

## ***Centrifuge Helps Filter Water and Process Fluids Automatically***

Customers' calls documenting the ability to remove solids that build up in their water in their production and processing plants continue to confirm for Jeffery Beattley, president of Midwest Engineered Products Corp., an original equipment manufacturer based in Indianapolis, Ind., that his recent invention of a new centrifuge for fluid filtration was just in time.

"Removing solids and fines at the source eliminates the need to send thousands of gallons of water to the waste treatment plant—and the water can be reused," Beattley said.

A customer with a coil-brushing operation previously drained 10,000 gallons of water from a metal rinse tank each week to waste treatment because the solids build-up in the tank adversely affected the cleaning process, Beattley said. The manufacturer now removes the solids constantly via the centrifuge reuses the water, dramatically reducing pump, valve and tank maintenance and labor costs as well as cleaning chemical, disposal, fresh water and wastewater costs.

"The return on investment is very short: three to 18 months," Beattley said.

The ability to anticipate what the motor is capable of based on its load provides a significant benefit to centrifuge users

### **Redesigned From Scratch**

Midwest's all-new centrifuge combines a bowl/blade clutch design with a single AC motor and AC motor drive; the centrifuge can remove sub-micron to one-half-inch particles and fines from virtually any coolant or lubricant at a processing rate ranging from 25 to 135 gallons per minute (gpm). Called CentraSep™, the centrifuge design appears deceptively simple, but it is able to remove as much as four times



the quantity of fines (solids) traditional centrifuges can filter out and is able to extend the fluid life for any given process by at least four times.

### **Traditional Bogs for Reinvention**

Through years of calling on all kinds of processing operations and selling them the company's filters, proprietary ScaleBuster™ descaler and Water Ringer™ evaporator (for oily wastewater from compressor applications), "an opportunity became clear," Beattley said. "We realized that most of the centrifuges sold to get fines and solids out of wastewater, grinding swarf, coolants, phosphate baths and other process fluids were broken down or abandoned in the corners and bone yards of plants."

Centrifuges usually are installed on a side stream or kidney loop treating a specific manufacturing process. Typical units are mechanically complicated and include two motors, one to operate the bowl (rotor) and a second gear motor to perform the scraping for solids discharge. Pneumatic clutches, one-inch chains and sprockets, or pinion gears, connect the motors and loads.

High-speed revolution of the centrifuge's bowl required to separate and "pack" solid particles against the bowl wall is rough on rotor bearings. When bearings fail, it typically takes four to six hours to pull the rotor just so maintenance personnel can begin to access the bearings. Mechanical centrifuges also require additional maintenance and service. Every time the bowl is full, the solids need to be removed manually before the next processing cycle can begin.

To avoid downtime, many processors have given up on centrifuges and have turned to paper filtration systems, sludge tanks and disposal at a higher operating cost.

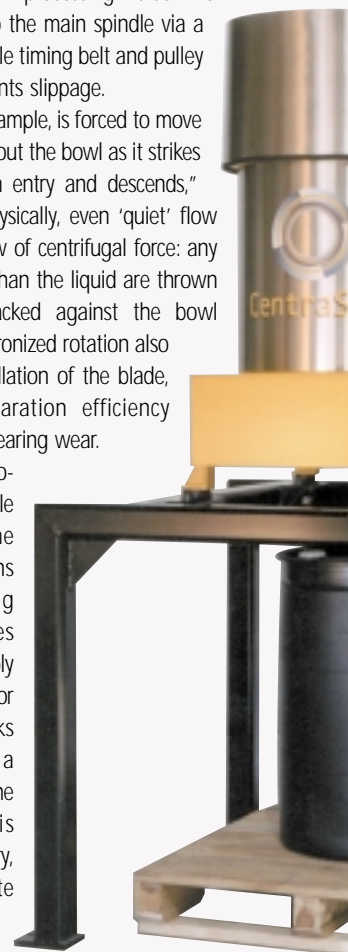
### **Series of Firsts**

The vision and technology combined in Midwest's new centrifuge reverses and removes virtually all of this downside labor, material and production/performance costs.

Mechanically, Midwest's centrifuge positively synchronizes the bowl and blade assembly, which consists of two scraper blades and two stilling vanes. A unique positive locking clutch couples the bowl's main spindle and the blade together so that both rotate at precisely the same speed when processing fluids. The motor is linked to the main spindle via a single chevron-style timing belt and pulley design that prevents slippage.

"Water, for example, is forced to move smoothly throughout the bowl as it strikes an accelerator on entry and descends," Beattley said. "Physically, even 'quiet' flow maximizes the law of centrifugal force: any particles heavier than the liquid are thrown outward and packed against the bowl wall." Such synchronized rotation also prevents any oscillation of the blade, maximizing separation efficiency and minimizing bearing wear.

When the automatic process cycle is complete, the feed pump turns off, the locking clutch uncouples the blade assembly from the main rotor spindle and locks the blades into a fixed position. The bowl then is rotated and the dry, dense particulate that is scraped



◀ To adjust the speed and centrifugal force of the bowl for different types of process fluids, operators can use a call-out on a PLC built into the panel.

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loose by the blades falls into a collection drum, ready for recycling.

### The Secret is the Electrics

With patents pending on the unique clutch and scraper design, Midwest credits new electrical control for making the CentraSep a reality. "In this design, the electrical and mechanical components are fused and inseparable," Jeff Beattey said.

Midwest realized early that getting optimum benefits from the clutch design "meant, by definition, using a single motor and single motor controller, but we didn't know if that was possible," Beattey said.

Accelerating the bowl and blade very rapidly for the processing cycle, bringing the loaded bowl to a controlled stop and turning the bowl against the scraper blades require high, breakaway torque and extremely precise motor control.

After trying several different controls and motor drives in designing the electrical panel for the centrifuge, a local distributor of ABB drives, Scherer Industrial Group, Inc., provided an ACS 600, 10 hp drive. Built into the drive

◀ This centrifuge design is able to remove as much as four times the quantity of fines (solids) traditional centrifuges can filter out.

is ABB's open-loop Direct Torque Control (DTC™) feature that enables the drives to calculate the state (torque and flux) of a motor 40,000 times per second. According to ABB, this responsiveness to the motor load not only makes the drives virtually tripless, but the absence of any required encoder for feedback from motor to drive also reduces capital costs for the controller by up to 25 percent when compared to like flux vector or pulse-width-modulated drives.

"Because this open-loop control of torque is so precise, the drives can adapt to and handle changes in load, over-voltages and even short circuits immediately," said John Emmert, the electrical designer who helped Midwest with the panel, motor and drive design. This ability to anticipate what the motor is capable of based on its load provides a significant benefit to centrifuge users. For example, if the load in the bowl would be too heavy, the AC motor would enter a stall mode rather than turning the bowl and breaking the shaft or blade assembly.

Both Emmert and Beattey worked closely with ABB engineers to develop the proprietary software that Midwest needed to program and operate the drive at extended torque parameters.

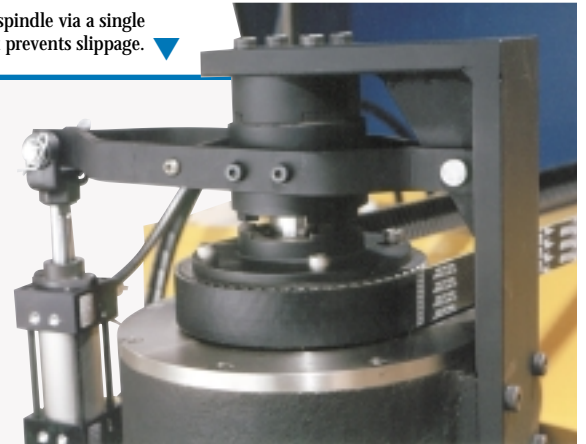
"We've had no drive failures from a single production unit," Beattey said, "and with ABB's Mean Time Between Failure (MTBF) on this drive at 150,000 hours and counting, we have a lot of confidence in these critical electrical controls."

To ensure that the exact same start-up software is programmed into every drive on all production units, Midwest uses ABB's DriveWindow™ tool. The Windows-based tool allows the company to back-up the programming, then restore it on each subsequent drive. "It removes the possibility of operator error," Beattey said.

This critical programming is not application specific. Instead, to adjust the speed and centrifugal force of the bowl for different types of process fluids, Midwest uses a call-out on a PLC built into the panel. The drive, in tandem with the PLC, gives Midwest the flexibility to customize the centrifuge for any kind of application.

### Reducing Waste, Improving Products

In addition to helping processors in the wastewater market eliminate 80 to 100 percent



of their usage and costs of paper media filters, the new centrifuge also increases the quality of the solid waste it captures. In a copper wire-drawing application, the "mud" the centrifuge now filters out is 86 percent pure copper and can be reclaimed since it contains no paper media.

Such effective removal of particulate also can reduce the frequency of cleaning out sludge tanks by 75 percent (once a year rather than four times a year) or better.

Most importantly, the ability to maintain particulate-free process fluids year in, year out reduces friction between tools and work surfaces so that the quality of parts produced is higher. "This centrifuge is at 8,000 hours and counting in a zinc-removal application, one of the toughest possible," Beattey said.

### Built For a Lifetime

The in-line performance of the first CentraSep units in a host of very difficult applications has only reinforced Midwest's decision to offer a lifetime guarantee with the centrifuge. Through the warranty, Midwest exchanges, on an annual basis, the entire rotor assembly—all mechanical parts except the motor.

The ability to change the rotor assembly in record time also keeps filtration lines moving in customer's plants without a hitch. "It has eight bolts, the timing belt and air-line quick connects; the rotor exchange has been done in as little as three minutes and six seconds," Kappen said.

Given the early receptivity to the OEM's re-invention of this product, what's next? "There are other new product ideas on our list waiting for our attention," Beattey said, "but we already know that increasing the capacity of this centrifuge line is a priority."

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