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Technology Focus

FLUID HANDLING AND FLUID POWER

This section was edited by Executive Editor Harry Hutchinson.

A NEW IDEA IN VALVES

A company formed less than two years ago is introducing various industries to a unique valve design. The company is Hemiwedge Valve Corp., and the name refers to the key feature of its signature product, the Hemiwedge cartridge valve.



The Hemiwedge cartridge valve is designed for quick switch-out of moving parts. A distinguishing feature is the hemisphere that opens and closes with a quarter-turn and acts like a wedge.

The valve contains a hemispherical wedge. Imagine half of a hollow ball. The valve opens and closes with a quarter-turn, to present either a hole through which fluid may flow or a solid wedge shaped so that the force is applied to the seat during the final few degrees of rotation to provide a drop-tight seal at both low and high pressures. The valve has a stationary core—in effect, a pipe—through which fluids pass to protect the seat when the valve is opened and closed. Among the many uses that the company recommends them for are emergency shutdown, and handling abrasive fluids and entrained solids.

Stan Allen, Hemiwedge Valve Corp.'s vice president for technology and business development, pointed out that, because the wedge rotates, the valve has a low profile and so the structure uses less steel. It is also a more efficient operation than the raising and lowering of a stem in a rising stem valve, he said. The valve can be operated by a lever, gear, or low-profile actuator.

The moving parts are contained in a cartridge that can be switched out to reduce downtime during maintenance. According to Allen, replacements that have been made so far all have taken less than 30 minutes to complete and one was accomplished in 13 minutes. Video of the valve showing its operation and a high-speed demonstration of a cartridge switch are available for viewing on the company's Web site, www.hemiwedge.com.

Allen said the valve has been sold to a number of customers, many of which are in the oil and gas, power generation, and mining industries. A customer, whom Allen declined to name, tested the valve and found that it required relatively low force to open and close under high-pressure flow.

Valves are available in sizes ranging from 2 to 12 inches. According to Allen, the design can be built as large as 20 inches. The valves are rated to operate at temperatures from -50 to 800°F and pressures to 3,600 psi.

They can be fabricated of various metals, and because it is protected during actuation, the seat also can be made of a variety of materials. Depending on the combination of materials, the price can be as low as \$900 for a 2-inch valve, although the price can go much higher than that if the application requires the use of expensive specialty alloys.

Allen said there are derivative products using the core technology. One is a downhole isolation valve for managed pressure drilling in an oil or gas well. Another is a subsea version that has been tested at pressures up to 30,000 psi. The company is licensing those products, he said.

Hemiwedge Valve Corp., based in Conroe, Texas, was formed as a unit of Shumate Industries Inc. early in 2007 to market the valve for which it is named. Shumate bought the original patent for the design and received subsequent patents for improvements in the device.

CHEAP SENSORS SPOT LEAKS

By Alan S. Brown

It's not surprising that up to 40 percent of the fresh water that flows into city water systems never comes out the taps at the other end. The pipes that carry it have been subjected to a century of wear, freeze-thaw cycles, ground movement, vibrations caused by nearby construction, and other disturbances. Water leaks away through cracks and punctures that have been growing for decades.

In a manufacturing plant, engineers would track down leaks with flow sensors that might cost \$1,500 to \$3,000 each. At those prices, the cost of instrumenting thousands of miles of underground water mains in a large city would be astronomical. Yet many cities, faced with swelling populations and limited drinking water resources, need to do something to manage leakage.

A sensor designer specializing in microelectromechanical systems, SensorDynamics AG of Graz-Lebring, Austria, has teamed with the Fraunhofer Institute for Silicon Technology in Itzehoe, Germany, to come up with an answer. They have developed a semiconductor-based flow sensor that costs only about 5 percent of the price of a conventional unit and can survive long-term use in water pipes.

The technology is elegant, and works much like the mass airflow sensors used to measure air intake in car engines. The sensor element on the semiconductor chip consists of two heating wires, one behind the other. Both are heated to a constant temperature by an electric current flowing through them.

Moving water quenches the front wire, which compensates by drawing more current to keep a constant temperature. Meanwhile, the heated water reaches the back wire, which also loses heat, but not as much as the front wire. It draws more current, too, but not as much as the front wire.

Measuring the difference between the current drawn by the front and back wire yields water speed and direction. That information and the pipe's volume allow calculation of water volume. By positioning sensors between pipe segments that have no tapping points and checking water volume, engineers can determine if there are any leaks.

The sensors have some additional features as well. They work intermittently, heating up to 50°C for only 3 seconds per minute. Pulsed operation prolongs battery life. When combined with low temperatures, it prevents lime (which acts as an insulator) from forming on the wires and reduces formation of air bubbles that distort measurements. The sensors report their measurements by either cell phone or radio.

SensorDynamics and Fraunhofer are testing 70 prototypes in the water system of Pisa, Italy. If the test proves successful, the partners plan to manufacture 10,000 sensors, said Fraunhofer project manager Peter Lange. Ultimately, he hopes to ramp up production to 500,000 units per year.

HYDRAULICS AND WIND

A manufacturer of hydraulic control systems, HAWE Hydraulics in Charlotte, N.C., has a compact power unit that it is pitching for the brakes in wind turbines.



Brakes for a windmill: A hydraulic power unit weighs less than 40 pounds.

The company calls the hydraulic power unit type KA and says it is a tank with an integrated submerged motor, a radial piston or gear pump that is directly attached to the motor shaft (without a coupling), and a connection block with the braking control modules mounted directly on it. The radial piston pump can supply oil pressurized to 10,000 psi, or 70,000 kilopascals.

According to HAWE, hydraulic control of the yaw and rotor brake shield gearboxes, rotor blades, tower, and foundations from wear and tear.

One of the advantages that HAWE cites for the application to wind turbines is that the units are compact. Approximate size is 7 x 7 x 20 inches and

weight ranges from 30 to 40 pounds. Because of the compact size, they can be installed directly on the turbine assembly and are small enough that they can be transported without a crane, HAWE says.

The units will operate in horizontal or vertical orientation. HAWE says it uses leak-free directional seated valves, which flush out dirt particles when they open. That prevents silting that can make some types of valves stick.

In the event of a malfunction, the modules can be swapped out without removing any hoses.

COAL-FIRED CONTROL

By Peter Easton

Developers of a new coal-fired power plant being constructed in Louisiana have contracted with Emerson Process Management to provide 10 Rosemount Analytical PowerVue fan and damper actuators to control fans.



“The end customer is already heavily invested in Emerson’s Fieldvue technology at its other generating facilities, and carrying this technology to fan and damper control is a next logical step,” said Doug Simmers, product manager at Emerson’s Rosemount Analytical Gas Division, which is based in Solon, Ohio.

“This boiler is using the latest circulating fluidized bed technology, and tighter control of the air through the furnace is important. This new, larger PowerVue design will deliver 7,200 foot-pounds of torque,” he said.

PowerVue fan and damper actuators are used at power plants, steel mills, refineries, pulp and paper mills, and wastewater treatment plants.

Available in sizes ranging from 4 x 5 inches to 8 x 14 inches, PowerVue

combines the Hagan-style actuator and the advanced control capabilities of Fisher's DVC 6000 Fieldvue digital valve controller.

According to the company, Fieldvue is a digital positioner that uses an internal PID closed-loop positioning system as opposed to a mechanical force/balance methodology. The Fieldvue offers diagnostics that can be displayed in the control room, indicating actuator performance and problems.

PUMP SMARTS

When a machine can tell you something isn't right, it can save you headaches later on. That's why ITT Goulds earlier this year made onboard intelligence a standard feature on its most popular process pump, the Model 3196. Now, the company has extended the feature, which it calls i-Alert, to all its ANSI configuration products. What's more, the company is marketing the i-Alert system to other original equipment manufacturers.



The i-Frame (top) attached to ITT Goulds' Model 3196 pump has a sensor and local alert that can warn inspectors if temperature or vibration becomes excessive.

The monitor measures temperature and vibration. If either condition exceeds a preset level, the system flashes

red warning lights designed to be easily seen by technicians making walk-around inspections.

According to Pat Prayne, product manager for ANSI process pumps at ITT Goulds, the addition of the condition monitor does not affect the price of the pump.

The monitor in the Model 3196 is a sealed device that sits on the power end of the pump, which Goulds markets under the name i-Frame. There are no moving parts, switches, or exposed wires, so the device is intrinsically safe for various plant environments. The device has a magnetic switch. The operator turns it on by touching a magnet to the top of the monitor.

Goulds makes the 3196 pump in 29 sizes and several variants. The company says that it ships thousands of them every month from factories in the United States, the United Kingdom, Mexico, Korea, and China.

GRANULAR START-UPS

A study at Penn State has discovered that lifting a plate through granular material requires increasing force to initiate movement as the size of the grains increases. The university said the finding may one day prove useful to engineers who design foundations for structures like electric-line towers in sandy soils. It may also have implications for determining the force needed to start industrial mixer blades.

A research team led by Peter Schiffer, associate vice president for research and a professor of physics at the Pennsylvania State University, have published their observations in a paper in the September issue of *Physical Review Letters*.

The researchers created an experiment in which they measured the force needed to push a flat circular plate up from the bottom of a bucket filled with glass beads. Dan Constantino, a Ph.D. candidate working in Schiffer's lab and an author of the paper, said that weight on the plate was the same for each trial, but the size of the beads differed.



Penn State researchers filled a cylindrical bucket with glass beads and measured the force needed to put an object into motion.

In a statement released by Penn State, Schiffer summed up the group's observations: "We found that less force is needed to lift an object that is buried beneath small grains than is needed to lift an object that is buried beneath larger grains. Basically, if you are buried alive and you have to push open a coffin lid, it's better to be buried under fine-grained sand than under pebbles."

Previous studies have observed the forces necessary to move objects through various granular materials. However, according to Schiffer, this is the first time that experiments

have looked specifically at the force needed to start the movement of an object resisted by grains.

Initiating movement requires that grains immediately above the object shift aside to make way. Surrounding grains must be loosened. Once an object is moving, that loosening has already taken place, so it requires less force to keep going. "It's the loosening of the grains around the object that seems to make the difference," Schiffer said.

The team plans to take similar measures for horizontal movement through grains. Plans also call for suspending

grains in liquid. According to Schiffer, practical application of the knowledge is speculative at this point.

Funding for the group's work came from NASA and the National Science Foundation.