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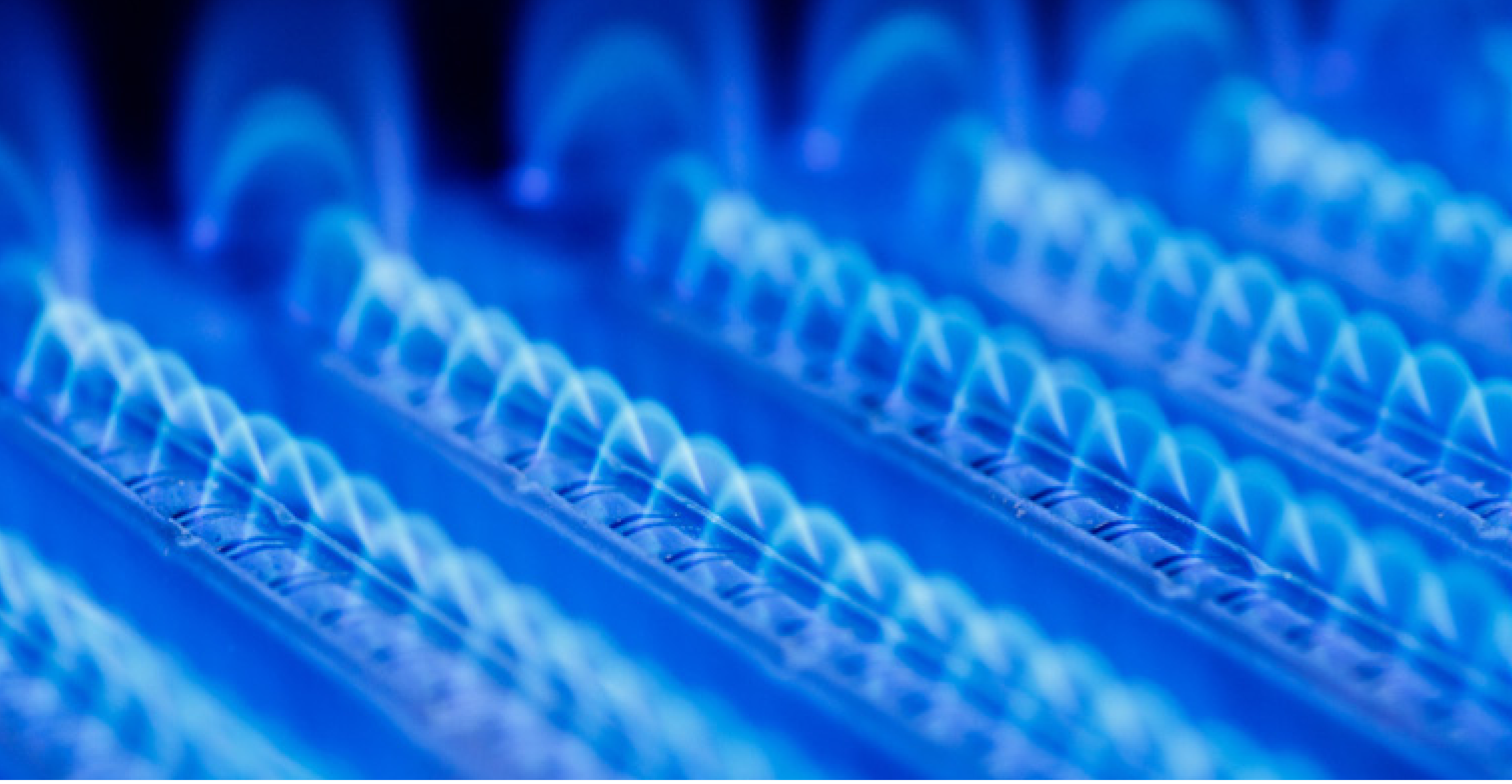


Heating Methods for Ultra-High Temperature Pasteurization

By Michael Campbell

THE MOVE is on for ultra-high temperature (UHT) pasteurization, which will extend the shelf life of milk and other dairy products. UHT pasteurization is being used because consumers are buying more dairy products in bulk, dairy operations are becoming larger, and population expansion is increasingly causing consumers to be located in more remote locations throughout the world.

Traditionally, milk is pasteurized at 180-185°F (about 85°C) and refrigerated. Other dairy products are commercially sterilized by subjecting product to temperatures in excess of 100˚C, and then packaging it in airtight containers. The basis of UHT is sterilization of the product before packaging, *then packaging it in pre-sterilized containers in a sterile atmosphere*. Processing dairy products in this manner, using temperatures exceeding 135˚C, permits a reduction in the required hold time to 2-to-5 seconds, and yields a shelf stable product that can be stored for extended period of time at ambient temperature.

Some examples of food products processed under UHT conditions are:

- Liquids such as milk, juices, yogurts, cream, and salad dressings.
- Foods with small particulates like baby food, soups, sauces, and stews.
- Soy based products in order to inactivate bacteria and reduce off flavors.

The traditional problems or difficulties in using a UHT process have been:

- Sterility: The complexity of the equipment requires more highly skilled operators to maintain sterility through out the aseptic process.
- Particulate Size: With larger particulates comes the danger of overcooking of the product surface.
- Product Quality: Heat stable lipases or proteases can lead to flavor deterioration. In a number of cases flavor deterioration has caused a more pronounced cooked flavor for UHT milk as an example.

A major consumer complaint about UHT products has always been the so-called unpleasant "cooked" taste and sometimes-brown color of the finished product. This is understandable when we remember that dairy products in general, and specifically milk, are a colloidal mixture of water, lipids, carbohydrates, and proteins. When the mixture is heated under pressure to ultra-high temperatures,

the protein structure is altered in such a way that some of the proteins are denatured and off flavors or browning can occur.

The conventional method for heating products to ultra-high temperatures has been to use indirect heating such as 1) plate and frame heat exchangers, 2) tubular-type heat exchangers such as shell and tube, or 3) scraped surface heat exchangers. The other current method for UHT production is steam infusion.

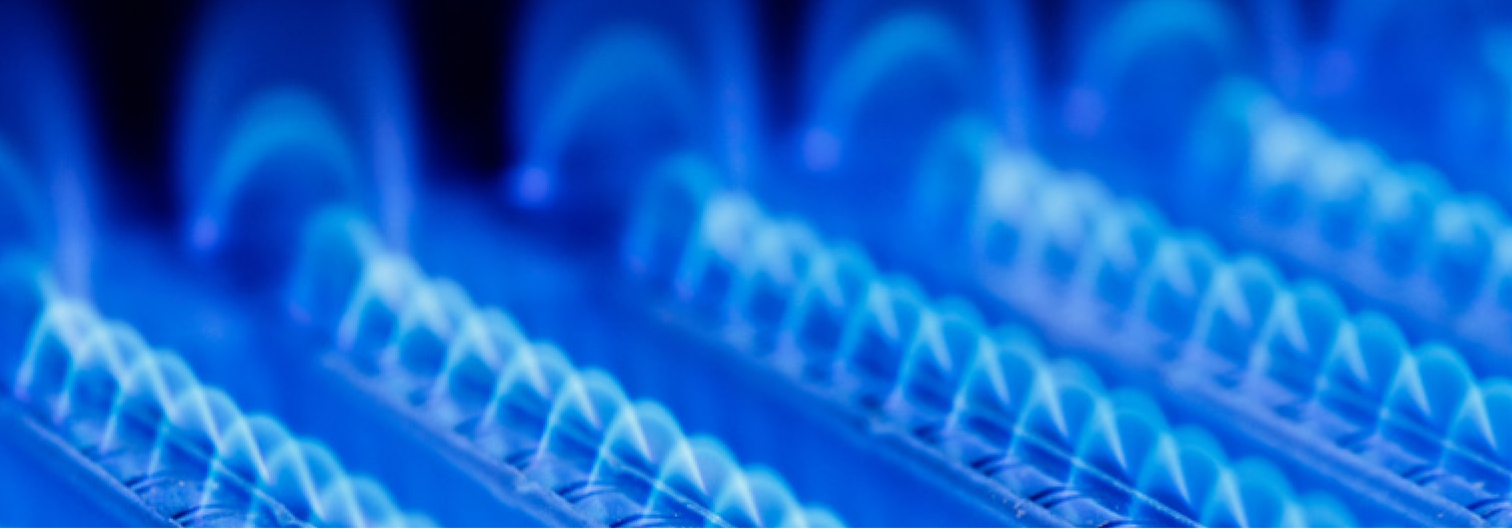
The goal of the equipment manufacturer today is not only to design equipment that can process product at increased product flow rates (over 35,000 liters per hour), operate continuously for more than 20-hours a day, and be easily inspected and cleaned, but also to design equipment that can minimize off flavors and browning.

CURRENT UHT COOKING METHODS

INDIRECT HEATING

With this method the heating medium and product are not in direct contact with each other. As mentioned earlier, the types of heat exchangers are plate and frame, tubular, and scraped surface. The advantage of using these types of exchangers is that you do not need culinary steam since the two media are kept separate. However, each type of exchanger has its own disadvantages.

- **Plate and Frame Exchangers:** While they are typically easy to inspect and take up less floor space than other types of indirect exchangers, they are limited by gasket temperatures and pressures. In most cases the EPDM gasket is limited to a maximum 160°C. The plates, while easy to take apart, can over time become



fatigued as they flex from the constant high temperature steam and lower temperature product passing over the contact surface. Liquid velocities are usually lower for a plate and frame exchanger arrangement and as such can lead to uneven heating and potential burn-on and browning.

- **Tubular Exchangers:** While they have fewer seals and therefore do not suffer as much from gasket limitations or plate fatigue, they typically take up more floor space and are not easy to inspect. Heating may be more uniform, however browning or burn-on is possible because of the large surface area required to achieve the desired set point.
- **Scraped Surface Exchangers:** This type of exchanger forces product through a jacketed tube in which a set of rotating blades is constantly moving product from the outer walls toward the center. The product is more evenly heated and there is less opportunity for product browning or burn-on. Scraped surface exchangers are also more suitable for highly viscous products and products containing particulates. A general negative has always been the time and cost required for inspection and maintenance of this equipment.

A final point concerning indirect heat exchangers is that while they do a good job of heating product at a fixed liquid flow rate, they suffer when the liquid side flow rate varies. The potential for burning increases as the liquid flow rate decreases.

STEAM INFUSION

The general concept is to take the liquid product stream and have it pumped at a higher pressure through a distribution nozzle into a chamber filled with slightly lower pressure, culinary quality steam. This system is characterized by cascading a small volume of product through a large steam chamber. The product then collects at the bottom of the chamber and is fed forward via a timing pump.

Product temperature is generally controlled by pressure. Additional holding time is accomplished through the use of hold tubes, plate and frame exchangers or tubular exchangers. This is followed by flash cooling in a vacuum chamber where all added moisture is removed as needed.

Variations of this method involve 1) pre-heating the product to a desired set point before the addition of direct contact steam, or 2) using the steam infusion method first followed by flash steam removal and perhaps reheating to a uniform set point.

All of these steam infusion methods accomplish the same thing:

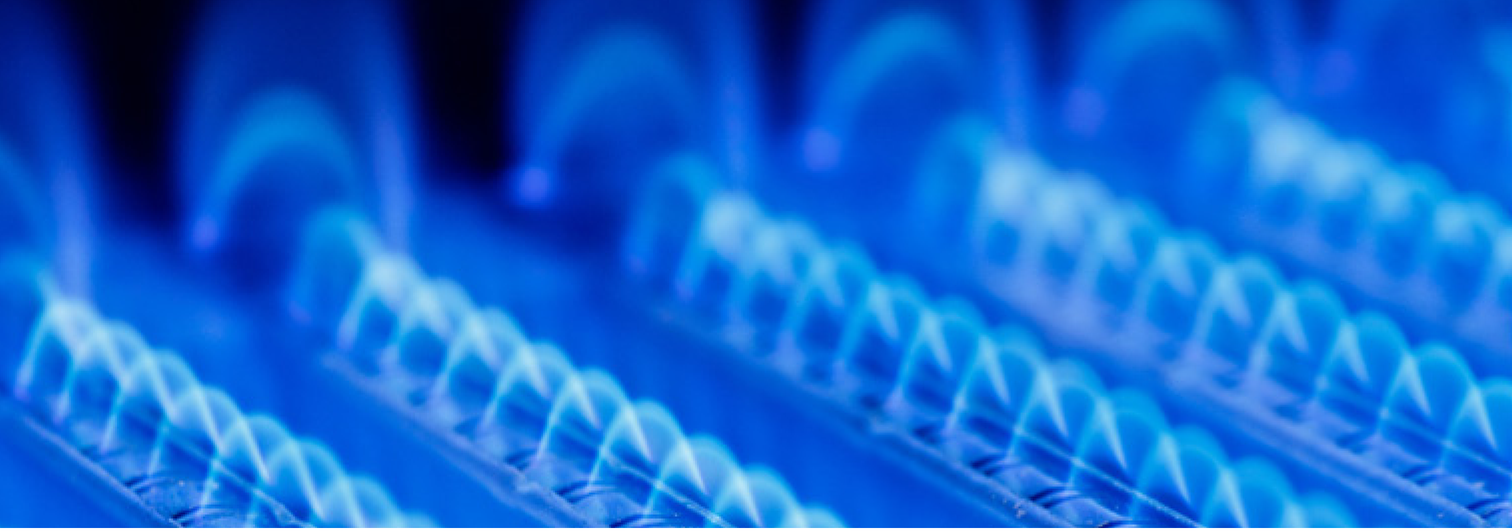
- Instantaneous heating and rapid cooling.
- Lack of overheating or burn-on.
- Heating of low and high viscosity products.
- Use of variable product flow rates.

The negatives of steam infusion are:

- Size: The infusion chambers take up a sizeable amount of useable production floor space.
- Sanitation: These systems are not easily cleaned.
- Capital Outlay: Units require high, initial capital investment.
- Operations: A fairly skilled work force is required to monitor pressures, feed pump flow rates, etc.
- Need for a Timing Pump: Added equipment and operating cost.

DIRECT STEAM INJECTION
MORE THAN A VIABLE ALTERNATIVE

Like steam infusion, Direct Steam Injection uses culinary steam to quickly heat a food product to the desired UHT temperature. Direct Steam Injection blends the liquid stream with the higher pressure steam using multiple orifice injectors, static mixers or venturi type injectors. The key is to get the product to quickly absorb all the steam energy and



elevate its temperature as quickly as possible. *Unlike steam infusion it does not require a large chamber filled with steam with a higher pressure liquid cascading through it to achieve the quick heat transfer of steam and liquid.*

The immediate advantage of this type of mixing is that the mixing chamber isn't much bigger than the liquid transfer piping. The overall assembly has a minimal foot print and the mixing chamber itself is especially small and easy to clean or inspect. Often the chamber requires no more than opening three quick release clamps to remove the device from the process line.

Because the steam has intimate contact with the product, the Direct Steam Injection method maximizes heat transfer. Another important feature is that the same system can, for the most part, process a wide variety of slurries to a desired set point. Some systems, depending on their designs, can even process particulates with little or no product degradation.

Another advantage is that Direct Steam Injection systems are available in a range of sizes capable of handling product capacities from 240-liters/hour to +20,000-liters/hour. Direct Steam Injection systems also require low capital investment, potentially half as much as any other method being considered.

The main disadvantages to using Direct Steam Injection or even steam infusion are:

- Steam injection like steam infusion requires the use of culinary steam.
- Dilution: Added moisture must be removed using an atmospheric or vacuum flash chamber. Depending on product specifications, this can be minimized or eliminated by preheating upstream of the steam injector.
- Sanitation: Current 3A standards call for COP on steam injector systems so a backup unit or removable spool piece should be considered.

TEST RESULTS

One manufacturer of Direct Steam Injection systems and an early pioneer in Sanitary Direct Steam Injection Heating, Pick Heaters, regularly tests a variety of food products to confirm cook temperature can be achieved and maintained while maintaining product integrity.

Recently a series of tests were conducted on whole milk with 4.5% butterfat to determine whether UHT temperatures could be achieved without browning and off flavors. Using 140-psig steam and liquid pressures of 100-psig, their Direct Steam Injection system was easily capable of a 40˚C temperature rise when the product was preheated to 95˚C. The product retained good full-bodied mouth feel, no browning and no strong burnt smell typically found in a UHT process. And while there was a little filming on the injector, it was quickly cleaned using traditional CIP methods.

CONCLUSION

The smaller direct contact steam injection system offers a number of important advantages over the other UHT methods being used today. Direct Steam Injection is more than a viable alternative for UHT processing, and should be given serious consideration.

Michael Campbell, is a Vice President with Pick Heaters, Inc., West Bend, WI (262-338-1191; Fax 262-338-8489). Since joining Pick in 1991, Campbell has made major strides in development of the Sanitary Heater market.

With over 30 years experience working in Research and Service, and concentration in the benefits of direct steam injection for starch based products, Campbell has worked with NCSA, PMCA, AACT and other food organizations to promote the Pick Sanitary Heater and its benefits as a suitable cooker in the jelly and gelatin confectionery markets as well as other food markets.

Bring on the Heat!

Cost, quality and safety concerns of food processors drive improvements in heat transfer systems.

By Mike Pehanich, Contributing Editor

HEAT! ITS application to a mix of ingredients creates a critical control point, a vital stage where issues of quality, safety and, ultimately, cost come to a head.

This heat juncture is often the focal point in the product stream, the defining point where raw ingredient becomes processed product. How carefully and hygienically you move heat from one medium into another may determine the quality and safety of your product.

Heat exchangers enable heat to pass from one medium to another without allowing them to mix. The evolution in heat exchanger technology has been a quest for the perfect tailoring of equipment design and materials to specific processed foods and beverages. Today, that quest encompasses process efficiency as well, namely lower cost and energy consumption and, equally important, running more product through the system.

"When you're designing a system, each process has certain requirements, such as throughput and rate of heat exchange," explains Carlos del Sol, vice president of global engineering systems for Campbell Soup Co., Camden, N.J. "Any equipment you buy for that system must meet those requirements.

"A lot of questions come into play with your selection," he continues. "Will the system be able to do what it's intended to do? What are the energy costs of running it? And then there are issues of maintainability: How long will it run before we have to change a part? How quickly can you clean it? What is the equipment's projected life?"

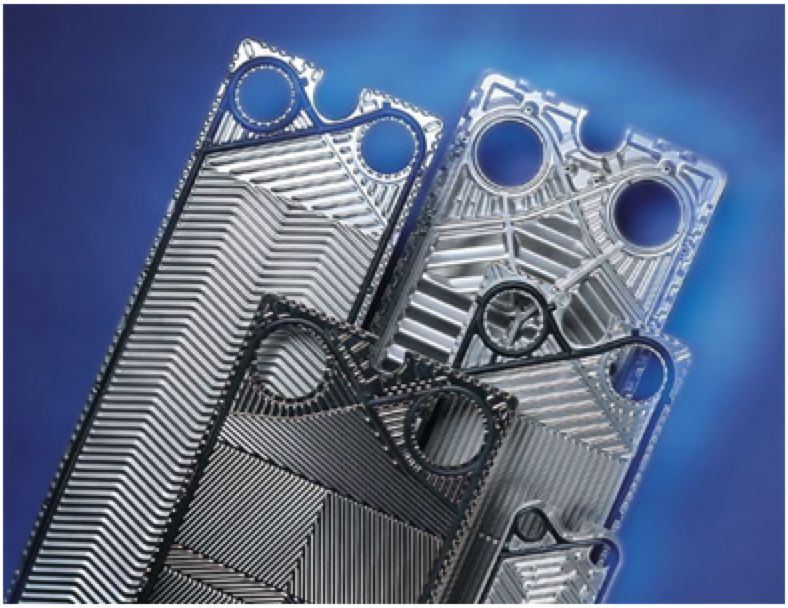
Cost has long been of paramount concern in the product development lab where pennies saved on ingredients convert to dollars on the profit ledger. For a few years now, food processors have been taking equal issue with the cost components on the processing side of the business. The goal may seem simple: produce more and more product at lower and lower cost. But in the real world, notes del Sol, decisions on systems and equipment must strike a balance between product, equipment life, maintainability and overall cost.

Yet cost considerations are never far from a food processor's mind.

"Every manufacturer is trying to get more throughput," says del Sol. "Virtually every manufacturer has a program of cost improvement. Yes, that entails consideration of line speed, but it is also influenced by the uptime of your system. It's not always a matter of how fast your equipment can run. Downtime can take that away. It's what you end up with at the end of the day. Throughput is the name of the game."

Throughput, indeed, factors seriously into the selection of heat transfer equipment these days. It is one of several key factors in the cost/quality equation.

Heat exchanger plates from API Schmidt-Bretten.



BIGGER IS BETTER

Manufacturers of heat exchangers are facing a good news/bad news scenario. The bad news is food processors still have a stranglehold on their moneybags. The good news is some heat transfer equipment, particularly in the dairy industry, is old enough to draw attention from antique collectors.

But another basic need is driving processors into the heat exchanger market. They need "bigger and better" to get the most out of their manufacturing network, bigger heat exchangers, bigger ports, larger surface areas to heat product.

"Processors need to accomplish bigger duties than in the past," says Jeff Ceier of API's Schmidt-Bretten division (www.apiheattransfer.com/), Buffalo, N.Y. "Some food equipment is simply not big enough. That's certainly been the case in much of the dairy industry. The duties of evaporators are getting bigger all the time. The food industry is not in the habit of investing now for results later. But the purse strings are opening."

Melissa Fryer, senior applications engineer for Invensys APV (www.apv.com/), Tonawanda, N.Y., reiterates the theme: "Higher flow rates. Longer run times."

Processors hunting for new equipment are finding more versatile heat transfer systems in their crosshairs.

"Processors want equipment to work with a large variety of products," says Fryer, whose company finds plate and frame heat exchangers its biggest sellers. "Sales of corrugated tubular heat exchangers are on the rise. They tend to be a bit more versatile (than plate and frame heat exchangers)."

"Our Votator II (scraped surface heat exchanger) was designed to be efficient with several process options so that it could be adapted to most heating and cooling applications," says Ray Klusman of SPX Process Equipment/Waukesha Cherry-Burrell (www.gowcb.com), Delavan, Wis. He links the introduction of new food products and ongoing plant consolidation to the expansion of scraped surface heat exchanger use.

"It also had to be easy to maintain," Klusman continues. "For example, the product heads are held in place by a bayonet ring, which does not require bolts. An integral gear motor drive eliminates the traditional drive shaft and motor coupling, and it reduces the overall length or height of the unit by almost two feet."

The Votator II Model 6 x 72 is the most popular heat exchanger for SPX. It offers more than 9 sq. ft. of heat transfer area. Because production efficiency is also a product of effective use of the processing floor, it is available in both a horizontal and vertical mount. The vertical offers space advantages but requires higher ceiling space.

Rapid changeover on flexible lines means that processors are using stronger and more advanced cleaning solutions for quick and efficient clean-in-place (CIP). The demand has forced manufacturers of heat exchangers to employ more corrosion-resistant materials in their equipment, including nickel.

"Many of the scraped surface heat exchangers that we specify today have heat transfer tubes made of 316 stainless steel," says Klusman. "But the thermal conductivity of nickel is about four

The Votator II from Waukesha Cherry-Burrell.

times greater than 316 stainless, so we enhanced the use of that metal by reducing the wall thickness and applying stiffening rings to the outside of the tube to maintain the high product pressure requirements of the equipment. Depending upon the process and the physical properties of the product, the resulting heat transfer efficiency can be very close to that of pure nickel tubes."

ENERGY, CONTROLS

"Energy costs are going up, and no one expects them to come down significantly in the near future," notes Chuck Sizer, former director of the National Center for Food Safety and Technology (www.iit.edu/), Argo, Ill. "So efficiency is important in heat transfer systems."

That may explain the increase in new plate models. Among the primary categories of heat exchangers, plate systems are the most energy efficient. Tubular types rank next. Scraped surface heat exchangers provide no heat regeneration. Despite that fact, they remain popular and at the high end of the technology because they heat product very quickly and, due to constant scraping action, without fouling.

The incentive of energy efficiency is swaying more processors toward aseptic processing of liquid beverages, Sizer observes.

"Aseptic has very good regeneration rates," he says. "Some of the plate heat exchangers employed are 92- to 94-percent efficient. Compare that with hotfill systems, which have a zero-percent rate. There's no recovery. All the energy is gone."

The ongoing effort to simplify operation and maintenance has nudged processors to select more automated equipment, too.

"Our Quad-Drive heat exchanger incorporates a PLC," says Fryer of Invensys APV. She notes that damage from over-tightened plate packs lead to costly and frequent maintenance calls. "But the Quad-Drive system knows the proper closing dimensions. The operator only has to press a button and walk away."

Heat transfer systems are becoming more automated. This APV Quad-Drive heat exchanger incorporates a PLC.

Advanced automation not only enhances quality and trending data, but can also enable processors to make better use of energy, reducing overall manufacturing and operations costs.

Alfa Laval (www.alfalaval.com), Richmond, Va., is introducing to the American market a new heat transfer system that couples features from both scraped surface and tubular heat exchanger designs. The latest model in the ViscoLine series, sold and manufactured by Alfa Laval in the United States under a licensing agreement with HRS, is the ViscoLine Dynamic Unit.

The unit mounts a bundle of parallel tubes

within an outer shell. Product medium flows through the tubes; the service medium flows outside. "This scraped tube heat exchanger with its dynamic plunger is an industry first," says Neil Swift, market manager-beverage and viscous foods for the Process Technology Div. of Alfa Laval. He notes its effectiveness in applications involving crystallization and evaporation of high viscosity products, with or without particulates.

Swift says top food industry players are testing its potential not only with the obvious products such as ketchup, dairy desserts and fruit and vegetable purees, pulps and concentrates, but with evaporating applications. "The applications are so varied, from cooking whole chicken to frying onions to freezing orange juice. Wherever you have a heavy heat transfer duty that is subject to fouling, this unit will work."

The alliance will begin manufacturing the units in the U.S. in September.

LOW-CARB AND SAFETY TRENDS

Heightened awareness to the threats of listeria and bioterrorism has made processors more open to alternative technologies. Advanced microwave pasteurization and sterilization systems could provide an alternative to irradiation to address bacterial threats, including anthrax.

"Microwave technology for in-package sterilization has taken off worldwide, but not here," says Sizer, who also sees opportunity for high pressure systems in the marketplace. Nevertheless, he anticipates advances in validating, controlling and monitoring microwave product that could pave the way for more use of the technology in the processing arena.

"Microwave will work," he says. "You just need to be able to control it. You also have a problem with absorption. Different compositions of food heat differently with microwave."

And now there are special considerations for low-carb products and reformulations.

Low-carb foods are driving changes in heat exchanger selection. The reasons illustrate the importance of versatility in today's processing equipment.

Incorporating features from scraped surface and tubular heat exchanger designs, the ViscoLine series is sold and manufactured in the United States by Alfa Laval under a licensing agreement with HRS.

"Processors are substituting fiber for carbohydrates and fats in the new formulations," says Alfa Laval's Neil Swift. "This leads to more viscous-type products that require a scraped surface heat exchanger."

Processors need very flexible heat transfer systems in today's competitive and safety-conscious world. Shorter runs with a clean-in-place cycle between are the order of the day.

"Another big development is the plate evaporator system for concentrating products," says Swift of a product introduced by Alfa Laval less than a year ago. "We used shell and tube evaporators in the past. They required a larger surface area to perform the same duty. They were less efficient and, with product spending more time in the evaporator, it was subject to greater heat degradation, which lowers the quality of the product." ■

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In 1945, Pick Heaters developed and patented a unique concept of Direct Steam Injection Heating. The original approach has remained unaltered...keep it simple and self-stabilizing, minimize moving parts and make it completely reliable regardless of operating environment. It is this design philosophy that has Pick at the heart of heating for over 60 years in industries ranging from food to chemical and pharmaceutical processing, pulp and paper to power plants.

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- Over 20 years ago Pick expanded its scope of supply to include **CUSTOM DESIGNED, PACKAGED SYSTEMS** including skid mounted pumps, instrumentation and other ancillary equipment to meet customers needs.
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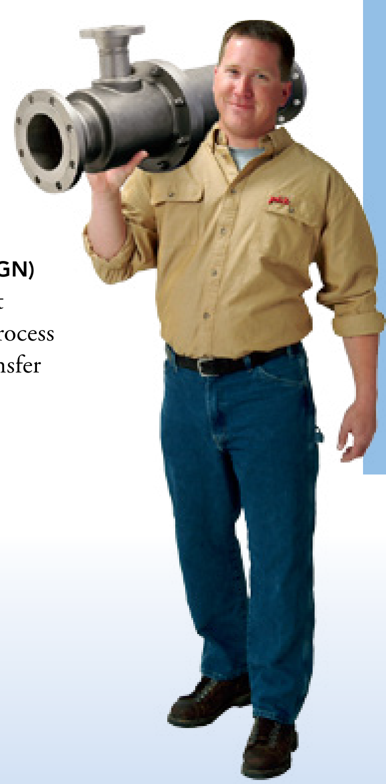

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PICK COMBINES THE RIGHT PRODUCTS WITH THE RIGHT PEOPLE - PICK THE BEST.

New Places to Look for Energy Savings

Lowering pressures, plugging air leaks and updating your motors can have a huge impact on your plant's energy efficiency.

By Mike Pehanich, Contributing Editor

SOARING ENERGY costs — and the chronic risk that they will only climb higher — have altered the economics of the food processor's supply chain. One way processors can get a grip on energy is to maximize the efficiency of equipment on processing and packaging lines.

"The market is being challenged by high energy prices," says Ted Worlick, engineering director for Schneider Electric (www.us.schneider-electric.com), Palatine, Ill. "A lot of companies saw their natural gas bills double. Now we're at a new high plateau for natural gas. Electricity costs continue to head upward."

The challenge is doubled in that processors, who are finally running plants at higher capacity utilization rates, cannot — and should not — sacrifice manufacturing output with equipment replacement or plant modifications. But processors do need to make energy investments that create savings over the long term.

Despite the enormous burden to operations costs that soaring fuel bills have added in recent years, many food companies have yet to take important energy-savings steps: from developing comprehensive energy programs to replacing or modifying equipment to making the necessary plant upgrades to save big energy bucks.

Incredibly, some companies have barely scratched the surface when it comes to processes and procedures to identify waste and save significantly on fuel costs. Heat recovery, capital projects for energy conservation and investment in energy control optimization continue to come on strong and have become more sophisticated — especially for companies that already have plucked the low-hanging fruit with the simplest changes in plant practices.

LOWER PRESSURES, HIGHER SAVINGS

Manufacturers have put energy efficiency high on their priority lists. "We've addressed energy efficiency in heating and cooling, pumping, homogenizing, and fluid and product movement," says Jim LeClair, technical director for APV Invensys (www.apv.invensys.com), WHERE. "Mixing, too. The more efficiently your equipment uses energy, the lower your cost of ownership (the sum of energy and maintenance costs). Your payback comes back quickly."

Today's high efficiency centrifugal pumps, for example, have added 20-30 percent energy efficiency on top of the overall performance efficiency of the pumps, compared to pumps of the 1970s and '80s. "We have gone from 45 percent pump efficiency to 75-85 percent efficiency. That means for every horsepower you put into a pump, you are getting an average 70 percent return. That's a significant difference," says LeClair.

Those are the kinds of savings plant personnel frequently overlook. But the addition of small improvements – even on systems as seemingly inconsequential as clean-in-place systems — can add up to big savings.

Heat exchangers have been other key targets for energy savings. New designs operate more efficiently at lower pressure. Heat exchangers operating at 75 psi today may work as effectively as those that operated at 100 psi in the past.

Manufacturers have focused on pressure and efficiency of heat exchangers to lower energy requirements.

"The lower the pressure drop required to maintain adequate pressure, the less pumping your equipment will need to do," explains LeClair. "As for the efficiency of heat exchange or the heat exchange pump, it is determined by the thickness of the plate and how (flows — port to port and cross flow — across the plate."

Energy-efficient designs can have significant long-term impact on plant energy costs. For example, LeClair touts APV's corrugated tubular heat exchanger for its energy efficiency. "The corrugated tube creates more turbulence and produces a better mixing of heat."

Homogenizers and mixers that require lower pressure to operate also are proving their worth in energy savings.

"The more efficiently you can make a homogenizing valve, the less pressure you'll need and the less energy you will use," says LeClair. In dairy operations, for example, taking a homogenizer's 1,800 to 2,600 psi requirement down to 1,100 psi will result in a huge energy savings.

"We have valve systems that will take pressure requirements down to 100 psi. That's $10,000 to $20,000 savings just due to the pressure difference in one year," says LeClair.

ARE YOUR MOTORS MODERN?

Processors can justify equipment purchases and energy management programs only when they have adequate data. Good data facilitates negotiation for better energy rates. Knowing energy requirements at every significant point in the plant makes it easier to identify problems with power systems and to lower power demand charges. It can also reduce downtime and help avoid blackouts.

Motors are always candidates for efficiency upgrades. Rockwell Automation published a study in 2002 showing the food industry was able to effect total energy cost savings of 12.4 percent in applications with high motor system content by implementing efficiency measures.

Baldor Electric (www.baldor.com), Fort Smith, Ark., the world's largest manufacturer of motors, often quotes a U.S. Dept. of Energy report that claims "electric motor-driven systems used in industrial processes consume some 679 billion kWh, or 63 percent of all electricity used in U.S. industry." It's easy to see how even a small efficiency increase in a motor, multiplied by the millions of motors out there, can add up to huge reductions in electricity use.

In 1992, the Energy Policy Act established minimum efficiency standards for industrial electric motors made after October 1997. But Baldor estimates only 10 percent of all motors in use today comply with those minimum efficiency levels.

Kettle Foods has one of the largest commercial solar arrays in the Pacific Northwest on top of its plant. It generates approximately 120,000 kWh per year.

The greatest gains in energy savings come when processors can integrate improvements from as many of the components of energy consumption as possible. In addition to motors, these include motor controls, power distribution, transmissions and plant floor equipment and processes.

Energy audits, of course, always precede such efforts. Plant drawings and utility bills come into play. Measurements of energy consumption at key points of the operation are critical. Motors driving processing and packaging equipment should be monitored often.

Strategies for improvement include load profiling, measuring electrical consumption over time; demand management to control electrical loads and to avoid demand penalties; and co-generation and the addition of backup energy measures.

PLANT INFRASTRUCTURE NEGLECT

In the late 1990s, Kraft Foods engineers lamented that the difficulty of demonstrating return on investment for capital expenditures indefinitely delayed needed boiler upgrades. They were not alone. Much of the food industry was guilty of the same penny-wise, pound-foolishness, for which processors paid dearly as energy prices skyrocketed.

"When processors should have made investments in the 1990s, capital dollars didn't go into energy systems," says Schneider Electric's Worlick.

"A lot of systems are 15 to 30 years old. We see more attention to them today. Companies are looking at ways to make older systems more efficient, but energy efficiency measures are still fighting hard for attention today."

Companies that avoided upgrades to steam generators and heat recovery systems in the past might want to reconsider. A lot of companies passed up steam trap systems to capture waste heat, steam vent losses and boiler stack losses a few years back. Worlick says they may want to take a second look today.

"The economics that come into play are different today," he says, identifying ionic stack economizers and other pieces of heat recovery equipment surrounding boilers as savings-makers. "If you have a place to put steam back into the process, you are now seeing one- to two-year payback." ■

Simply replacing drafty old doors with modern, energy-efficient ones can be a big energy saver, as discovered by Truitt Bros.

If batch cooking is costing you too much...

Get In-Line.

Pick Sanitary Direct Steam Injection (DSI) systems provide instant, in-line cooking for a wide variety of liquids and food slurries, including those containing bite-size pieces. Batch cooking is time-consuming, wasteful and maintenance-intensive. Continuous cooking with a Pick is a more efficient process that will allow you to reduce costs while retaining product quality.

Common applications include, but are not limited to:

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- Purees
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- Refried beans
- Salsa
- Starch slurries

Get in-line and get your products cooked for less, with a Pick Sanitary DSI system.

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