Sugar is ubiquitous. It delights our taste buds and tummies. Sugar is one of the ingredients that makes birthdays, weddings, and the holidays special. Sweets represent events and people that we hold dear, and sweet treats are often associated with things that make us happy.

Most people probably think of sugarcane as the source for granulated sugar, but sugarbeets were being grown to satisfy sugar demand in Europe as early as the mid-1700s. Andreas Marggraf was a German chemist credited with making a crude extraction from pulverized beet roots. Marggraf showed that the crystals formed from the extract were identical to sugarcane crystals. Franz Karl Achard continued Marggraf’s work, developing processing methods for extracting the sugar, and selecting beet types that were shown to have higher sugar content.

The early days of the sugarbeet industry largely took place in crude factories that sprang up in France during the Napoleonic wars that were fought in the late 18th and early 19th centuries. During the wars the British blockaded shipments of cane sugar to Europe, which effectively stimulated the rapid growth of the European sugarbeet industry. By about 1840 approximately 5 percent of the world’s sugar came from sugarbeets. Just 40 years later that number had grown to roughly 50 percent.

**Beets in the United States**

Eventually, sugarbeet cultivation made its way to the United States. The first successful US sugarbeet factory was built in 1879 by E.H. Dyer in Alvarado, California. The industry grew quickly, and by 1917 there were 91 commercial sugarbeet factories operating in 18 states.

Subsequent decades saw continued advances in the industry, which over the years experienced growth in production volume while seeing a consolidation of processing facilities. By 2005, 23 highly efficient sugarbeet factories operating in 10 states were responsible for processing 30 million tons of sugarbeets grown on approximately 1.4 million acres. Today, more than 4.5 million tons of sugar is produced from sugarbeets each year in the United States. Beet sugar now represents slightly more than half of domestic sugar production, according to the American Sugarbeet Growers Association.
The Facility
Amalgamated Sugar was founded in 1897. Today, Amalgamated is the second-largest US sugarbeet processor, growing approximately 180,000 acres of the tubers in Idaho, Oregon, and Washington. Headquartered in Boise, Idaho, the company produces the White Satin brand of industrial and retail sugar, and also produces beet pulp, molasses, and other products used by food and animal-feed manufacturers.

The process used to turn raw sugarbeets into table sugar and other products has many steps and, as with many other manufacturing processes, requires significant volumes of water. And where you find water, you’re also likely to find pumps.

Kirk Buckley is the day crew maintenance supervisor at Amalgamated’s Paul, Idaho, facility, which sits on about 10 acres in south-central Idaho. Among his other duties, Buckley said he’s in charge of about 800 pumps at the facility.

“I have a little bit of everything, from progressive cavity gear pumps, process pumps, and heavy slurry pumps [with capacities] all the way from 14,000 gallons down to 1 gallon,” Buckley said.

A quick overview of sugarbeet processing quickly reveals why so many pumps are necessary.

- Harvested beets are transported to the factory where they are washed to remove excess soil and debris before they are sliced into french-fry sized strips called cossettes.
- The cossettes are sent to a tank where they are placed in hot water, which diffuses sugar from the cossettes creating what is known as raw juice.
- The raw juice is sent to be purified, and the remaining pulp is pressed to remove residual water. The pressed pulp is sold for livestock feed.
- Lime and carbon dioxide are added to the raw juice to remove impurities using a clarifier and filers. The result is a highly pure sucrose solution called thin juice.
- Thin juice is concentrated into a syrup called thick juice, which is then enriched with raw sugars in a melter, producing standard liquor. The liquor is further concentrated in vacuum pans, causing crystallization.
- Once the crystals reach the desired size they are separated from the remaining syrup using high-speed centrifuges. The resulting sugar is then washed with clean water.
The sugar is then cooled, screened, classified, and packaged according to size. But before beets can be harvested, the crop must be planted, tended, and watered. Remarkably, the water required to sustain these sugarbeet crops comes from the beets themselves.

“When the beets come into the facility a large percentage of the beet is water,” Buckley said. “We don’t draw any water out of the ground at all. All of our water comes from our product.”

This includes not only the water to grow the beets, but also the water to clean and process them and water to wash down the equipment and factory floor after processing. A number of sumps are situated around the factory to receive washdown water or any spilled liquid along with any debris that may find its way to the floor. At last count, there were 65 sump pumps in the facility, Buckley said.

**The Challenge**

For years the approach to sump maintenance in many industrial applications has been to simply replace one inexpensive pump with another when the current one burns out.

Increasingly, however, that approach is changing.

“We’d send them off and have them repaired from a motor rewind shop that we have in our area, but of course the wear on the wet end parts is what I was looking for to have a little bit better wear characteristics,” Buckley said.

“In Idaho people are very frugal,” said Kerry Hillman, a long-time salesman for C.H. Spencer & Company. Hillman has been recommending and selling pumps for 26 years. He said it has been common for industries to seek out the lowest cost replacement when a sump pump goes out.

“They would go to a hardware store and buy a little pump and run it. Sometimes these guys would buy 10 or 15 pumps because they were three or four hundred dollars apiece,” Hillman said. But each time an inexpensive pump burned up, it took time and manpower to take the old pump out, replumb the sump, and hook up a new pump.

“Over the years people were starting to be a little more sensitive to the preventive part of maintenance,” Hillman said. If a sump is in an area where there are heavy concentrations of mud, organics, pebbles, and other debris, lighter pumps will usually fail quickly.

“If I put them in an application where there’s sand or dirty water or an abrasive environment they wear out pretty fast, and I have a number of those around,” Buckley said. “I also have some corrosive environments, too, in places where we have a number of chemicals around, so the pH doesn’t stay at a neutral level. If we have an acidic situation of course those things come into play with the lifetime of the pump.”
In the past, the pumps that were installed were not necessarily intended for the demands of the environment.

“They're not like ones you could put in and pump sewage waste with, they're a little water pump and people would do that because they felt they were saving money, but time is money now,” Hillman said. “Over my years of experience people are starting to spend more money on better quality products. That's what this is — it's a step up from throwing a bandaid on something and having to change the bandaid all the time.”

The Solution
When Hillman got the call from Buckley, he recommended BJM’s KZN37 heavy duty submersible pump. These 5 horsepower, heavy-duty submersible agitator pumps are designed to tackle the toughest conditions. The impeller, wear plate and agitator are made of abrasive resistant 28 percent chrome iron. The top discharge and slim design allows the pumps to fit into smaller spaces.

“I've used a number of different pumps over the years,” Buckley said. “What I was looking for when I bought these BJM pumps is something that had a little more durability than just a standard 5-horse pump. That's what I have in most of these places, and I go through those things pretty fast.”

It's a challenging environment. The Paul, Idaho, factory is the largest beet factory in the world, Buckley said.

“When I say that, I mean that this coming year we're going to process about 3.75 million tons of beets. That's more than any other factory in the world will do during one beet slice campaign by far,” Buckley said. “There are a couple other factories in Europe that can have a larger slice capacity per day, but their beet campaigns are only 90 days long. Ours are 200.”

“Campaign” is the term applied to the annual process of harvesting and processing the beets. Because beets are perishable, it's a race against time and Mother Nature to get them out of the ground and into a form that can either be stored or processed into sugar before they spoil. The harvest typically begins in late August or early September and the
actual cutting and processing of the beets lasts until March. During this time about half of the liquid sugar is held in eight 6-million-gallon tanks. Three more tanks are being added this year.

“So during our beets campaign, we’re making as much granulated sugar as we can of course, but we’re only using half the sugar that’s coming out of the beets,” Buckley said. The other half of the sugar is being stored in liquid form until after the campaign is over. The juice is then brought back into the factory where it is then granulated and sold.

“So half the factory runs 11-and-a-half months out of the year, the other half runs those 200 days during the beet campaign,” Buckley said.

Because of the variability of factory operations, the pumps may cycle on 8- to 10-times a day, or may only come on every few days. They may pump for 5 minutes, or 15 minutes, or longer, depending on the float level.

Additional technical features of the KZN pumps include:

- **Class H motor insulation** and built in amperage and temperature overload protection.
- **Double silicon carbide mechanical seals** in a separate oil filled seal chamber.
- **Heavy Duty Lip Seal** provides additional protection for the mechanical seals. Stainless steel shaft and shaft sleeve saves on shaft wear due to abrasives and corrosion.
- **Pump volutes cast from hardened Ductile Iron** 300 Brinnell hardness; twice as abrasive resistant as standard ductile iron.
- **KZN heavy duty slurry pumps are utility pumps** frequently dragged from one site to another. The KZN doesn’t have a side discharge connection that can break off or be damaged as it is pulled and pushed into place.
- **Top discharge pumps are cooled by pumped liquid** and can pump a sump or pit down to within inches of the bottom. A side discharge pump without a cooling jacket must stay submerged to avoid overheating, leaving as much as 3 feet of un-pumped slurry.
- **Top discharge means "SLIM,iero** even the largest model with a 22.75 inch "waistline" will fit down a manhole with a hose attached.
- **The KZN’s hardened ductile iron volutes** are cast with extra thick walls at the point where pumped slurry enters the discharge.
- **High-Chrome Agitator** helps keep solids suspended in liquid and helps prevent pump from clogging.

**The Outcome**
“BJM Pumps fit a niche,” Hillman said. “They have qualities that handle a lot of dirt and sludge and temperature. It’s just a niche that is more cost effective for companies that are looking to upgrade.”
So far Amalgamated has installed four pumps. Two were installed more than a year ago and the other two were installed this year. Buckley said that the real test will be to see how they hold up during this year’s campaign, but so far he’s had no issues with them and if they perform well, he’s likely to install more.

About the Authors
Keith Grgurich serves as Sales Director for BJM Pumps, LLC. He has more than 40 years of experience in the pump industry. Ben Wells serves as Western Regional Sales Manager for BJM Pumps, LLC. He has more than 23 years of experience in the pump industry.

About BJM Pumps
BJM Pumps, established in 1983, supplies electrical submersible pumps to industrial and municipal markets throughout the United States, Canada and South America. BJM Corp. is headquartered in Old Saybrook, Conn. For more information, visit www.bjmpumps.com.

About C.H. Spencer & Company
CH Spencer is a supplier of refractory products, high-pressure steam valves and steam traps, along with a full range of pumping and related equipment. The company has been providing quality engineered and distributor products for more than 50 years. It is a supplier of pumps and related equipment to the mining, power, industrial and municipal markets in Utah, Nevada, Idaho, and Wyoming. For more information, visit www.chspencer.com.

About Amalgamated Sugar
Amalgamated Sugar is the second-largest sugarbeet processor in the United States, growing sugarbeets on approximately 180,000 acres in Idaho, Oregon, and Washington. Amalgamated manufactures industrial and retail sugar products marketed under the brand White Satin, and also produces and sells beet pulp, molasses, and other feed products for use by food and animal-feed manufacturers.