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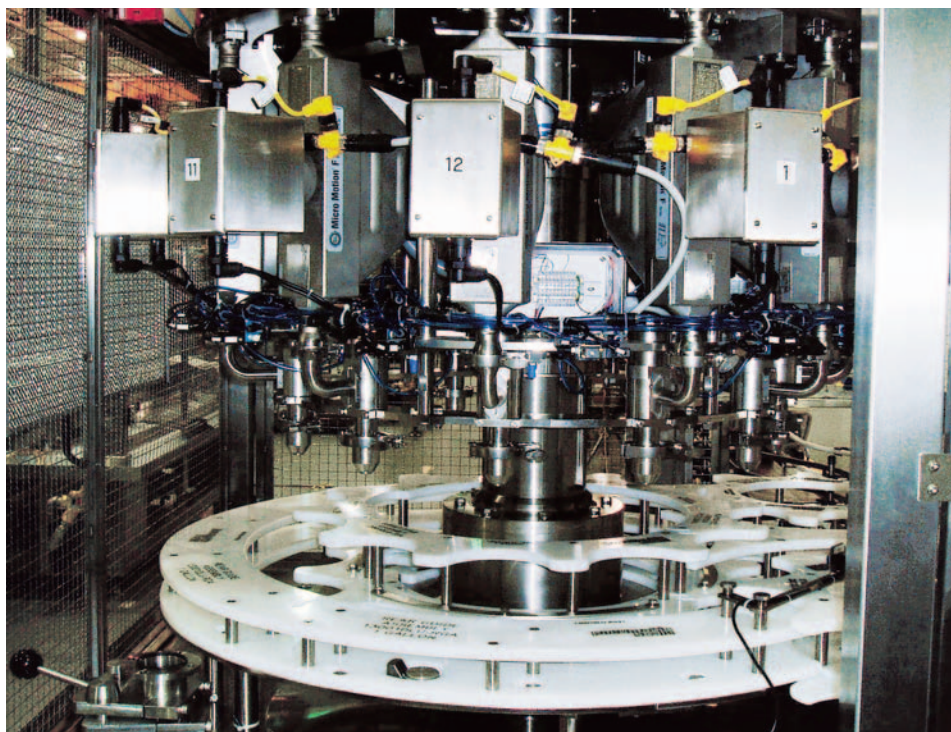
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Coriolis meters measure flow in paint-filling machines

Coriolis mass-flow meters provide accurate fills without contamination problems on fillers running a variety of paint colors and textures.

Anationally known paint manufacturer has recently switched to using machines from Pneumatic Scale Corp. (www.pneumaticscale.com) equipped with Coriolis flow meters from Micro Motion

(www.emersonprocess.com/micromotion) to fill cans of paint. A Coriolis meter measures the mass of the product flowing through it, whether running liquids or gases. This is an absolute measurement of quantity that is unaffected by changing fluid properties, such as viscosity or density. In addition, changing fluid process conditions, such as temperature or pressure, do not introduce additional



This rotary paint filler has 12 Coriolis meters installed in the numbered housings mounted above the fill nozzles. Five of these rotary units have been installed; four with 12 heads, as shown, and one six-head machine.

Coriolis mass-flow meters take advantage of the Coriolis effect to very precisely measure mass-flow of a fluid as it passes through the meter.

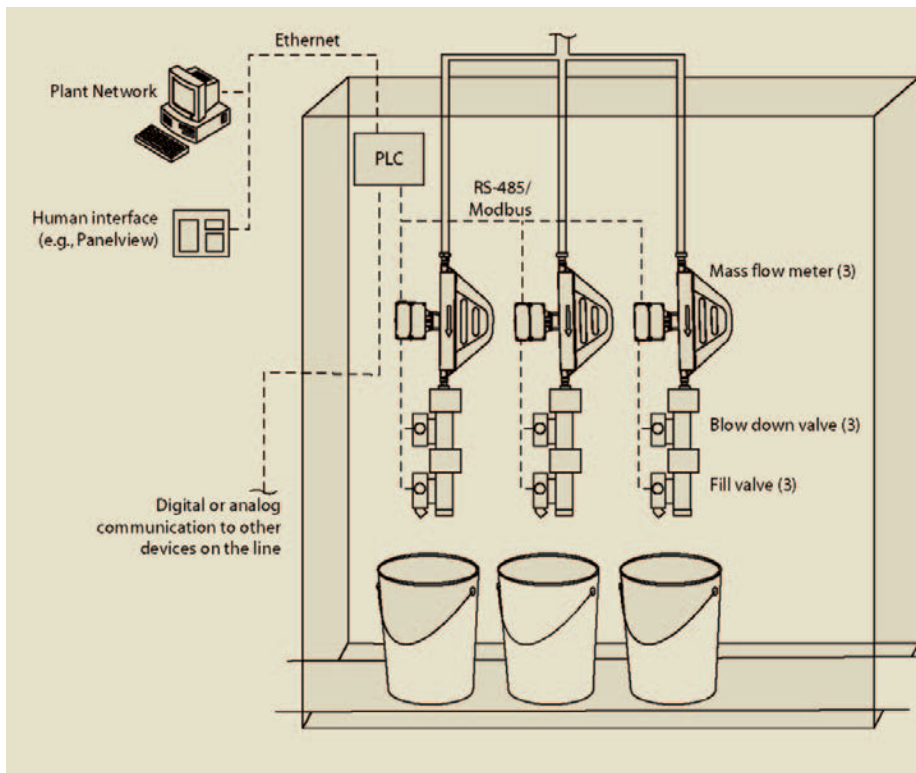
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measurement uncertainty. Coriolis meters eliminate the need for density-compensation-correction systems to adjust the actual measured volume flows to standard, or reference conditions, because a direct mass measurement has no need for density compensation. In fact, the multivariable measurement principle of Coriolis technologies also provides a measure of fluid density as a secondary output.

A Coriolis meter requires two components: an in-line fluid-flow sensing element and an electronic unit with a transmitter that interprets the signals from the sensor and converts these signals into useable outputs, usually pulse, 4 to 20 mA analog, and digital outputs. The sensing element usually consists of a manifold that splits the flow into two parallel tubes, although the smaller meters used for lower flow ranges often are configured to use only a single tube. The flow tubes are driven so that they vibrate in opposition at a resonant frequency, similar to a tuning fork. As the flow passes through the tubes, the fluid momentum, coupled with the oscillatory motion created by the vibration, induces a Coriolis force directed along the length of each tube. This force produces a phase shift (or time difference) along the length of the tube, which is directly proportional to mass flow rate. Two electromagnetic sensors located on opposite legs of the flow tubes sense the vibration of the tubes, which produce sinusoidal signals, and the phase shift between these signals can be measured.

Micro Motion Coriolis meters do not require special installation procedures, flow straighteners or special lengths of straight pipe to correct the fluid-flow profile. Eliminating these piping requirements reduces the size and cost of many Coriolis-based flow measurement systems.

The paint company has long been using machines from Pneumatic Scale Corp. (PSC) to fill cans of paint using traditional piston-displacement technology and, more recently, loadcell weight-measurement technologies. Volumetric-displacement



piston fillers are a reliable way to fill a lot of cans quickly, says the filler manufacturer. The piston pulls product from the filler's supply line into a cylinder on the upstroke, and then pushes the contents of the cylinder into the paint can on the downstroke. Valves open and close in concert with the pistons' strokes to ensure that the product is always going in the correct direction. Piston fillers can sometimes have problems with high-texture paint products or in applications requiring frequent product and/or color changes. The texturing in the high-texture product wears down the piston's rings and other contacting parts, while switching between products and colors is difficult, because the previous product can get trapped in the system.

Loadcell fillers, in general, are an accurate way to fill cans of product, says the company. The system is controlled by the weight measurement taken before the can is filled. A can is placed under the filler, and the empty container weight is tared, after which a valve opens, letting the product enter the can until the weight reaches a predetermined value. The product settles in the can, and the loadcell takes a final weight reading. The main

problem with using loadcells to fill paint is the spilled paint that accumulates quickly and becomes nearly impossible to clean. The spilled paint skews the accuracy of the product measurement or even gums up the loadcell to the point where it does not function properly.

Coriolis meters take advantage of the Coriolis effect to very precisely measure the mass flow of a fluid as it passes through the meter. When the meter's totalizer has counted the preset mass of fluid, the unit communicates to other devices in the system to open or close valves or to operate other automated equipment. Given the difficulties that PSC says it needed to overcome in its paint fillers, using a Coriolis flow meter in some new filling machines was a clever solution, it reports. PSC has introduced two new types of filling machines, one rotary and the other in-line, that have Coriolis flow installed above the cans to be filled. When a can moves into place, the fill valve opens, and paint flows through the Coriolis meter, which measures the mass flow and sends a signal to the valve when the preset product mass has been reached. The valve closes, and the filling machine exchanges the filled

can for the next empty one and repeats the process.

The Micro Motion flow meters on the new machines have batching control and constant correction built into them via their transmitters. Each flow meter controls its fill and blow-down valves directly, but also communicates with the filling machine's single PLC via an RS-485 Modbus network. The PLC then communicates with other equipment and devices in the filling line and with the plant's network via Ethernet.

PSC has installed seven machines with Coriolis mass-flow meters. Five of the machines are rotary-style. Four have 12 heads (shown in the photograph) and one is a six-head machine. All of these machines have turrets with 900-mm pitch-diameter. Two of the machines are in-line machines with three heads; each head fills a 2- to 5-gal pail. The basic

layout of the in-line machine can be seen in the control/line drawing.

Six of the machines are used for latex paints, including anti-skid, textured paints, while the seventh is used for solvents and sealers. Each filling head has its own Micro Motion F-Series flow meter. All of the machines are currently set up for filling different container sizes between 1 qt and 5 gal, but unlike other filler types, there is no maximum weight or volume imposed by the measurement technology. Only the container-handling parts would need to be changed or modified to run other sizes or types of containers.

The customer says the new PSC mass-flow fillers have met its expectations and provide a number of benefits. The filling machines are at least as accurate as those with loadcells, but require very little maintenance. Because the working components are inside of the flow meter, there are no concerns about paint spillage

or frequent cleaning, maintenance or calibration. The design of the flow tubes makes them ideal for the heavily textured paints because there are no tight, moving seals that the paint texturing can wear down, and there are no cracks or crevices where previously colored product can hide, waiting to contaminate the color of the next product to be used. Vibration on the filling line has little or no effect on the measurement accuracy of the fillers.

The new fillers are simple and reliable to operate. Their networked configuration uses just one PLC in the main electrical cabinet. The only wiring to the filler is power and communications to the mass-flow meters.

■ **More information is available:**

Pneumatic Scale Corp., 330/923-0491.

www.pneumaticscale.com.

Micro Motion, 303/527-5200.

www.emersonprocess.com/micromotion.

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