refrigeration capacity.



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THANK YOU.

For More Information Contact: Scott Houtz

570-523-4822

info@airmanagement.com