Who Are the Top 100© Food & Beverage Companies?

Plus...
Business Issues for All Food Processors

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The Top Food & Beverage Processors
Our Top 100® ranks the largest food processors in the U.S. and Canada.

By Dave Fusaro, Editor in Chief, Food Processing

Two things strike us as we examine this year’s list of the 100 largest food & beverage processors in the U.S. and Canada:

• A couple of companies have become so big and unfocused that they will or already have split into two companies.
• 2011 was very tough year on some of these companies.

This is our 37th annual Top 100®. It ranks food & beverage processors based on their sales of value-added, consumer-ready goods that were processed in U.S. and Canadian facilities. You won’t find a comparable list anywhere else; you won’t find many of these figures anywhere else, either.

The first thing we remarked on last year at this time was just one company out of that whole bunch reported a loss in 2010. That dubious distinction belonged to Dole, which got squeezed by both lower banana production worldwide and weaker pricing – how does that happen?

You’ll notice one additional 2010 loss in this year’s chart. Michael Foods was a private company in 2010 and did not report earnings, but in its pro forma computations, it acknowledged a loss in 2010.

We can’t say the same this year. Dole recovered, to a $38 million profit, but six others swung into the red. At the top of that list is Dean Foods, which swung from an $83 million profit in 2010 to a $1.6 billion loss in 2011.

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Notes:
1. Fiscal year was 53 weeks.
2. For companies listing in euros, year-to-year comparisons may not be fair because the euro was significantly lower at the end of 2011 than it was in 2010.
3. Does not include raw milk transportation.
4. Total sales and income figures are for parent Marfrig Alimentos SA, Brazil.
5. Formerly referred to as Lala USA, and earlier National Dairy Holdings.
6. Previous year’s figures were for predecessor company Lance Inc.
7. Payments made to co-op members.
8. Formerly part of Fortune Brands, spun off on October 3, 2011.
9. Subjective adjustments were made to company financial statements.
10. Estimate.
11. Figure is restated from what we carried last year.
### FOOD MERGERS UP, BUT SLOWING

The Food Institute recorded a total of 381 mergers in the larger food & beverage industry in 2011, an increase of about 20 percent over the 317 deals in 2010. While the numbers are comparatively high when considering the lull in 2009 that followed the recession, when deals dropped to 264, they’re well below recent highs of 422 in 2008 and 473 in 2007, when credit was good and money was cheap.

Among just food & beverage processors, the results are similar: 63 mergers were completed, another 17 are still pending — higher than the 58 in 2009 and 2010 but below the 110 recorded in three consecutive years: 2006-2008.

(The Food Institute includes in its definition of the food industry a number of other entities, such as brokers, consultants & other service providers, investments firms & banks, packaging & equipment suppliers, raw product & ingredient suppliers, restaurants & foodservice, retailers, and wholesalers & distributors.)

To add to the confusion, the activity also marks the re-entering of private capital and investors into the food industry, the institute notes.

In addition to prominent deals: On Oct. 3, 2011, Sara Lee Corp. completed the sale of its North American refrigerated dough business to Raley’s Holdings for $545 million. That presaged Sara Lee’s split (concluded this June) into an American processed meats company (Hillshire Brands) and a new consumer coffee company (Keurig Green Mountain). As part of that strategy, Sara Lee also sold a majority of its North American foodservice, coffee & tea operations to J.M. Smucker Co. for $355 million, and acquired AriZona Sausage Co. for $87 million.

Raley’s was the target of an acquisition itself, but refused to talk with ConAgra Foods about its $5.18 billion takeover bid, which began in early 2011 and was worth $1 billion after ConAgra’s offer in May. Raley’s refused to talk with ConAgra, which it had bought from Kraft in 2008.

Raley’s was forced into it. With ConAgra edging a semi-public campaign through most of 2011 to buy the company, because of ConAgra’s burgeoning interest in private label, Raley’s responded by reworking its 2010 financials, which were published in “industry-wide” fashion in March from Kraft in 2008. That makes Raley’s again an overwhelmingly private label company. (Since the Post acquisition, the spirits company can’t be considered a purely food company.)

ConAgra was the target of a sprawling split last year, with ConAgra chairman and CEO Gary Roden on the short list of potential buyers. ConAgra was a sprawling company with $13 billion in annual sales, and Raley’s refused to talk with ConAgra, which it had bought from Kraft in 2008.

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By the end of 2011, ConAgra was a sprawling company with $13 billion in annual sales, and Raley’s refused to talk with ConAgra, which it had bought from Kraft in 2008.

### Mergers & Acquisitions 2011 2010 2009 2008 2007 2006 2005 Agricultural Cooperatives 1 0 1 5 NA 0 0 Diversified Firms 17 10 5 0 9 5 5 All Food Processors 63 58 58 110 110 2 2 Brewers, Distillers, Wineries 6 4 8 4 3 2 1 Bakeries 2 3 2 6 1 0 0 Confectioners 4 1 2 3 15 3 7 Dairy 3 5 7 5 12 6 3 Fruit & Vegetable 3 2 4 7 25 27 27 Meat 7 3 3 13 11 11 11 Multi-Product 26 21 16 43 14 3 3 Poultry 4 5 4 4 7 2 1 Seafood 2 2 3 8 0 0 0 Snack Food 4 5 3 2 16 8 8 Other 3 2 4 15 16 16 16 Soft Drink/Water/Juice 5 12 20 19 0 0 0 Total 285 228 264 392 368 1

1. In addition to deals closed in a given year, there are some that carry over from the following up year. There are 50 such acquisitions that did not close in 2011. 2. There are seven other categories (e.g. restaurants, retailers) that are not included in this table, but are in the final numbers.

**Source:** The Food Institute
Get In-Line.

Heating Methods for Ultra-High Temperature Pasteurization

By Michael Campbell, Pick Heaters

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 180-189°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 air tight 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 2-5 seconds, and yields a shelf stable product that can be stored for extended periods 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—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 throughout 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, and 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 production 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 a 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 of 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 burning 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.

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 more efficient and will allow you to reduce costs while retaining product quality.

Common applications include, but are not limited to:
- Baby foods
- Pie fillings
- Purees
- Rice cereal
- Sauces
- Baby cereals
- Gravies
- Puddings
- Refried beans
- Salsa
- Starch slurries

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- Pie fillings
- Purees
- Rice cereal
- Sauces

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

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 include 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 injection 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 sizable 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

Like steam infusion, Direct Steam Injection uses culinary steam to quickly heat or cool foods. Because the product is in direct contact with the desired UHT temperature, Direct Steam Injection lends the liquid stream with the higher pressure steam. Direct Steam Injection systems are available in a range of sizes capable of handling product capacities from 240 liters/hour to more than 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 injection 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 percent butterfat to determine whether UHT temperatures could be achieved without browning and off flavors. Using 140-psi steam and liquid pressures of 100-psi, their Direct Steam Injection system was easily capable of a 40°C temperature rise when the product was preheated to 95°C.

Pick Sanitary Heater with a threaded steam line consisting of an iron steam strainer, steam control valve and sanitary non-return check valve.
Gamajet, part of the Alfa Laval Group, designs and manufactures customized solutions for cleaning tanks, vessels, mixers, totes, and more in the food and beverage processing industry. Gamajet® rotary impingement tank cleaning machines are automated and fluid-driven, completely eliminating the need for confined space entry and excessive water and chemical usage.

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Rotary Impingement Tank Cleaning Equals Significant Water and Cost Savings

By Gamajet

Tank cleaning has always been viewed as a necessary evil for manufacturers. During the cleaning process, a significant amount of resources (time, chemicals, water, electricity and labor) is required between batches not only to appease FDA standards but to ensure a reliable, uncontaminated, quality batch is produced. Although these repeating expenditures have a significant effect on the bottom line, there are food and beverage manufacturers that continue to rely on outdated yet standardized technology for cleaning, not realizing the potential opportunity for substantial cost reductions and revenue recovery through CIP optimization.

To understand how to optimize a cleaning process, one must first understand the basics of cleaning. Herbert Sinner, a former chemical engineer for Henkel, first summarized the basic principles of cleaning in 1999. His summary, now referred to as the Sinner’s Circle, describes the factors that can be manipulated in any cleaning scenario: Temperature, Chemical Action, Time and Mechanical Force.

When the effectiveness of any factor is reduced, it must be compensated with the increase of one or multiple other factors. Washing dishes is an effective example of how the four factors interact. Hot water (temperature) is going to remove stuck on food better than cold. Adding soap (chemical action) makes the process even easier, and you can either soak a dish overnight (time) or scrub the dish clean (mechanical force). When cleaning tanks, it is imperative to examine not only the effectiveness of the cleaning process but the efficiency as well, especially in such a competitive market.

Sinner’s Circle can be easily applied to tank cleaning as a way to compare the efficiency of processes. The most common tank cleaning processes are: wetting (static spray balls), rotary wetting (rotary spray balls), boiling out, manual cleaning and rotary impingement cleaning. Rotary wetting and wetting are more easily understood as a “cascading method.” By applying massive amounts of cleaning solution to the tank interior, the residue eventually erodes off. This results in a significant amount of time and effluent consumption and a minimal reliance on temperature and mechanical force (the average force from a spray ball, rotary or static, is approximately .01 lbs). The effectiveness of this cleaning process is accurately described as “fast,” often resulting in additional manual cleaning (scrubbing and scraping). The boiling out method offers a similar cleaning at an even slower rate, with even more effluent and temperature, and no mechanical action. Manual cleaning, on the other hand, offers a reasonable amount of mechanical force, with minimal effluent but often results in ineffective cleaning, due to human error. Also, with safety in mind, lower temperatures must be utilized therefore increasing time. Rotary impingement cleaning utilizes the most mechanical force than any other process, therefore reducing time and cleaning solution drastically. Additionally, a repeatable and reliable result is assured.

How rotary impingement works

Rotary impingement tank cleaning machines combine pressure and how to create high impact cleaning jets. Cleaning occurs at the point at which the concentrated stream impacts the surface. It is this impact and the tangential force that radiates from that point which blasts contaminants from the surface, scouring the tank interior. In conjunction with this impact, these machines are engineered to rotate in a precise, repeatable and reliable, 360-degree pattern. This full-coverage, indexing pattern ensures the entire tank interior is cleaned, every time. This combination of impact in a controlled indexing manner results in an economic homeron, because impact is a one-time investment; chemicals, temperature and time are continual, never-ending expenditures.

Following are three specific incidences in which rotary impingement tank cleaning was used to optimize an outdated cleaning solution.

Example 1: Rotary Impingement vs. Fill and Drain

One of the largest hot dog manufacturers was seeking a solution to the abundance of waste water the facility produced. A majority of the focus was spent trying to alter the manufacturing process, which resulted in minimal savings. Eventually they upgraded their entire CIP process, and the final water savings were staggering.

The company utilized a fill and drain cleaning process to clean a series of four ribbon blenders which were used to mix processed meat. Cleaning was required daily, between each batch. The effectiveness of the clean, when dealing with such meats remained the primary concern. The residue, a buildup of oil and fats, and the surfaces of blind spots due to the tank design, caused even more difficulties for the company to clean. Like most food and beverage companies, their cleaning process proved effective enough, thus the cleaning method remained the same for many years. The process included filling the tanks with water and agitating the blenders. This
In one of the world’s largest kettle manufacturing companies, the Gamajet was used to clean kettles from a blender.

Three Paths to a Better Bottom Line

Acquisitions, emerging markets, energy efficiency may help you compete.

By Chris Nay, GE Capital, Corporate Finance: Special to Food Processing

These are challenging days for companies in the North American food processing industry. Overall growth is slow, with most categories tied to incremental population growth in the low single digits. At the same time, profits are being squeezed by escalating commodity costs, which food processors can’t easily pass along to price-sensitive consumers. What’s more, many retailers are holding the line on price increases and forcing processors to absorb extra costs.

Of course, low growth and difficulty in passing along costs are not new developments, but they are becoming the new normal for the industry. To survive, companies will need to find creative ways to step up growth, gain pricing power and reduce their own costs to improve margins. These are ambitious goals, but they are achievable. In fact, companies are already pursuing several pathways to improve their bottom lines, including making strategic acquisitions, entering emerging markets and improving energy consumption.

Strategic acquisitions are particularly compelling today given the ample liquidity in the market. Bankers like the stability of the food & beverage industry and are willing to offer relatively aggressive financing – e.g., higher multiples of EBITDA (earnings before interest, taxes, depreciation and amortization) – to facilitate deals.

In fact, M&A among food processing companies ticked up in 2011. Among food and beverage processors, 65 mergers were completed in 2011, according to the Food Institute. That’s higher than the 58 in both 2009 and 2010, but below the 110 recorded in the three consecutive years from 2006-2008.

Strategic acquisitions are a way to grab market share and boost growth. But they are also an avenue to high-growth niches with more pricing power. The recent acquisition of Bolthouse Farms for $1.95 billion by Campbell Soup is a case in point. With the purchase, Campbell is making a foray into the packaged foods category. The $12 billion category is growing at nearly 7 percent – much faster than traditional grocery staples. The deal is also evidence of the ample liquidity in the market. Campbell is paying 9.5 times Bolthouse’s EBITDA.

A second growth strategy for food processing companies is to look overseas to grow organically or through acquisitions – specifically to the fastest-growing emerging markets where a nascent middle class is driving dramatic changes in food preferences. For instance, spice maker McCormick & Co. made several emerging market acquisitions in 2011 that helped boost sales by 11 percent to $3.7 billion. Ramos SA, a Polish company that makes spices, seasonings and mustards, and KuboNoo Foods Ltd., an Indian company that sells basmati rice and other foods.

McCormick and other companies are enticed by a growing middle class that is adding more protein (meat) and vegetable oils to its diet. It’s also consuming more processed foods, as women move into the workforce and have less time to prepare meals at home. These long-term demographic trends bode well for food processing companies. Consider this statistic from McKinsey: By 2025 China’s upper middle class will comprise 520 million people with a combined disposable income of $2.1 trillion.

Acquisitions and forays into emerging markets are not the only levers to improve the bottom line. A third pathway is reducing costs and vigilantly driving efficiencies wherever possible. One cost center that many food processing companies are paying particular attention to is energy consumption. In most manufacturing processes, food processors need both electrical and thermal energy that they purchase through public utilities. To better manage these costs, some companies are taking a closer look at Combined Heat and Power (CHP), which allows the processor to improve thermal efficiency.

CHP is not a new technology, but its adoption has been held back by the capital expense of building these facilities on site and the slow payback. But some companies – such as Unilever – are avoiding this major capital outlay by partnering with an energy services company (ESCO) or independent power producer (IPP). These companies build the power facility on site for the food processor, which then buys the cheaper energy and reduces greenhouse gas emissions without spending its own capital. This frees up capital to drive the business side.

Making strategic acquisitions, entering emerging markets and improving energy efficiency are just three pathways to a better bottom line. What’s critical – given the exceptional challenges in today’s global business environment – is that executives think creatively about both the cost and revenue sides of their operations. Only then can they hope to out-innovate competitors, create a sustainable advantage and improve the bottom line.

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Click here for the full version of this white paper.
Corrosion of steel operating equipment and piping under insulation has been recognized as an important problem in the ammonia refrigeration, chilled water, chemical and petro-lem industries. Insulation is a necessary component and there to function in three ways: save energy, control process temperatures, and protect workers from high wall temperatures. The environment under insulation, the CUI environment, can be hot, wet, and promotes aggressive corrosion.

The American Petroleum Institute has directives that address the CUI problem and detail a program of identification, maintenance, and remediation. These directives, as well as efforts by professional societies (NACE and ASTM), promote the development of new solutions. The issue in achieving a good end result is that no clear solution exists for new installed piping as well as maintenance and remediation of existing installations.

NACE Standard RP0198-98 [1] is an excellent source of information for preventing corrosion under insulation, but many corrosion engineers would agree that electrolytes will eventually find their way into even the best system. Selecting the right coating is extremely important. The coating is the last line of defense for keeping the electrolyte from the metal surface and preventing corrosion.

Recent coating innovations include a hydrophobic anti-corrosion gel that is tolerant of less than optimal surface preparation, is designed to keep the electrolyte away from the surface of the substrate, and also has the ability to neutralize the electrolyte if it breeches the vapor barrier and insulation.

**Technology**

The reactive anti-corrosion gel utilizes mineralization technology. Mineralization is the ability to grow very thin minerals on metal surfaces for useful purposes. The minerals are formed when reactants are delivered to the surface of the substrate as shown in Figure 1.

How the reactive gel corrosion treatment works:

1. **When the ferrous (steel) surface (1) is covered with a layer of reactive gel (2), the metal surface reacts with components in the gel to form a mineral layer (3).** This thin, glasslike layer (3) acts as a barrier between chlorides and the metal surface, thus providing corrosion resistance. The mineral layer (3) has a thickness of 50-200 angstroms, only 0.01 percent as thick as a piece of paper. Although the thin mineral layer can be damaged by mechanical abuse, there is extra protection built into the system.

   The presence and uniqueness of the mineralized layer can be confirmed by conventional analytical surface methods such as X-ray photoelectron spectroscopy (XPS) or atomic force microscopy (AFM) (Figure 2 and Figure 3).

2. **Barrier system –** The specially formulated products have great adhesion characteristics and are hydrophobic to help keep moisture away from the substrate.

3. **Buffering system –** If moisture migrates through the gel, it is buffered to a high pH which is protective to steel piping.

4. **Mineralization –** Growing an engineered surface, or surface conversion – creating a surface which resists corrosion even if moisture gets to it. The anti-corrosion gel has a maximum service temperature of 350°F (177°C).

**Background**

The mineralization technology in the anti-corrosion gel has a history of solving unique corrosion problems. The first application of the mineralization technology was by a major automotive supplier in a crevice corrosion application on the strand of brake cables. The design of the brake cable combined with the cyclical environment of...
heat and moisture creates a severe crevice corrosion environment. The technology has been used for over 30 years in this application, which has resulted in a reduced service life and greater reliability.

The first non-automotive industrial application was with the US Navy. Following successful laboratory, pilot side, and shipboard demonstrations of the effectiveness of the gel in preventing crevice corrosion in anchor chain detachable link cavities, the US Navy in 1999 changed the Planned Maintenance System (PMS) to specify the use of a mineralizing gel as the replacement for white lead and tallow in all surface ship anchor chain detachable links. Also in 1999 following extensive testing, the Navy issued MACHALT 526 which changed the design of the interiors of weather deck watertight and air tight door dogging mechanisms. The basis for the change is the use of a mineralizing lubricant inside the spindle sleeve in the door frame to stop the corrosion that had been the cause of dogging mechanism failure. The watertight door dogging mechanism corrosion problem was one of the top maintenance issues for the fleet. In May 2002 a second MACHALT 544, was approved to apply the same technology to ballistic type watertight doors in DDG-51 Class ships. These solutions have resulted in an increased service life and greater reliability.

The gel has years of history on Corrosion Under Insulation applications in the Food & Beverage Industry. It has also been used as an anti-corrosion coating in well head casings, on pig doors, structural cations in the Food & Beverage Industry. It has also been used as an anti-corrosion gel to protect pipes in an aerated bath of 5 percent salt solution. One glass-bead-blasted and non-coated sample were pulled at 7, 31, 80, 138-day, and 1-year intervals. The results of tests show a very distinct line separating the sections of the iron pipes that were treated with the anti-corrosion gel and the sections that were left untreated. The untreated pipe sections had significant corrosion at 7, 31, 80, 138-days, and 1-year intervals. There were no sign of corrosion on the coated sections of the pipes. Performance of the gel was good even with minimal surface preparation prior to the application.

ISOthermal: One such laboratory test was a simulated CUI cell under isothermal and wet/dry cycling test conditions [2]. The test conditions selected for the research program were (1) isothermal and (2) wet/dry cycling. The isothermal tests included maintaining the temperature at the ring surfaces at 150°F (65.5°C) continuously. The wet/dry tests included two cycles of maintaining temperature at 150°F (65.5°C) (wet) for twenty hours followed by a 250°F (121°C) (dry) for four hours. The samples were evaluated using electrochemical polarization resistance data per ASTM G39 and mass loss (ML) data per ASTM G1. The results of the test were that the anti-corrosion gel reduced the corrosion rate by a factor of ten and was effective in four practical applications: on bare steel at isothermal (isothermal at 150°F, 65.5°C), on pre-corroded steel at isothermal (150°F, 65.5°C) on bare steel in wet/dry environment (150/250°F, 65.5/121°C, cyclic), and on pre-corroded steel in wet/dry environment (150/250°F, 65.5/121°C).

Weight Loss: ASTM B117 Salt Spray Protocol was used to evaluate the anti-corrosion performance. The ASTM B117 protocol simulates a severe corrosion environment using salt-water spray. The control coupons (bare steel) were tested alongside the coated samples to insure a predictable corrosion rate. A total of 10 samples (1/2 x 3 x 0.062 inch 1020 steel coupons) were used for this test. The coupons were weighed prior to being coated or being placed in the ASTM B117 cabinet. 5 coupons were coated with approximately 20 mils of gel (Group #1) and 5 coupons were left uncoated to be used as controls (Group #2).

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One of the major concerns for the food industry is the state of the global economy. Europe, Canada and Japan have become critical banking partners to U.S. industries. Unfortunately, recent European crises have further emphasized the need to have a variety of funding resources, including a strong U.S. partner. A diverse base of financial partners helps reduce the impact on capital resources when there is stress in one segment or region of the financial community. A banking partner can help prepare these businesses to compete more effectively in the global marketplace, positioning them with capital resources that will help them successfully ride the waves of uncertainty and market conditions.

Every business cares about having access to money. What the banking industry can add to current financial conversations in the food industry is experience with how access to capital is influenced and obtained. Specialized banks can:

• Help forge strategies and serve as advisors to C-level executives to help them plan for future capital needs.
• Identify obstacles in international trade and expansion.
• Build relationships with equipment vendors and service providers.
• Share insights about why parts of the world are experiencing financial crises while others are struggling to keep pace with prosperity.

Banks have billions of dollars invested in food businesses, and are active participants in the ebb and flow of the industry. More importantly, they want to see their clients succeed. These industry-specific lenders are working to ensure that capital is available at any point along a product’s lifecycle to help food companies get their products onto store shelves and into the hands of consumers.

Specialized Banks Support the Industry

Challenging times make financial understanding more critical.

By Elizabeth Hund, U.S. Bank; Special to Food Processing

If no secret the past several years have been challenging for the food & beverage industry. Food processors and manufacturers are deal-
However, the food item—from frozen pizzas to fresh burritos, baked goods to candy, or health bars to processed cheese—the need for transporting food products from initial receipt of raw materials through each process stage in the food production line with high throughput, minimized product damage and a high level of product safety is of critical importance.

Despite utilizing the best processing equipment to manufacture and package food products, if the material handling systems being used for moving these products into and out of the equipment is inefficient then the finished products and throughput volume will be compromised. Yet, too many food manufacturers are plagued with conveying equipment that is not ideally suited to address the needs of their particular food processing and packaging applications.

One industry that is heavily dependent on the use of conveying systems is breakfast cereal manufacturing, where a variety of different conveyor applications, with varying levels of efficiency, have traditionally been utilized to transport cereal products between sequences of processes.

**Conveying Challenges in Breakfast Cereal Production**

Breakfast cereal processing plants are beset with several critical conveying challenges. One of the most important is ensuring that the finished product, once it has gone through its various processing steps, emerges undamaged before its final packaging. Keeping the clusters, loops, puffs and flakes whole can be a significant challenge, however, given that at the end of most machine processing steps the product falls, it is dropped down onto a conveyor system before being taken to the next process. The idea is to get that product through the processes and into the packaging as gently as possible to avoid breakage.

Breakfast cereal plant managers and plant engineers know that how their product is conveyed during the entire manufacturing process plays an important role in ensuring minimum waste as raw goods are transformed into finished cereal products ready for packaging. Product contamination is another key issue influencing conveying in breakfast cereal production. In every step of the process, from receipt of raw materials through packaging, precluding any foreign matter from entering the process stream is a critical objective. Traditionally used in cereal processing, bucket elevators and belt conveyors, having an open profile, not only permit the entry of cereal dust and foreign particles into the food stream, but they also promote and spread dust because of their exposed format. This opens the door to contamination and unwanted spread of allergens.

This problem is particularly evident during product transfer between the coating, drying and packaging operations, where there is exposure to a combination of different ingredients. The importance of the product contamination issue is magnified with increasingly stringent governmental and industry mandates, and consumer demands for maintaining product integrity and safety.

Line changes have become a focal issue in breakfast cereal plants relative to both cleanliness and speed of changeovers. Companies are trending more and more wanting to run different product lines within a shift or day. Despite these changes, processing plants are expected to maintain stringent levels of sanitary operation. This can be a time-consuming challenge when cleaning conveying systems.

Bucket elevators and belt conveyors are particularly notorious for requiring significant time for cleaning because of their various interlocking components. Every minute spent disassembling a conveyor system for cleaning consumes valuable production time. Yet, if not cleaned properly, that batch of cereal that needs to be discarded in-process because of contamination is lost profit. Or worse, consumers could be negatively impacted, resulting in potential injury, costly recalls and impacted brand reputation. To resolve these issues, cereal processors are charged with administering changeovers as quickly as possible while maintaining 100 percent system cleanliness.

**Traditional Systems for Conveying Breakfast Cereal**

For decades, open conveyors, such as flat-belt conveyors and bucket elevators, have been the predominant systems used to transport breakfast cereal products through the manufacturing process, from raw materials through packaging. But, because of the limitations of these open conveying systems, cereal processors have gradually moved to utilizing other conveyor types, dominated by closed-system tube conveyors. Like the open conveyors, they each have design strengths and weaknesses. Following is an assessment of the major types of systems being employed in breakfast cereal processing.

**Flat-Belt Conveyors**

Although this type of conveyor can handle cereal products gently, the product is exposed to ambient contamination, unless covered. The cover, however, collects cereal residue and must be removed and cleaned between runs to reduce the risk of cross contamination, a usually tedious task. The cereal product when introduced onto the conveyor is typically dropped from the processing machine, which produces dust and at that point can cause product damage.

**Bucket Elevators**

Bucket elevators use a continuous line of buckets, either attached to each other on a rubber belt, or attached by pins to two endless chains running over tracks and driven by sprockets. Centrifugal force throws the cereal out of the buckets into a dis-
charge spout as the buckets pass. This type of conveyor can transport fragile materials with minimized product damage. But the system can be very dusty, as dust is generated when cereal is loaded into the buckets and while the product is being conveyed, resulting in residue build-up which can cause cross-contamination. The excessive dust produced can also open the door for dust explosions.

Pneumatic Conveyors — These systems use air to move cereal from extruder to packaging, by generating air pressure levels that are either above or below the atmospheric pressure. There are two main types of pneumatic conveyors: the dilute phase conveyor and the dense phase conveyor, which differ by rate of speed and pressure. Both of these systems can be set up as a pressure or vacuum system. Pneumatic conveyors enable flexibility, allowing them to reach many multiple destinations with one system. They are also able to convey cereal at very high rates without product breakage, and with minimal dust dissemination. One of the main problems with this type of conveyor is its high power consumption. Pneumatic conveying is the most expensive method for moving cereals.

Auger Conveyors — Known as flexible screw conveyors, they can transport cereals vertically, horizontally and at any angle. They consist of a stainless steel flexible screw enclosed in a rigid steel tube or flexible plastic tube driven by a motor. The enclosed tube rotates around a central shaft, transporting the cereal according to the screw design and rotational direction. When the breakfast cereal reaches the end of the tube it is discharged into the process machine or container for packaging. These conveyors have a throughput of up to 100,000 pounds per hour. Auger conveyors, however, have limitations on how much product they can transport before effecting product breakage, which can be significant. Also, internal cleanliness can be an issue resulting in a cross contamination risk, and the need to disassemble the unit on a regular basis for cleaning.

Aeromechanical Conveyors — A completely enclosed, high-capacity mechanical conveyor that can move breakfast cereal vertically, horizontally and at varying angles. Within a stainless steel tube, a wire rope with evenly spaced discs travels at high speeds, running in sprockets at each end of the conveyor. The high-speed action generates an internal air stream traveling at the same high velocity as the discs. As the cereal is fed in, the air stream aerates, or fluidizes it, and carries it to the packaging outlet, where it is discharged by centrifugal force. The system can move up to 240,000 pounds per hour of cereal. A drawback to this system is that the flow of product can easily become inhibited, causing the conveyor to run without transporting cereal at expected throughput volumes. Downtime is also a factor because the tension on the wire rope needs to be adjusted at regular intervals.

Tubular Drag Chain Conveyor — This conveyor gently moves breakfast cereal through a sealed tube with a drag chain pulled through it on a loop. Solid circular discs (flights) are attached to the chain, which push the cereal through the tube. This system can move up to 80,000 pounds per hour throughput of cereal, and can run under either pressure or vacuum modes. One of the drawbacks to this system is the tendency of the chain to accumulate cereal debris build-up, which poses a cross-contamination risk, so it needs to be regularly removed. Also, the chain-drive components need to be regularly adjusted to keep the system in registration, which increases downtime.

Tubular Drag Cable Conveyors a More Efficient Solution

Embodying these requirements, the tubular drag cable conveyor, developed by Cablevey Conveyors, is fast becoming the system of choice for product movement through all phases of breakfast cereal production. The system gently moves friable cereals through an enclosed tube without the use of air. This latest generation of tubular drag cable conveyors can transport up to 49,000 pounds of breakfast cereal product per hour, at low speed, and with product degradation practically eliminated.

Similar to tubular drag chain conveyors, tubular drag cable conveyors gently move product through a sealed tube, but instead using a patented, coated, flexible stainless steel drag cable pulled through on a loop. Solid circular discs (flights) are attached to the cable, which push the cereal through the tube. The coated cable ensures that no debris accumulates within the strands of the cable, as the cable is totally sealed.

Designed for quick cleaning, quick line changes, and maximized system uptime, the tubular drag cable conveyor system employs sophisticated cleaning mechanisms to reduce debris build-up. The flexible design of this completely enclosed system keeps contamination out, while enabling it to be cleaned-in-place at multiple points from cereal build-up. For example, an air knife at the product discharge location in the system automatically releases food particles from the discs and cable. Also, urethane wiper discs attached to the cable eliminate any residual debris from the conveyor system while in progress.

To increase uptime, the system is equipped with a cable self-tensioning device, as different from other conveying methods which require continual adjustments to their mechanical operating systems.

The tubular drag cable conveyor operates on low horsepower, utilizing energy-efficient variable-speed motors of 5 HP or less, effectively consuming minimal power compared to other conveyor systems utilized in breakfast cereal manufacturing. The system’s production flow can be adjusted to variable speeds.