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White Paper

Making the World a “Yealthier” Place

*Hillphoenix and Zone Mechanical
Team Up to Overcome Hurdle*

“Yealthier”??? No, that’s no typo and your eyes aren’t playing tricks on you—but it is the makings of a really great story that all started with “love at first bite”. Back in 2009, the husband-wife team of Jenny and James Marino decided to try something different for dinner—turkey burgers on sprouted grain buns. Sprouted grains—the extraordinary version of whole grains—make oven-baked goods that are delicious, nutritious, and easy to digest (*figure 1*). The taste left them speechless and the experience forever changed their lives. That night, they set out on a mission to prove that *yummy* and *healthy* can coexist—people can eat “yealthy”! Cementing their intentions and laying the foundation for their dream, Jenny and James bought the bakery that made those sprouted grain buns and turned it into what you see today, Angelic Bakehouse, located in Cudahy, Wisconsin. And so far, it’s all going according to plan. In 2013, they moved into their current 44,000 sq. ft. facility where they sprout their own grains and create their own mash before baking the low carb, high protein healthy-eating finished goods that they ship all across America (*figure 2*). In the 10 years they’ve been in business, they have broadened their product basket to include a variety of other baked, sprouted grain bread offerings and grown their business twelvefold in the process.



Figure 1: Sprouted Grain Products



Figure 2: Angelic Bakehouse Facility

So, at this point you may be wondering, just how could a refrigeration equipment company like Hillphoenix and contractor like Zone Mechanical make this any better? Businesses that undergo rapid growth often encounter the same constraint—their need to produce exceeds their capacity to do so—and Angelic Bakehouse was no exception to this. Within one year of

moving into their new facility, Angelic Bakehouse was already feeling the pinch with limitations arising in their ability to quickly freeze breads down, get them packed and shipped out to customers. This method of quick freezing is referred to as “blast freezing”. Simply put, a *blast freezer (figure 3)*, sometimes referred to as a shock freezer, is intended to reduce the temperature of foodstuffs or fresh produce very rapidly, freezing them quickly in the process. The importance of performing this step properly and effectively was absolutely critical to the quality of Angelic Bakehouse’s finished product.



Figure 3: Angelic Bakehouse Blast Freezer

When you freeze food (or anything else for that matter) the water inside crystallizes into ice. The longer the freezing process takes, the larger the ice crystals. Larger ice crystals damage materials by causing phenomena like cell bursting, which affects quality and flavor of foods. The speed of the blast freezing process leads to the formation of significantly smaller micro-crystals. The volume of these micro-crystals is only slightly greater than the aqueous substance from which they are formed leaving the cellular structure of your product in near-perfect condition. This prevents the loss of consistency, collapse and sweating that is normally experienced with more traditional freezing methods. Most everyone has experienced this at one time or another after freezing a loaf of bread to preserve it beyond its expiration date and

then thawing it at a later time. When a successfully blast frozen and properly stored product is brought back to temperature, it will have virtually the same characteristics as that food product would have in its natural state. Frozen berries provide an excellent example of this concept. Upon thawing traditionally frozen berries will bleed and become mushy while their blast frozen counterparts will maintain shape and texture with little to no bleeding.

Essentially, Angelic Bakehouse needed to blast freeze approximately 1,000 pounds of finished product bread per freeze cycle and then place the goods in a holding freezer, keeping the products at a temperature that maintains their quality and nutrition. The challenge was clear—putting the bread, packaged in plastic wrap, on large cooling racks inside the blast freezer with a starting point of 75 degrees F and cooling the bread down to 15 degrees F in less than 3 hours of time would not be easy. The folks at Angelic Bakehouse needed a solution, so they reached out to the experts on the matter, Zone Mechanical, a highly-regarded refrigeration installation contractor based out of Franklin, Wisconsin (with headquarters in Alsip, Illinois).

Starting in 2014, Zone Mechanical began working with Angelic Bakehouse to determine the best solution to their refrigeration expansion needs. Several system options were initially considered covering the gamut of refrigerants from HFC (R-448) to ammonia to CO₂. Whatever solution prevailed, it had to supply refrigeration to 5 blast freezers (each 12 ft. x 30 ft.), a packaging area and refrigerated dock. The total refrigeration need was pegged at 2.3M BTUH. After careful consideration, the decision was made to go with a Hillphoenix Advansor CO₂ system (*figure 4*). “What we found was once you get to a certain BTUH threshold, especially when combining medium and low-temp applications, the price of a CO₂ system is essentially the same as an HFC system. With that in mind, there are so many benefits of CO₂ over HFC that it became a five-minute conversation,” said Brian Korfmacher, sales manager and project designer for Zone Mechanical. “There’s also a lot of benefits teaming up with Hillphoenix on a system like this. For starters, it’s easy to communicate with them. There are very few manufacturers who have the experience and capabilities of Hillphoenix when it comes to CO₂ systems, particularly large-scale systems like that needed at Angelic Bakehouse. The

Hillphoenix Advansor product has been in use in Europe for over 20 years and boasts the most installations currently in the U.S.,” added Korfmacher.



Figure 4: Hillphoenix Advansor CO₂ Transcritical Booster System

After making the choice for CO₂, Zone Mechanical and Angelic Bakehouse worked up the system design along with the walk-ins while Hillphoenix performed the engineering and finish design in conjunction as a team. Key to the design concept was the placement of the rack house on the roof of Angelic Bakehouse’s facility (*figure 5*), saving premium plant floor space for operations directly involved in the manufacture of all those “yealthy” goodies. Hillphoenix provided drawing and equipment specs allowing the general contractor to design the roofing structure needed to support the refrigeration rack house.



Figure 5: Rooftop-Mount Rack House

The proposed CO₂ system design needed to serve a significant and diverse refrigeration load (over 200% more refrigeration capacity than the system it was replacing) created primarily by components such as:

- Five (5) blast freezers (*figure 6*), each having two (2) Guntner high-CFM evaporator coils designed specifically for blast freezing applications (rated at 250,000 BTU each).
- Refrigerated Packaging Area with five (5) center-mount, low-velocity evaporator coils to maintain 40 – 45 degrees F ambient temperature.
- Refrigerated Dock Area (*figure 7*) with two (2) medium profile evaporators also maintaining 40 – 45 degrees F ambient temperature.
- Main storage freezer having two (2) large warehouse evaporator coils, each with a capacity of 130,000 BTU.



Figure 6: Blast Freezers



Figure 7: Refrigerated Dock

Zone Mechanical conducted comprehensive design validation testing to prove that the CO₂ system would properly reduce the blast freezer temperature in the required amount of time considering the somewhat unique physical properties of sprouted grain breads in plastic packaging that would inherently affect the air flow characteristics in the freezer.

Installation of the new CO₂ system was quick from start to run. Since that point in time, Angelic Bakehouse has delighted in 15 problem-free months of operation. “Before the decision was finalized to go with CO₂, we had some initial concerns related to the operation and maintenance of such a system—after all, CO₂ was all so ‘new’ to us. We felt good about CO₂ being an environmentally-friendly and very effective refrigerant for applications just like ours,” said George Psaris, Plant Manager of Angelic Bakehouse. But any concerns proved to be fleeting as George added, “After working together with Zone Mechanical on the overall design and witnessing the stellar level of service they perform and preventive maintenance program measures they prescribed, we felt very secure with our decision—and the evidence speaks for itself—zero problems with the system to date.”

George Psaris and the folks at Angelic Bakehouse have become believers. “We would recommend CO₂ refrigeration to any food manufacturing plant having the need to blast freeze finished product very quickly using a safe, environmentally-friendly refrigeration process,” he confidently stated.

With the solid, successful experience that Zone Mechanical has had with CO₂ system installation, they have become vocal advocates of the process when the application involved

requires a certain BTU threshold, as was the case with Angelic Bakehouse. Brian Korfmacher is quick to point out the following facts and benefits of going with CO₂:

- Long-term refrigerant — never have to change it out — not subject to regulatory mandates or bans.
- Natural refrigerant — unlike other harmful refrigerants, they are not synthetic chemicals and can mostly be found in nature.
- Global Warming Potential (GWP) = 1.
- Can legally vent it to the atmosphere.
- Very energy-efficient.
- Concerns related to CO₂ being a “high-pressure” system are overemphasized. While the system’s discharge side is higher pressure, the lines going out to the evaporator coils are standard fare. What higher pressure aspects of the system are involved can be easily and safely handled by any competent refrigeration technician.
- Cheaper to install — smaller copper lines, and low cost of CO₂ refrigerant — means the cost of materials involved is lower.

CO₂ is certainly not new to the world of refrigeration. But technological innovation, like the Hillphoenix Advansor CO₂ Transcritical Booster System, is once again bringing CO₂ to the forefront of retail, commercial and industrial refrigeration solution discussions. Once thought to be an application of diminishing efficiency of operation in warmer ambient climates, the integration of several key design technology advances has led to solutions to remove flash gas in hot climates and improve the system’s overall performance and efficiency in these environments. Most notable among the advances are:

- Usage of Adiabatic versus Air-Cooled Gas Coolers
- High Pressure Sub-Coolers
- Parallel Compression Systems
- Gas Ejector Systems
- Adoption of Case Controllers as a Standard

Jenny and James Marino and all the good folks at Angelic Bakehouse continue to work hard to make the *yummy* and *healthy* palate pleasers that their customers have come to expect from them. Their dream is no longer held hostage by a refrigeration system incapable of supporting the rising demand for their coveted products. Hillphoenix and Zone Mechanical teamed up to overcome that hurdle, allowing so many more people than otherwise would have been, to share that same epiphany of taste that Jenny and James experienced that night a decade ago. Dare we say—Hillphoenix and Zone Mechanical have worked together to help make this world a “yealthier” place to live.