Case Study: Custom Fabricated Melt System

By Kevin Roe, Process Engineer

When a company producing packaged cheese slices decided to expand their facility, they turned to A&B Process Systems to supply a custom fabricated stainless steel melt system. The challenge for A&B Process Systems produce a melt system able to receive forty-pound blocks of butter, melt it at a closely controlled temperature to produce a homogenous, high-volume supply of liquid butter at the minimum rate of 1500 pounds per hour.

At A&B, the solution began in our process engineering department. In melt system design, we continually look for unique ways to maximize heat transfer surface in contact with product, while attempting to minimize loading height and consumption of floor space. These objectives are often at odds. As contact surface is minimized, media temperatures and velocities must increase to maintain the level of energy input required by each unique process. Heating media selection is tied to specific melt product properties while equipment geometry relies on the heating media constraints. At the same time, each design must allow end users to maintain the desired production qualities.

Familiarity with the specific properties of the product and experience in implementing a variety of heating media are key to the design and fabrication of a successful melt system. Butter can be a tricky product to melt. Though it melts easily, it can scorch, separate into solids and oils and will become rancid if it picks up entrained air. During the initial design step, I discussed heating media options with the customer. The facility used steam as its primary heating medium. But steam, even under low pressure is too hot for butter. Hot water is a better heating medium for butter as water can be more precisely controlled to a steady temperature at a much lower range. The customer chose a simple hot water set designed to limit energy individually to specific areas using zone balance valves. Activated by a proportional control loop, this system offered the ability to closely control the temperature, to balance the temperature across the system and to conserve energy by targeting specific areas of need within the melt system.

With the heating medium chosen, I began the physical design of the melt system. Experimental data developed by A&B Process Systems used in conjunction with custom software aided me in evaluating heat transfer and throughput requirements. Loading, ergonomics and available floor space all played a role in the final design. To conserve space and aid the customer in installation, I designed a modular system. As the melt system would be fed manually, I sought a design that would be comfortable for operators to load. Because of these factors, I chose a high volume “melt table” with a heated melting grid over the traditional jacketed melt tank design. The result was a modular melt system that provided a comfortable working height for operators with only a minor loss in floor space. I incorporated a low-profile receiving tank into the design to capture the liquid butter and provide a steady supply as the process demanded. To keep the butter at an even temperature and prevent separation, I added a gentle agitation that kept the liquid butter in

contact with the heated surfaces without incorporating air into it. Level controls were integrated into the receiving tank. This not only provided sensing for on-demand liquid butter transfer but also enabled me to limit agitation to periods when the liquid butter level is sufficient to cover the impeller. Though Clean-In-Place options were available, the customer preferred manual cleaning. Because of the complications of manually cleaning the receiving tank, I designed it as a 3A sanitary unit with hinged end covers for easy access to all interior surfaces.

Due to its modular design and prefabrication, installation of the melt system was relatively quick and trouble-free. The system has exceeded the customer's specifications for throughput, and is capable of providing liquid butter at a much greater rate than the 1500 pounds of liquid butter per hour minimum.