The whey forward

Reliable and accurate instrumentation for the dairy industry

FRANK FRENZEL – Milk is a complex mixture of substances that is processed to make a large variety of finished products such as butter, yogurt, cheese, cream and so on. In larger dairies, milk is treated in largely automated, closed production lines. Due to the complexity of some of the process steps, the delicate nature of the raw product and the need to adhere to strict hygiene regulations, the instruments that measure, monitor, regulate and control the process line must be accurate, reliable, robust and designed for hygiene. ABB supplies a wide range of such instruments, the characteristics of which can be explored by describing how they are used

ABB's pressure and temperature products are ideal for most stages of the milk treatment process.

For many parts of the world, milk is an important source of nutrition. Milk contains water, fat, protein, milk sugar (lactose), enzymes, vitamins, minerals and trace elements. It can be processed to produce butter, cream, cheese, yogurt, etc. Much of this processing is carried out in large dairies that employ a high degree of automation. The complex composition of milk and the potential danger to health should something go wrong in the processing means that great care has to be taken at each step as the raw milk is turned into the finished product. In larger dairies, to ensure good quality and product consistency, most parts of the process are instrumented.

Most parts of the dairy – milk processing, cheese making, yogurt production, etc. – are similar in terms of instrumentation. Looking in detail at one part – the milk production line, for instance – gives a good indication of how ABB instruments can help dairy operations as a whole → 1.

Delivery and pasteurization

Raw milk is delivered to the dairy in tankers and is immediately tested for bacteria or other contaminants. Subsequently, if suitable, it is transferred to storage tanks or goes straight into the process. At this point, the delivery quantities will usually be determined by a magnetic-inductive flowmeter such as the ABB HygienicMaster FEH300/500. The HygienicMaster has a coating of vacuum resistant PFA and employs stainless steel elements to maintain hygiene. It is the most common flowmeter found in an ABB-equipped dairy. If the milk has warmed in transit, it is cooled to 5 °C and stored in agitated tanks. ABB level/pressure monitoring devices, eg, SMW and 261GG/AG types, can be used to monitor tank levels here and throughout the dairy.

The HygienicMaster FEH has a coating of Teflon PFA and employs stainless steel elements to maintain hygiene.

Pasteurization is a core activity of any dairy. Here, the raw milk is processed into drinking milk or is prepared for use in other products, such as cheese, etc. Pasteurization involves heating the milk for 15 to 30 s to around 74 C and then immediately cooling it to kill any harmful organisms. When cooling, much of the heat energy is won back by carefully

Title picture
Dairy operations are delicate and thus require the very best instrumentation. ABB has products to monitor and control every stage of the processes that turns milk into cream, yogurt, butter and cheese.

The CoriolisMaster is well suited to online cream concentration correction.

1 Milk processing is a delicate operation that needs the best instrumentation.

controlled heat exchangers. Overpressure is applied to the treated milk to ensure it never comes in contact with untreated milk. ABB's pressure and temperature products such as the 261GG/AG gauge pressure transmitter, SensyTemp TSHY thermometer for sanitary applications and the TTH300 head-mount temperature transmitter are ideal for most stages of the milk treatment process.

Here, and throughout the dairy, flows can be controlled with the ABB TZDIC intelligent digital positioner. These stainless steel smart positioners combine high accuracy and adaptable control functions, and their auto-stroke functions make them easy to commission. The TZIDC requires little maintenance and works over a wide temperature range, making it suitable for the milk production line.

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Separation and standardization

To clean the milk of contaminants and to isolate components of individual interest – such as cream and skimmed milk – the milk goes through a separation procedure. The milk then has to be standardized: Raw milk has a higher fat content than the law recommends for drinking milk so after the cream is removed from the milk it is added in again in a controlled manner to achieve the correct fat levels.

To keep within the law and to not "waste" valuable cream by adding too much, this blending process has to be tightly controlled. As well as using the instrumentation described above, this stage of the process also utilizes the ABB CoriolisMaster FCB/FCH150 or FCB/FCH450, described in detail on pages 34 – 36 of this issue of ABB Review. The CoriolisMaster is well suited to online cream concentration correction: As well as accurately measuring mass flow by exploiting the Coriolis effect, the device also makes an independent density measurement using the resonant frequency of the filled system thus making it easy to track the changing cream concentration. The device has a flow rate measurement accuracy of 0.1 percent (FCB/FCH150 and FCB/FCH450). The CoriolisMaster is

2 Just some of ABB's wide range of flow and control products commonly used in dairies.

ABB level/pressure monitoring devices, eg, SMW and 261GG/AG types, can be used to monitor tank levels throughout the dairy.

also less prone than other flowmeters to give erroneous readings when gas bubbles are entrained in the flow, though large cavitation events will skew measurements → 2.

Homogenization and packaging

To prevent the cream in the milk from separating and floating to the top in the finished product the milk is passed through a fine sieve under pressure to break up the larger fat globules. A cavitation technique further breaks up the globules so that they are distributed throughout the medium and have less tendency to collect at the top. The milk is then filled into its final container.

The instrumentation described earlier is used in these process steps too to measure flow, pressure and level. The ability of the instruments to withstand high pressures while maintaining hygienic levels is an important consideration.

Hygiene

Rigorous daily cleaning and sterilization is an essential aspect of the dairy business. Temperature sensors and flowmeters ensure that the cleaning materials are of sufficient temperature and that they reach all parts intended. Conductivity measurements can determine flushed impurity levels and can ascertain if contamination levels are high enough to warrant the addition of further cleaning agents.

Service

As well as delivering the instruments themselves, ABB also organizes the installation and commissioning of the automation instrumentation, as well as provides regular maintenance and repair.

Optimizing many aspects

Milk is a complex product to process. To successfully cater for the critical parameters involved in milk processing – such as temperature, concentrations and flow quantities – and ensure top quality and hygiene, a dairy will be equipped with the very best control, sensing and instrumentation technology. This automation technology will also help optimize raw milk use, reduce energy consumption and ease daily tasks like cleaning. ABB's wide range of instrumentation fits in well with the rigorous demands of the milk processing industry.

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