MARLEN
A DURAVANT COMPANY

INDUSTRY ANALYST REVIEW

CRITICAL ELEMENTS OF BLAST CHILL CELL DESIGN

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Written by Bill Faivre
Faivre Technical LLC

INTRODUCTION

Cooked, partially cooked or "heat treated" meat and poultry products must be stabilized by cooling to prevent the growth of spore-forming bacteria. Best stabilization guidelines, FSIS Appendix B, require "that cooling be continuous through the given time/temperature control points". But, how many or how few plant chilling devices can demonstrate control points being reached reliably so that random sampling of production lots can never challenge a plant's validated processes?

THE PROBLEM

The meat and poultry industry has long been suffering from a lack of understanding of what is required to chill their products efficiently and uniformly. Just as we may dial down our home refrigerator to a setting where milk is perfectly chilled only to find that soda cans have frozen and popped, processors' first instinct is also to turn the dial down while degrading their products in the course. The refrigeration contractors that processors relied upon knew how to make air colder, cold enough to theoretically bring about convective heat removal, but understood very little about the thermal conductivity of the processor's products. The result was that errantly crusted product later became sour as the unwanted layer of ice crystals "locked" the product, preventing it from aspirating heat and moisture naturally.

Confessing their need for better understanding, processors who hadn't found a solution through other sources turned for help to the same people who produced their smokehouses. Some of these manufacturers simply copied the contractor design style and just as surely failed. Others thought that a "reverse smokehouse" would be the answer, placing an evaporator coil where the smokehouse heat source would typically reside. It was not. Cold air cannot be circulated and controlled in the same way that hot, moisture laden air is circulated and controlled. Circulation of cold air must be more precise, always through - *and not around* - the product mass and at a greater volume with variable control of velocity.

HISTORY

"Cold rooms" using harvested ice were the only means of stabilizing meat until ammonia-cycle or "mechanical" refrigeration became available. First installed on rail cars to meet the needs of the largest meat processors of early times, such as Armour, Swift and Wilson, mechanical refrigeration removed heat from and stabilized carcasses enroute from the slaughter facility to the processing plant.

When the first similar refrigeration unit was installed in a processing plant, the results must have been thrilling. Now a controllable mechanical device, not just the melting of ice, gave the processor the ability to store meat products, and remove additional heat, both in a more reliable way. However, because these "chill areas" were not very well segregated from other hot and humid plant operations, the early units were probably better snow makers than product coolers.

In any case, the placement of early refrigeration units in one corner of a poorly insulated room did not provide for uniform removal of heat from the product. Even with units that were sized (per heat load calculations) to easily reduce product temperatures in the specified time period, the results were disappointing. Although processors were feeling better off with mechanical refrigeration in their grasp, the occurrence of "sour" meat was still frequent.

HISTORY (continued)

Later designs addressed the need to better isolate the chill zones from the plant environment. Doors, heavy with insulation, isolated the refrigerated space. The area's floors, walls and ceilings were at the same time better insulated.

Wall and ceiling surfaces were covered with materials that better retarded moisture transfer to what was often cork insulation beneath. Later, less moisture-absorbent insulation materials provided control of damaging mold at about the same time processors began to understand the need for better circulation of chill media.

Even with this growing knowledge, the best chilling rooms still had a major problem with heat and moisture infiltration. The rooms were sized to accept several loads of hot, moist product from plant smokehouses. Operated in a "first-in, first-out" manner, chilling rooms would be well along in the cooling and condensing of moisture on one smokehouse load when another hot, wet load would arrive. This would retard the progress of chilling and condensing moisture on the partially chilled load. As a result, the time required to chill products was lengthy and uniformity still suffered.

Chilling rooms had to give way to chilling "cells" as stabilization guidelines became more stringent. Cells were now sized to accept a single oven load, but meat and poultry processors found little expertise available to properly design and construct such cells. The new generation of refrigeration contractors that were consulted knew how to make air cold more efficiently, but without understanding of the thermal properties of the product to be chilled, they too were left to rely on simple heat load calculations. Once again, not understanding the product's ability to give up heat made for considerable guesswork.

Although chill cells were now sized to the oven load, mistakes were repeated in the construction of the new, smaller room. Poor fit of doors or cabinet panels allowed the infiltration of warm, moisture-laden plant air to form ice on evaporator surfaces. This required frequent defrosting of coils, resulting in longer chill cycles. And, uniform product chilling was not improved either.

SOLUTION

Surrounding product of any kind with "cold" has never been good enough. The industry needed an equipment manufacturer who understood the ***properties of the products*** to step up and design a better chill cell. Marlen did just that.

Knowing the "reverse-smokehouse" was not the answer, Marlen examined the issue from the standpoint of the product needs. Different products with varying thermal properties have different abilities to give up heat and moisture. This is a physical reality that cannot be altered. By matching the abilities of the chilling apparatus to the thermal properties of the product – and just as importantly the processor's objectives for that product – Marlen equipment yields the desired results.

Producing a chilling recipe for each product, similar to a cooking recipe, Marlen addresses the product's need to aspirate naturally, giving up a precise amount of moisture and no more. The Marlen Blast Cell adjusts itself to remove condensed moisture during an initial phase per the chilling recipe. The recipe then dictates adjustments to air velocity and chill temperature to step the product through the cycle with greatest efficiency. The chill recipe not only brings about the most rapid stabilization but does so with optimum uniformity – no "hot spots", no errant crusting.

SOLUTION (continued)

If we count "reverse-smokehouse" manufacturers, there are still only a few sources for manufactured blast cells. Marlen turned their design focus away from old methods and toward a new air handling concept that overcame all of the shortcomings of prior built models. Called "looped airflow", Marlen's design calls for a massive volume of air to be moved ***- always through, not around –*** the product. With their better management of airflow, wasteful short-circuiting of the process media is eliminated, saving energy and process time. This advantage has been verified, independent of Marlen, in many blast chill cell installations. Marlen's users enjoy faster chill times and more uniform results as compared with other types of air chill systems.

Airflow velocity of the chilled air mass is controlled, again by the specific recipe. Marlen moves air through the product with speed dictated by the products ability to give up its heat. The result repeated: no "hot spots", no errant crusting.

SUMMARY

Just as Marlen delivers well analyzed solutions for their smokehouse users based on full understanding of each processor's products and objectives, the same care is taken in the application engineering of Marlen Blast Chill Cells.

Marlen gains a full understanding of what products AND processes dictate and develop chill recipes before the equipment is installed. This allows the processor to hit the ground running. Add Marlen training, processing consultation, and the famous Marlen commitment to service, and the choice should be obvious.

About Faivre Technical LLC
Bill Faivre, dba Faivre Technical LLC, is an independent consultant and serves the meat and poultry processing industry. For more information, e-mail Faivre Technical at bill@billfaivre-consult.com.

About Marlen
Recognized as a global manufacturer of highly engineered food processing equipment and systems, Marlen designs and builds innovative solutions for the food processing industry. Our premium products have long set the standard for quality and performance in vacuum stuffing and pumping, portioning, size reduction, thermal processing, and food handling. Marlen is a Duravant Company.