Application Description AG/PP104-EN

CoriolisMaster mass flowmeters from ABB: offering a precise measure of additives in a mill

ABB has supplied the Smurfit Kappa mill at Ponte all'Ania with a mass flowmeter for measuring the concentration of additives, making this the first installation of this kind in Italy.

Requirement

During paper production it is absolutely necessary to measure out the various types of additives in order to have a product of consistently high quality. There are several different types of additives, including: dyes, bleaches, powdered products diluted in water, and liquids with a low conductivity and / or high viscosity.

The Smurfit Kappa mill at Ponte all'Ania, part of the Smurfit Kappa Group, worldwide leader in the production of paper and corrugated cardboard packaging, produces 200 thousand tons of packaging per year and uses 100% recycled paper as its raw material.

For this type of production, adding starch additives to the recycled paper is necessary in order to strengthen the cardboard. The starch arrives at the mill in powder form with various particle sizes and moisture content and is stored in silos. Using a variable speed auger the starch is then mixed with water in a small tank and then pumped into the piping system for transportation to the cooking system. To ensure that the finished product has a consistent quality, the starch must be cooked accurately, adhering to the precise stoichiometric calculations between the cooking additives. To guarantee the required levels, the dosage – that is to say the concentration of the starch in water and mass of the dry product – must be as consistent as possible. In the past, electromagnetic devices were used to obtain the measure of additives, but today the use of mass flowmeters such as Coriolis are much more common.

Solution

ABB proposes to replace the existing measurement of volumetric flow with the more precise mass flow measurement of the concentration of a solid diluted in water, using the CoriolisMaster MC2 series mass flowmeters for liquids.

Fig. 1: The Smurfit Kappa mill

The ABB mass flowmeters for liquids work according to the Coriolis principle; when mass flows through a vibrating tube, Coriolis forces are generated, creating torsions in the tube. These small torsions in the measuring tube are detected by sensors and then processed electronically. Since the signal given out by the sensors is proportional to the mass flow, Coriolis mass flowmeters make it possible to directly determine the mass transported through the measuring instrument.

The Coriolis measuring devices (standard versions) are able to simultaneously detect three base values:

— The mass flow of the liquid;
— The density of the liquid; and
— The temperature of the liquid.

Fig. 2: The CoriolisMaster MC2

The instrument supplied to the Smurfit Kappa mill is equipped with separate electronic controls to facilitate installation, as well as a software application dedicated to calculating the concentration of a component within a liquid.

The software is based on a matrix in which data is entered regarding the relationship between the density measured by the CoriolisMaster mass flow meter and the concentration of the product to be controlled (in this case starch) at different temperature levels. The concentration values are shown below in degrees Brix:

Concen-tration	Temp. Concen-tration	Temp. 1	Temp. 2	Temp. 3	...	Temp. 10
%1	K 1 Brix	density	density	density	density	density
%2	K 2 Brix	density	density	density	density	density
%3	K 3 Brix	density	density	density	density	density
...	...	density	density	density	density	density
%10	K 10 Brix	density	density	density	density	density

The density data to be included in the matrix must usually be obtained experimentally, although some products have pre-calculated tables from the manufacturer of the component to be measured.

The concentration value is brought to the control system via a 4-20 mA analog output available on the electronics of the ABB mass flowmeter.

The intermediate concentration values are calculated by the instrument as an interpolation between the closest values.

Fig. 3: The separate electronic controls for the CoriolisMaster MC2

Result

After the initial checks for consistency, the device operates fully automatically and the concentration signal is used to regulate the dosage system, which maintains a consistent concentration by varying the speed of the auger. The use of the mass flowmeter during the cooking phase allows consistency of the concentration values of starch to be achieved, which means that the quality of the final product is more consistent, and within the manufacturing tolerances required. This has also led to a reduction in production waste and has essentially improved productivity at the Smurfit Kappa mill.

Contact Details

For further information please contact:

ABB Automation Products GmbH
Process Automation
Dransfelder Str. 2
37079 Goettingen
Germany
Tel: +49 551 905-534
Fax: +49 551 905-555

www.abb.com

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